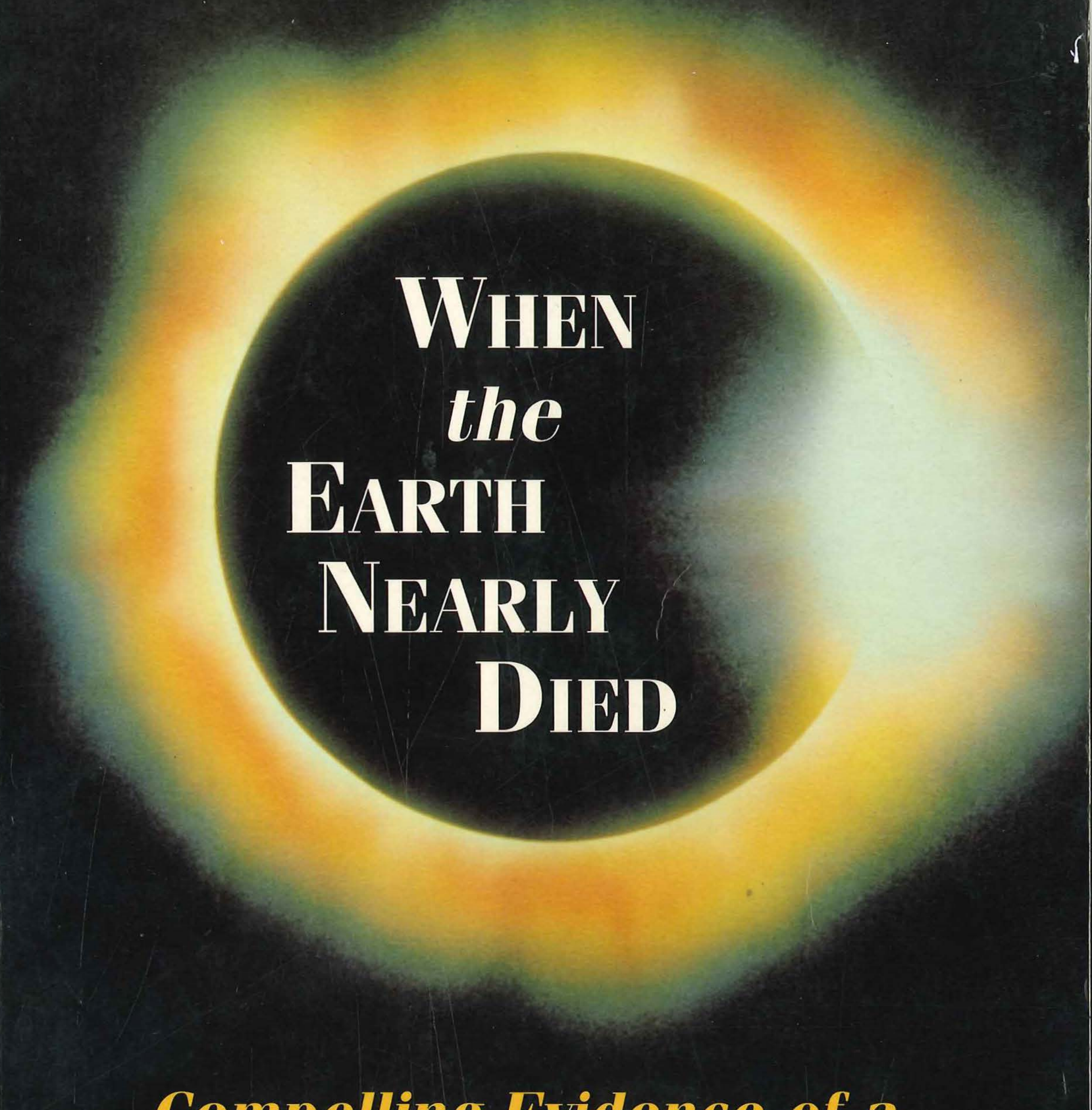

WHEN *the* EARTH NEARLY DIED

Compelling Evidence of a Catastrophic World Change 9,500 BC

D.S. Allan & J.B. Delair

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Compelling Evidence of a World Cataclysm 11,500 years ago

D. S. ALLAN & J.B. DELAIR

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Introduction

This book is about the greatest single disaster known to have befallen Earth. The event was actually part of a still larger catastrophe which, commencing in interstellar space, eventually embraced most of the solar system. In terms of geological time it occurred extremely recently, although science has been decidedly reluctant to admit the fact, and modern humanity has largely forgotten it.

Among other things, the calamity profoundly affected all forms of terrestrial life, early Man included, who considered it to be a never-to-be-forgotten experience. Accordingly, almost every nation of antiquity perpetuated the memory of it in tradition, ceremony, religio-social attitudes, art and epic literature, and all regarded it as a major historical datum. Today, if it is remembered at all, it is known as the Great Flood or the Noachian Deluge.

The relatively familiar story of Noah, his Ark and the Deluge is, however, very incomplete, and when equivalent traditions from other sources are examined we find the Deluge itself to have been but one aspect of an awesome event as multi-faceted as a fine-cut diamond. These other sources refer to frightful natural convulsions simultaneously on land and sea and in the air, and to the greater part of life on Earth being violently extinguished by a wide variety of horrific processes, accompanied by extraordinary concomitant phenomena in the heavens. The overall picture is one of disaster of the very first magnitude.

For these reasons, the present essay encompasses what may at first glance seem many unrelated fields of enquiry, but which, as the panorama unfolds, are found to be intimately connected. In a sense, therefore, this book is really many books in one – although to satisfactorily explore all the salient features and evidence of what is an immense canvas inevitably incurs a degree of incompleteness. Such an interdisciplinary study inevitably necessitates a rational and comprehensive correlation of the material discussed, and with that objective in view each major theme is fully documented throughout. Cited references include several which are unfortunately rare or difficult to procure. Irrespective of their rarity or otherwise, *all* references have been consulted by the authors.

In this book we set out to demonstrate that the history of human culture is far richer and more complex than standard history is usually prepared to admit, and that the true record of human experience is infinitely more dramatic than that conventionally documented. As will be shown, a very great deal of this ampler past was the outcome of a single traumatic event.

Science has accumulated a body of factual observations which, in view of the relative stability of Earth's contemporary physical environment, so puzzled scholars that they felt obliged to postulate a series of devastating glacial ages to account for them – though the genesis of this assumed 'Ice Age' is in turn no less puzzling. Yet, other scientific findings have accumulated which do not fit easily with this glacial scenario. Such data often remains accessible only to specialist audiences. More significantly, when considered together, they seriously strain orthodox explanations beyond reasonable credulity.

On the whole, it is sensible to support or retain a theory only if it 'works', provided that, in drawing diverse fragments of knowledge into defensible patterns, it enables useful predictions to be made about the shape of further discoveries. Conventional glacial theory, however, fails to meet this criterion. In the face of mounting evidence militating against this likelihood, it repeatedly disintegrates under the constraints imposed upon it by that evidence. On the other hand, research into an entirely different domain – ancient traditions, folklore and classical writings – *is* providing us with an increasingly persuasive body of evidence from a wide variety of cultures. These bear remarkable similarities, despite the fact that the names given to the characters in the dramas bear superficially little relation to one another.

Some anthropologists have understood this to be a consequence of fundamental human characteristics which have shaped human cultures and have caused the invention of similar myths by apparently diverse cultures. Others, such as C G Jung, have given an essentially psychological explanation to this, in terms of a shared unconscious psychological disposition, which gives rise to such stories. Though we would not necessarily want to challenge such assumptions generally, we nevertheless suggest that *certain* of these stories originated from a real live experience of early humanity, and have evolved in an attempt to comprehend and pass on to posterity the experience gained.

Alongside Glacial Theory, this book traces the successive rival theories and interpretations which characterised the formative years of modern geological science, showing that, at one extreme were 'Catastrophists' who sought to reconcile traditional recollections of a global catastrophe with the known geological data. 'Catastrophists' for long emphasised the fact that numerous Deluge traditions mention one or more celestial agents as having assailed Earth and caused that calamity, and that prolific evidence is available which can be reasonably interpreted as having originated from genuine experience of such an event. At the other extreme, 'Uniformitarians' have argued that disasters of such magnitude are completely contrary to the normal workings of Nature on Earth. They know of no self-inducing mechanism capable of generating a terrestrial catastrophe on such a scale – and since they discern no physical *proof* of a conflict between this planet and some other celestial body, categorically dismiss all such claims as spurious. They insist that the factual data used to support most 'Catastrophist' claims is explicable – at least in principle – in terms of the widespread but slow action of ice rather than of fast or violently moving water.

It is thus paradoxical that worldwide memory of an appalling flood disaster has survived traditionally as a major event in the early history of mankind, whilst science, having assembled a veritable library of facts dealing with the very same period, interprets the same evidence as due to quite another cause.

Charles Lyell's nineteenth century formulation of an alternative theory to 'Catastrophism', bringing in the fewest possible assumptions in order to explain the natural phenomena, was admirable. However, wholesale adoption of his 'Principle of Uniformitarianism', rather than continual investigation of alternative interpretations actually serves us only if it can adequately explain every relevant phenomenon. Since the inception of Lyell's hypothesis and the present, much contrary evidence has accumulated, which, were Lyell alive today, even he would find difficult satisfactorily to account for by uniformitarian concepts.

If we widen our perspective beyond the specialist discipline of geology, we are left with the problem of the extraordinary testimony of innumerable living animal and plant species, as well as the great corpus of curiously consistent world tradition. Even were we left with no option but to anthropologise or psychologise the traditional material, no such solution can apply to the zoological and botanical evidence. Some other all-embracing unifying explanation is clearly required.

We attempt this by examining the range of huge phenomena for which Catastrophism does have explanatory value, and for which Uniformitarian solutions fail. At the same time we shall try to order this great body of data into what, we submit, is its proper perspective.

This perspective will not, however, be found in conventional Establishment geological histories, for although the overwhelming number of sources cited *are* Establishment sources, standard college texts on the subjects discussed are, like those in nearly all scientific disciplines (and for many reasons), notoriously slow to modernise. Indeed, many orthodox textbooks lag more than a decade behind the current frontiers of the subjects with which they profess to deal. Several of the conclusions paraded in this book will therefore be found to be diametrically opposed to many normally featured in orthodox texts. These deviations have not, however, been reached lightly, but are solidly grounded on the testimony of abundant and varied field evidence often either ignored, dismissed, or forced by many conventionalists to fit various notions that, although well-entrenched and frequently treated as *fact*, are actually hypothetical or even demonstrably untenable, or so recently discovered that they still await incorporation into conventional histories.

Some readers may recoil at the abundance of references and might even regard them as irksome or intrusive. In a work of this genre precise documentation is essential, and in point of fact the references used actually constitute a rather small but representative fraction of the total available on the themes reviewed. There may also be disapproval of the use of a comparatively high percentage of 'old' sources. Such objections will speedily dissipate when it is realised that many of the most singular events and discoveries referred to – particular local terrestrial cataclysms, certain Arctic and Siberian explorations, specific cave excavations and finds – occurred long ago and were essentially *unrepeatable*. In such cases these *are* the only references that can be cited. But whether 'old' or recent, it is significant that the *character* of the drama thus documented remains persistently consistent. Furthermore, the physical events and effects described in many traditional accounts are *precisely* those advocated by modern theoreticians considering essentially similar themes.

Every effort has been made to keep technical terms to a minimum, but where usage of these has proved unavoidable, concise explanations are contained either in the text or in the glossary.

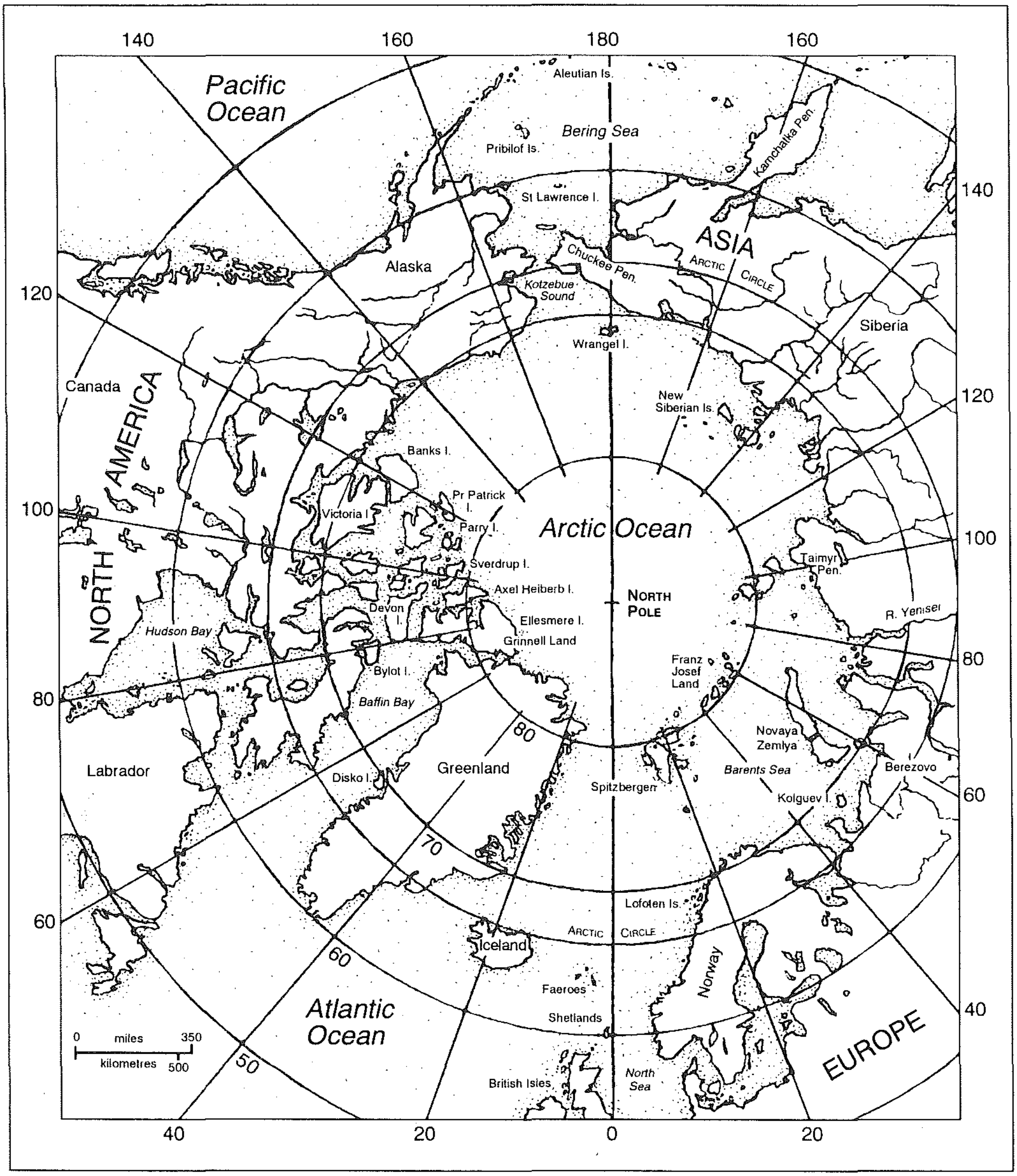
In dating specific evidence we have used the convention of expressing dates in years BP (before the present). Current processes for estimating the age of fossil remains, rock strata and so on all have certain limitations, so that the time-scales used by geologists, palaeontologists, anthropologists and others inevitably contain a degree of uncertainty. Our chronological estimates derive from averaging out from a wide range of documented radiocarbon dates and other accredited methods. We are therefore as confident as it is presently possible to be in their general reliability. Appendix B summarises the relevant dating procedure and cites a selection of the abundant data now available.

Readers must perforce judge for themselves whether the facts genuinely support the conclusions here offered. What cannot be denied however is that real facts, howsoever interpreted, are inescapable, actual and immutable, and the testimony they represent cannot be altered.

If the conclusions arrived at in this book prove to be valid, then recent Earth history as we know it urgently needs extensive revision. In effect they provide a new key to that segment of world history occupying approximately the last 15,000 years. The genesis of much of present world topography merits fundamental reassessment, prehistoric archaeology an equal adjustment, and the scientific concepts of uniformitarianism and catastrophism, with their bearing on organic evolution, very substantial modification. Perhaps with this new key, we now stand at a threshold of new and exciting historical perspectives.

Part One

A LOST BEGINNING



Map 1A. The Arctic regions today. A major key for unlocking the Phaeton question.

1
The Age of the Earth

Today, educated society is fully aware that, compared to the average human life-span of three score years and ten, the age of the Earth, which modern geology has divided into successive eras and periods each millions of years in duration, is absolutely immense. Yet this concept was not always so, and was not in fact seriously developed until the first half of the nineteenth century.

Before then, researchers had tried to establish the age of the Earth by studying ancient calendars[1], and various assertions about 'time' in classical, Near Eastern and Norse literature[2], or by working out and totalling the recorded generations of Biblical figures between the traditional 'first man', Adam, and the birth of Christ[3]. Regarding this last mentioned method, the existence of different translations of scriptural sources only served to compound the difficulties. Some authorities, for example Isaac Vossius of Leiden, contended that the most authentic biblical genealogies are to be found in the original Greek translation of the Old Testament, the *Septuagint*, rather than in the Masoretic Hebrew texts[4]. Others disagreed. Thus, the age of the world calculated from Patriarchal genealogy as recorded in the *Septuagint* produced a date of 2,342 years, whereas that based on the Masoretic texts gave a date of 1,656 years[5].

That no really precise date for the age of the Earth was forthcoming from varying sources like these quickly became transparently obvious.

Early scholars everywhere recognised that, so far as it was known to them, a great break had occurred in Earth's history, or at least in the human portion of it. The break had been caused by a vast flood, which for Christian and Jewish historians was the Deluge of *Genesis*, and for classical writers the Great Flood of *Deucalion*. To all these authors this inundation became a highly important marker event[6].

Not only Christian and Jewish savants, but others of the pagan pre-classical and oriental worlds, agreed that the Deluge had terminated an earlier Golden Age, itself conceived of in many quarters as one of a succession of former world ages individually characterised symbolically by metals (bronze, iron, *etc*), elements (fire, water, *etc*), or by astronomical motifs (solar, lunar, *etc*). Moreover, ancient traditions collected much later from lands such as the Americas and Australia, certainly unknown to most early European, Near Eastern and Oriental writers, also preserved closely similar beliefs in which 'suns' were sometimes substituted for 'ages' as vague measures of spans of time long past. Tantalisingly, the actual durations of such 'ages' or 'suns' were seldom if ever stipulated.

Other early thinkers, especially those of pre-Hellenic and early classical Greece, devised the concept of cyclical world history, which, because it postulated a succession of different ages, again involved the idea of great spans of time. These, though of vague durations, were usually stated in terms indicating an antiquity far greater than the 1,656 and 2,342 year dates obtained by biblical studies. This doctrine was followed by, and probably led to the development of, that of the cyclical Great Year, championed by Empedocles and the Pythagorean philosophers of ancient Greece. The doctrine itself was apparently based upon earlier Chaldean teachings which advocated that the Universe, though eternal, undergoes cyclical destruction from either fire or water at lengthy but irregular intervals. The Deluge was held by them to be the most recent of these destructions. Popularised by Berosus, a Babylonian scribe of the 3rd century BC, the doctrine of the Great Year became very influential and was subscribed to by many famous cosmologists and philosophers of the day, including Chrysippus, Zeno and Plato. It survived in modified form down to at least the beginning of the 19th century.

An especially noteworthy aspect of the above topic is that all accounts of the Deluge shared the notion that, in addition to it having been a very destructive event, it was somehow connected with celestial changes. In some narratives, these are ascribed to heavenly displeasure or divine wrath at a reportedly iniquitous mankind. This factor, and the ancient concepts of bygone World Ages and a lost Golden Era, will be considered again more fully later.

Thus, irrespective of their literary or traditional sources, their advocated religious significance, or their alleged social connotations, all these accounts were as one in agreeing that a tremendous watery cataclysm had indeed occurred long ago and drowned the greater part of Creation. As one of the most widely remembered and enduring of all human traditions, the Deluge became a critical datum in virtually every early chronology, it being customary then for historians to term everything preceding it as *antediluvian* (before the Flood) and everything following it as post-diluvian. It was not until 525 AD that the now standard method of dating events BC and AD was introduced.

Even in the days of the earliest known writers, dates were proposed for the Deluge – another pointer to the great importance it then held for historians. These dates were, like so many later ones, usually calculated in relation to dates worked out for the Creation itself. Of these we may briefly mention that, in the 2nd century, Theophilus of Antioch calculated that Creation had occurred in 5529 BC, and that Jerome, in AD 381, thought it had erupted in 5502 BC. Some datings attempted extraordinary precision. One Jewish scholar in the 2nd century AD averred that Creation had taken place at 11.11pm on Sunday, October 6th, 3761 BC[7].

Many of these early datings, as well as many later medieval ones, were commonly set to accord with the six days of Creation described in *Genesis*, and to generally conform to Julius Africanus's combination, in the 3rd century AD, of the 'six days of Creation' and the 'Millennium'. Relying upon the authority of *Psalms* 90:4, and the virtually sacrosanct assurance of the Christian apostle Peter that for God one day is as a thousand years, Africanus reasoned that the six 'creational' days really meant six thousand Earth years. It was not long, therefore, before scholars like Augustine, Lactantius, Isadore of Seville and the Venerable Bede began dividing up human history into Six Ages totalling six thousand years, although not necessarily of one thousand years each. As remarked by Prof Dennis Dean, who undertook a special study of this theme:

> Eventually, schemes involving seven 'days' (with present time the sixth) became popular. These related conceptions of the Earth's history endured well into the seventeenth century, where we find them influencing geological theories by Descartes, Kircher, Steno, Burnet, and Whiston. Few erroneous historical assumptions have ever remained credible for so long[8].

A great up-welling of scholastic interest in the age of the Earth occurred during Renaissance times, and in England alone over one hundred different authors, working along different lines of enquiry, proposed dates for the Creation. Even those utilising solely Hebrew sources managed to differ alarmingly, their datings ranging from 3928 to 4103 BC[9].

Inevitably, by Renaissance times there were those who doubted the validity of biblical chronology as a whole, and those who redoubled their efforts to discover the real date of Creation. Among the latter was James Ussher whose monumental study of the problem, first published in Latin[10], appeared four years later in the English language version of 1658 – *The Annals of the World, Deduced from the Origin of Time* (London). Ussher convincingly argued for Creation having occurred in 4004

BC, a date subsequently affixed to the Lloyd Bible of 1701, by which it quickly came to be regarded as practically a part of scriptural authority itself[11].

Among the doubters were those who, even as early as the 1500s, argued that the Biblical 'days' were merely figurative. Others, like Isaac Peyrerius, postulated that, far from representing world history, biblical history represented only Jewish history and that Adam was not the first man but the first Jew. Like Friedrich Stoss in Germany, Charles Blount in Britain, and other Europeans, Pierre Bayle in Holland[12] voiced further criticisms about that time and proposed different chronological schemes of surprisingly lengthy duration, not on geological but on varied oriental cultural evidence. Some of these required Creation to have taken place far earlier than Ussher's 4004 BC. Indeed, by 1588, so much scholastic confusion and contradiction had been achieved that John Harvey found himself obliged to write with regard to all chronological compilations thitherto produced that they were:

> ...ambiguous, uncertaine, fallible, erroneous, deceitful.[13]

Earlier, none other than the great Roger Bacon had concluded that the disputes between authoritative versions of the Bible respecting the age of the world would be resolved only by astronomical evidence[14].

Almost 300 years were to elapse before any serious attempts were made to develop that avenue of approach. Meanwhile, like practically everything else in the *Old Testament* before the Exodus, the Deluge was still not precisely datable, yet continued to be the only graspable world datum since, as mentioned previously, everything before it was indisputably antediluvian and everything after it obviously post-diluvian. For that reason it became an increasingly critical historical marker event.

2
Debris of a Broken World

During the seventeenth and eighteenth centuries efforts were made to explore connections between Mosaic chronology and the then fast developing sciences of astronomy and primitive archaeology[15], very much as forecast by Roger Bacon 300 years earlier. Many of these studies embraced the previously-noted older doctrine of successive world ages and laid special emphasis upon the ending of individual ages by terrible floods and conflagrations. Inevitably the Biblical Deluge received particular attention, although whereas nearly all early speculations about it had concluded that it was the result of divine anger, these new investigations sought rational physical causes for its occurrence. Thus, in the opinion of the late seventeenth century English mathematician and physicist William Whiston, the Deluge had probably been caused by the close approach to Earth of a giant comet[16].

Whiston was Isaac Newton's laboratory assistant, and, like Newton, was a friend of the astronomer Edmund Halley, who may be said to have been the discoverer of the periodicity of comets (a subject returned to in Part Four of this book). Whiston was also well versed in ancient history, classical literature and the Latin, Greek and Hebrew languages. His invocation of a cosmic agent as the cause of the Deluge thus not only accommodated the aforementioned 'astronomical' elements associated with that event in many early histories and ancient traditions, but also used what at that time were some of the very latest findings on astronomy, physics, and mathematics, including Newton's then recently announced Law of Gravity. Little wonder Whiston's theory was well-received in nearly all quarters, and significantly influenced historians over the next 130 years or so.

No 'geological' chronology had been formulated in Whiston's day of course, and fossils, though well enough known[17], were still commonly interpreted as the relics of creatures (Earth's afore-cited iniquitous antediluvians) destroyed by Noah's Flood. Nor did any proper conception exist that, as an organism, man was significantly younger than the fossilised creatures found at innumerable localities, or of any vast pre-human period of Earth history.

Nevertheless, we would be at fault here if we omitted to add that as early as 1671 the naturalist John Ray may have had an inkling of reality when he opined that the world might well be "a great deal older than is imagined", and that humans were late arrivals on the terrestrial stage when, in a letter written in 1695 to the Oxford antiquarian Edward Lhwyd, he ventured:

> ...whatever may be said for ye Antiquity of the Earth itself & bodies lodged in it, yet ye race of mankind is new upon the Earth, & not older than the Scripture makes it, may I think by many arguments be almost demonstratively proved[18].

Ray, however, was apparently not the first to reach such conclusions, for Thomas Nashe, in 1592, had complained in a pamphlet about "Mathematitions abroad that will prooue men before Adam"[19]. Regrettably, Nashe did not name the mathematicians concerned.

About the time that Nashe was voicing his complaints another notable observation was put on record. The French potter Bernard Palissy recorded that, when collecting suitable clays preparatory to manufacturing his wares, he:

> ...found many species of shell fish, petrified in the earth, which are not modern kinds living in the ocean... a sort which is unknown to us, and are not found at all, except lapidified" (fossilised).[20]

These were vestiges of some prior creation. The question to be answered was: did these shellfish belong to a creation destroyed by the Deluge? The Deluge continued to be a central point in the problem of the age of the Earth.

We may also mention that, in 1655, shortly before John Ray's remarks, Isaac de la Peyère had pursued the same theme of humans before Adam[21], in the process distinguishing two Creations, that of *things* and that of humans. Observations like Palissy's may have contributed to the formulation of such conclusions and undoubtedly underlay the arguments of the early eighteenth century French savant René de Reaumur, who, in 1720, stated that the fossil record attested to a duration long preceding the Deluge[22].

Certainly by the mid-eighteenth century many writers, including Diderot[23], Buffon[24], and Maillet[25], were beginning to propose chronologies far longer than that apparently permissible from orthodox analyses of world history summarised in *Genesis*. Maillet, for example, argued for an indefinitely ancient Earth and a human existence of 400,000 years, while Diderot went even further in stating that the world was "hundreds of millions of years" old[26].

Like James Howell, all these authors were aware that, long before, Apollonius the Egyptian had claimed that the world was 153,075 years old, and that the classical Greek writer Diodorus Siculus had stated that pharaonic history spanned more than 18,000 years[27] – plenty of time, even in his day, for two Creations, and for humans to become sufficiently sinful to invoke divine displeasure culminating in a universal Deluge.

Now, while modern archaeologists have since shown 18,000 years to be grossly inflated as a date for pharaonic history, they have also discovered that, like many classical Greek thinkers[28], and unbeknown to seventeenth and eighteenth century scholars, both the ancient Egyptians[29] and the Babylonians[30] took a deep interest in fossils and the problem of 'time'. Apollonius's apparently wild claim of a world 153,075 years old, while actually much too short, was perhaps formed, or partly based, on long-forgotten palaeontological investigations, and that a great deal of seventeenth and eighteenth century discussion respecting the age of the Earth had, in essence, already occurred more than 1,500 years earlier.

Although Robert Hooke in 1688 had suggested that it might be possible to "raise a chronology" from fossils "and to state the intervalls of the times wherein such, or such catastrophies and mutations have happened"[31], subsequent studies showed that fossils were capable of several almost equally plausible interpretations insofar as the age of the world was concerned, and that the utilisation of other less uncertain methods was preferable.

Even as far back as the late seventeenth century these were being sought by men like Edward Lhwyd of Oxford. He believed that the seemingly slow accumulation of boulders in two north Welsh valleys was evidence that the age of the Earth must be far greater than then generally envisaged[32]. Lhwyd evidently omitted to consider that accelerated rates of boulder-accumulation could occur through sudden flooding, ice action, earthquakes or persistently torrential rains causing landslides.

Then, in 1715, Edmund Halley of cometary fame proposed the determination of the world's true age by extrapolating from the sea's supposedly regular increase in salinity[33]. This method also proved to have only limited application. Later, Buffon's associate, J T Needham tried to calculate the age of the Earth from sedimentation rates, but found the results so staggering that he could not accept them[34]. In any case, sedimentation rates vary widely in different latitudes and under differing conditions.

Later still, in 1779, the rate of advance by glaciers was advocated as another method[35], but that too was illusory. At the time it was unfortunately not appreciated that glaciers sometimes retreated, modern research showing that some do on a cyclical basis in response to various environmental factors.

During the mid-eighteenth century it was widely assumed that land-forms (mountains, valleys, deserts *etc*) and the rocks comprising them had been created at different times. This led one writer, Johann Lehmann, to distinguish three kinds of mountains, created respectively before, during and after the ubiquitous Deluge[36]. But although the Deluge continued to dominate the thoughts of many naturalists during this period, there were others, such as Baron de Holbach and Montesquieu, who argued for sequential destructive upheavals at largely irregular intervals, each apparently devoid of design or purpose[37]. These ideas reached a head in the writings of G H Toulmin, a medical doctor, who concluded:

> ...convulsions and revolutions violent beyond our experience or conception, yet unequal to the destruction of the globe, or the whole of the human species, have both existed and will again exist... [terminating] ...an astonishing succession of ages.[38]

The *Catastrophist* school of geology, to which we will return shortly, was truly born through the writings of these authors.

Contemporaneously with the activities and published opinions of the afore-named scholars were the conclusions reached by Jean Guettard, now justly acclaimed as the discoverer of the natural evolution of land-forms[39]. His discoveries were to have far reaching effects on geology (the study of the composition, structure and origin of rocks) in general and, over a century later, in the development of geomorphology (the study of surface physical features and their relation to structures and land-building and land-eroding processes), another important topic to which we will return later in this book.

The eighteenth century, with its ever-mounting fascination with the age and structure of the Earth, closed with two highly important geological turning-points, and with several singular discoveries. Of the former the first was the publication in 1785 of James Hutton's *Theory of the Earth*[40], in which the immensity of geological time, altogether dwarfing Ussher's earlier 4004 BC date, was forcefully stressed, as also the Earth's essential stability. For Hutton, "it is the little causes, long continued, which are considered as bringing about the greatest changes of the earth". He emphasised the thousands of separate details which, operating over a "long succession of ages", refute "the hypothesis of violent causes" that a truncated chronology would require. In these statements, Hutton launched what was later to become known as the *Uniformitarian* school of geological thought, a perspective central to the main theme of this book to which we shall repeatedly refer.

The second of these turning-points was the discovery in 1797 by a talented land surveyor, William Smith, that Earth's crust is composed of a definite sequence of fossil-bearing deposits in which individual strata (levels) are characterised by distinctive suites of fossils (bygone faunas and floras) each peculiar to the stratum yielding it. Once again it was obvious that long periods and eras had been necessary for the development of each of these successive organic assemblages – very much as Hutton and Diderot had independently postulated. Though well known in geological circles by 1800, Smith's discovery (which earned him the amusing nickname of 'Strata Smith') was not published until 1816[41], by which time much further evidence supporting it had come to light elsewhere.

The singular discoveries concerned the finding in 1772 of a deeply frozen carcass of a woolly rhinoceros near Vilui in northern Siberia, and, in 1787, of a large portion of a hairy mammoth in the Yakutsk region of Siberia. Like some earlier poorly-documented similar finds in the Siberian Tungus, both these specimens retained flesh, hides and hair[42].

Such discoveries greatly influenced the deliberations of many late eighteenth and early nineteenth century naturalists, for it was clear that, since these northern animals had been frozen instantly and had remained so until found, their demise must have been extremely sudden. Such suddenness betokened a catastrophically swift event, yet men like Hutton and Smith were discovering indisputable evidence that such catastrophes were rare. Just as clear was the fact that, for the ice and frozen ground enclosing these carcasses to have remained unmelted for the vast periods of time implied by 'Huttonian' theories, the destruction of these Siberian animals must, geologically speaking, have been very recent.

The Siberian finds increased naturalists' interest in the numerous mammoth and woolly rhinoceros bones which had long been known from, and were indeed still being met with in, more southern European latitudes. These, it was quickly realised, generally occurred either in caves or rock fissures or in superficial surface deposits like sands, gravels, clays or marls. Usually unconsolidated (loosely held together), these deposits were also largely unstratified (unlayered) and often of very irregular linear extent and thickness, exhibiting every sign of having accumulated under agitated conditions which had apparently affected huge areas of the globe more or less simultaneously. Due to the exceptional nature of these surface deposits special names were coined to distinguish them, *eg*, 'Boulder Clay', 'Hard Pan' and 'Till'. Researches showed that the lowest of these deposits, the 'Till', usually lay directly upon solid bedrock, the upper surface of which, irrespective of the kind of rock involved, had frequently been smashed, fissured, striated (marked with linear ridges, furrows or scores), polished or pulverised into countless fragments. This phenomenon not only extended surprising lateral and vertical distances, but had affected a great variety of extremely hard rocks.

To most naturalists at the time it was perfectly obvious that some tremendous event had occurred which, among other effects, had fractured hard rocks over immense distances, and had deposited the resultant debris equally extensively as gravels, sands, clays and muds. The bony remains of the hordes of animals which had been destroyed by the event now lay within these deposits, which, in northern Siberia, had become permanently frozen. All these interrelated remains thus represented the debris of a former but now-broken world.

Clearly any agency capable of venting so much devastation must have been not only awesomely powerful but must, from the evidence, have affected the entire world. Late eighteenth and early nineteenth century scholars rapidly expanded their concepts of terrestrial chronology from thousands or tens of thousands of years to spans of time stretching to many millions of years, and to the notion that for a large part of these immense periods quiet and equable conditions had prevailed[43]. On the other hand they were being confronted with mounting evidence that something traumatic, something catastrophic, had affected the whole Earth, geologically extremely recently.

Men were not long in concluding that this event had been the Deluge of *Genesis* and widespread tradition, and that perhaps the scriptural record and the accumulating geological record could, after all, be reconciled. Many books appeared on this theme during the first thirty years of the nineteenth century. Three examples only need be cited here[44]. Were the ancient traditions right after all? Had a long-lost Golden Age been suddenly and disastrously terminated by a frightful global Flood? The growing evidence suggested to many that this may indeed have been the case, and efforts were redoubled to investigate these possibilities.

The results were interesting and to some extent completely unexpected.

3
ENIGMAS IN STONE

The first quarter of the nineteenth century, when geological science grew apace, saw much attention given to rock striations and polished rock surfaces, and to the vast number of boulders which, because they were usually foreign to the districts in which they reposed, were accordingly called 'erratics'.

The rock striations were generally found to be aligned north-west to south-east, both north and south of the equator. At many places either side of the Atlantic the striations occur only on the summits of high hills or only on the northern or north-western slopes of mountains. Locally, however, other striations cross the predominating examples at all sorts of angles or even at right-angles to their long axes. Such evidence suggests that whatever produced them proceeded from a general northern or north-western direction and totally ignored pre-existing topography.

At many localities these rock striations furrow extraordinarily smooth rock surfaces, in some instances exhibiting a glass-like polish. Such surfaces are of irregular extent, but occur with or near striated rocks so frequently that little doubt exists that the striating and polishing of these surfaces had a common origin, both in cause and time.

Many of the 'erratic' boulders are of immense size and weight, the very largest being literally miles long[45]. In some districts they abound in almost unbelievable numbers, perch precariously in long lines along mountain crests, or lie singly upon the very summits of lofty eminences. At other places they choke valleys and gorges or repose in splendid isolation on the surfaces of plains and deserts. Sometimes the boulders are visible in their entirety – elsewhere they are buried almost out of sight by surrounding surface deposits. 'Erratics' are often reported as sharply angular and "fresh-looking"[46], rounded and polished, or as sometimes scored by "well-marked parallel striae"[47], and

Table 1A
Geological Eras, Periods and Epochs

Geological Eras and Periods

The sequence of eras and periods which comprise Earth history, with their estimated durations given in parentheses.
Not to scale.

Millions of years	ERA	PERIOD
2	CAENOZOIC (Recent life)	QUATERNARY
12 29 41 51 60		TERTIARY (58,000,000 years)
130	MESOZOIC (Middle life)	CRETACEOUS (70,000,000 years)
160		JURASSIC (30,000,000 years)
185		TRIASSIC (25,000,000 years)
210	PALAEOZOIC (Ancient life)	PERMIAN (25,000,000 years)
265		CARBONIFEROUS (55,000,000 years)
about 320		DEVONIAN (50-55,000,000 years)
360		SILURIAN (40,000,000 years)
440		ORDOVICIAN (80,000,000 years)
540		CAMBRIAN (100,000,000 years)
at least 840	PROTEROZOIC (Primitive life)	Somtimes divided into 300,000,000 years or longer
unknown	ARCHAEOZOIC (Beginning of life)	Duration unknown

The Tertiary and Quaternary Periods

The *conventional* subdivisions of the Tertiary and Quaternary periods with their estimated durations shown in parentheses.
Not to scale.

PERIOD	EPOCH			Millions of years
QUATERNARY	HOLOCENE			.011
	PLEISTOCENE	Upper	***Ice***	
		Middle	***Ages***	
		Lower		2
TERTIARY	PLIOCENE (10,000,000 years)			12
	MIOCENE (17,000,000 years)			29
	OLIGOCENE (12,000,000 years)			41
	EOCENE (10,000,000 years)			51
	PALAEOCENE (9,000,000 years)			60

in every case as having travelled considerable distances to their present locations – their points of origin often remaining obscure. Their angular and "fresh-looking" condition, however, suggests that their transportation was rapid and of short duration, a startling conclusion respecting the largest 'erratics'.

Like the rock striations mentioned above, these boulders were evidently dispersed by an agency operating oblivious to older geographical barriers and sometimes obliquely to the long axes of pre-existing ground features[48]. Repeating associations of polished rock surfaces, striations and erratics are known from many widely-sundered localities, such as Montana[49], Brazil[50], and Finland[51]. Clearly these phenomena are different expressions of a singular event which occurred on a hemispheric scale.

The superficial sands and gravels which contain the bony remains of woolly rhinoceroses, mammoths and other large contemporary mammals, also lie unusually to adjacent local topographical features. They are often banked up against northern or north-western mountain or valley slopes only. At other places they mantle only the summits of high mountains, sometimes to depths of several thousand feet or metres. Elsewhere they bury the lower flanks of whole mountain ranges or even fill up entire valleys. They also frequently contain large quantities of geologically recent plant remains, at some places so profusely that, in company with coeval (same age) animal bones, they completely fill caves and rock fissures. Yet, even in such apparently chaotic evidence a curiously consistent theme emerges, for at many sites – those around Muggendorf in Germany for instance[52] – only the caves and fissures facing northwards or north-westwards have been so filled.

Almost all early geologists attributed these clearly linked phenomena to the action of powerful water currents flowing in a general north-to-south direction. The first scientific explanations purporting to account for these phenomena included vast river floods, 'waves of translation' generated by hypothetical giant submarine earthquakes, and the equator-wards drift of huge numbers of silt and stone-laden icebergs of northern origin, which deposited their stony cargoes in warmer latitudes. These explanations invoked essentially catastrophic causes, and the irregular character of the relevant deposits, due to their supposed transportation by water or ice from one place to another, were soon widely referred to as 'drift'. In turn, the advocates of such explanations were grouped with those who, like Whiston, had long postulated recurrent violent episodes in Earth history, and were regarded as 'Catastrophists'.

For many older naturalists the 'drift' deposits and the pulverised and fissured bedrock upon which it frequently rested represented the stony remnants of a former but now badly scarred world, destroyed by an agency which, in the geological scale of things, had operated remarkably recently. Recognising the modernity of this material, present geologists assign most of it to the Pleistocene period which, ending approximately 11,000 years ago, immediately preceded the Holocene (our own) period (see table 1A).

4
WORLD AGES – WORLD SUNS

One of classical Greece's most celebrated philosophers, Plato, citing even older Egyptian records, stated that in addition to world disasters resulting from fire, there had been not one but many great floods which had terminated several earlier successive ages[53]. The pre-Columbian Mexicans possessed generally similar beliefs in which various past ages, which they referred to as 'suns', were brought to violent ends by tremendous natural upheavals, floods, furious winds and rampant fire[54]. Numerous other Amerindian recollections, particularly those from western North America, mention 'ages' as 'suns', the number of which varies from three to five in different accounts[55], and traditionally attribute their ends to a disastrous "falling of the sky". As the mythographer Alexander has remarked:

> The notion of cataclysmic destructions of the world by flood or fire, often with a concomitant falling of the sky, is frequent in West Coast myth...[56]

Even the remote tribes of the Amazon basin possess these beliefs, many of which embody the idea of terrible disasters involving fire and prolonged darkness and, above all, an immense world-drowning flood analogous to that mentioned in *Genesis*[57].

On the other side of the world, the Dusan tribe of western Borneo (Kalimantan) preserve a similar idea which they link to seven 'suns' thus:

> The sky, originally low, retreated when six of the original seven suns were killed.[58]

A belief in recurrent world disasters terminating successive earlier ages was formerly extremely widespread, both in time and geographically. The Voguls of Siberia, for instance, believed in recurrent conflagrations attended by fearful thunder[59]; the Welsh Triads, compiled from more ancient sources during the middle ages, refer to three great cataclysms, one involving a deluge, another a fire and a third a drought[60]; in the 6th century BC both Anaximenes and Anaximander assumed periodic world destruction with subsequent re-creation, as did Diogenes of Apollonia in the 5th century BC; Aristarchus, who flourished at Samos in the 3rd century BC, taught that the Earth undergoes destruction by fire and water every 2,484 years[61]. The Chinese entertained similar ideas[62], as did nations as far apart as Hawaii[63], the shores of the Bengal Sea[64], the early Icelanders[65], and the Jews[66]. The ancient sacred book of the Buddhists, the *Visuddhi-Magga*, mentions a still more ancient work called *Discourse on the Seven Suns*[67], indicating that the same notion had long existed on the Indian subcontinent, while in Mexico, the old Mayan *Annals of Cuauhtitlan*, written about AD 1570 on the basis of still earlier sources, mentions seven 'sun' epochs known as the Chicon-Tonatiuh[68].

Many early memories of these world-shaking events specifically link them with the abrupt destruction of a primeval earthly paradise widely known to classical writers as a Golden Age. The Roman writer Ovid stated that during the reign of the legendary king Kronos (Saturn of the Romans, and the alleged ancestor of the Olympian gods of both ancient Greece and Rome) springtime was perennial[69]. Virtually every commentator of antiquity on this topic agreed that this lost age was a golden one and the Earth a veritable paradise. It was, as Lenormant once noted, traceable

> ...among all people of the Aryan or Japhetic race.[70]

Ver perpetuum, or perpetual spring, was its alleged climate[71]. Various remarkable and often quite unbelievable characteristics were attributed to it, such as it being a place "...where the human inhabitants are in the prime of life, with no aging or senility"[72].

The early Egyptians preserved similar memories, for:

> In Egyptian mythology, the reign of Râ was like the primeval reign of Kronos; the myth of it was a reminiscence of the sinless Golden Age.[73]

Classical writers like Strabo and Pherecydes discussed the location of the seat of Kronos' empire, and concluded that it was a northern one:

> Pherecydes described Kronos as dwelling in that part of heaven 'nearest the earth', *ie*, the North; Strabo places him in the 'home of Boreas'. These all agree in essence with Sanchoniathon, as preserved in the Greek version by Philo of Byblos, who said that the seat of Kronos' power was 'in the middle of the lands... in a place near springs and rivers'.[74]

Most mythographers agree that Boreas, in whose home Kronos dwelt, equates with the Norse Bör, known to the ancient Greeks as the demiurge Ophion, who, under various guises, lies at the very root of most of the world's mythologies. Thus, in the Norse epics, it is the sons of Bör who build Asgård, the abode of the gods and their kin, from which they reputedly wrought many wondrous deeds both on Earth and in the heavens[75]. Odin, the principal Norse deity, lived there, as did his Finnish counterpart Ukko, who resided at *Tätela* or the *Place of Tähti*[76]. Very interestingly, *Täht* in the Estonian language means 'Pole Star' – so, again, we are directed to a northern location for this ancient paradise.

Early Greek authors like Apollodorus and Theopompus expressly called this traditional lost land *Meropia* and its inhabitants the *Meropes*. The latter were sometimes anciently identified with the *Hyperboreans*, a near-mythical people alleged to have dwelt either in the extreme west or in the far north. Dominating all was a lofty mountain named *Meru*. Meru also features in ancient Indian epic literature, not so much as a particular peak but as a generally elevated region[77]. It was evidently the centre from which a long-forgotten empire was ruled, for we find that *Deva-Nahusha*, one of the Vedic deities of old India and whose greatness was extolled in glowing terms, for a time had:

> ...sovereign control of the affairs of *Meru*... he led his armies through all... the world; by means of matchless wisdom and miraculous heroism he made his empire universal[78].

Ancient Chinese traditions likewise speak of a highly elevated region wherein dwelt gods and other wonderful personages. The principal Chinese deity, *Lao-T'ien-Yeh*, known as the 'Heavenly Master of the First Origin', and credited with creating the first humans, reputedly lived with his consort, *Queen Wang* – who reappears in the ancient Chinese romance of the *Emperor of Mu* – in the K'un-Lun mountains[79]. Variant Chinese traditions refer to the supreme deity as *Shang-Te*, whose palace was located in a "celestial space about the North Pole"[80]. Likewise the western Mongolians placed the abode of their gods on a 'Golden Mountain', the apex of which they considered identical with the celestial Pole[81]. Presumably for these reasons the Japanese, who held essentially similar beliefs, addressed their principal god as the 'Lord of the Centre of Heaven'[82].

Probably the best known of all recollections of this idyllic land (shared by Moslem, Jew, and Christian alike) is the 'Garden of Eden'. Unmistakable variants of it occur in early Persian, Arabian and Sanskrit (Indian) literature; it is mentioned as *Atlan* by the Aztecs and as *Xibalba* by the Quiché Maya of Yucatan. The Polynesians remember it as the 'lost home of Kane', and Plato apparently left us a comparatively detailed account of it in his description of the legendary sunken island of Atlantis[83], although suspicion exists that much of his version is somewhat idealised.

Several widely-scattered traditions describe the catastrophic termination of this wonderful primordial age. The inception of terrible unaccustomed cold was a special feature of that event. Thus Iranian tradition asserts:

> The first of the good lands and countries which I, Ahura Mazda, created was *Airyana Vaejo* (Iran the Ancient)... There are ten winter months there (now), two summer months, and these are cold for the waters, cold for the earth and cold for the trees[84].

Other traditions about a disastrous refrigeration of the former abode of the gods and the cradle of mankind have been ably reviewed by Pietremont[85] who, among other things, mentioned Lactantius's assertion that prolonged darkness accompanied a dreadful winter at the time[86], and that the Delaware Indians remember closely similar details in their account of the event[87]. This icy calamity was almost certainly identical with the appalling *Fimbul* winter of Norse mythology, of which more anon.

Also remembered among the cataclysmic agencies which destroyed this primeval age was a gigantic destructive flood, in which:

> ...trees, flowers, fruits, birds, vanished in an instant, amid terrific clamour.[88]

The significance of these memories will become all too clear as this book unfolds.

5
A DISPLACED AXIS?

Very interestingly, life-forms like those just listed are biologically-compatible organisms inasmuch as, despite its traditional northern or polar location, the paradisical *Eden*, *Asgård*, *Meru* or *Airyana Vaejo* enjoyed a perennial spring-like climate. As shown later, these details are supported by a great deal of factual evidence.

It is also clear that the loss of this ancestral paradise involved a rearrangement of the seasons. Indeed, describing the "World Before the Present", the Navajo Indians of North America insist that:

> ...The seasons were much shorter than they are now. A year then was but a month of our time.[89]

The statement contained in Zad Sparan's paraphrase of chapters 1 – 5 of the Persian *Bundahish* texts agrees with the above in describing how, when *Airyana Vaejo* was lost, the whole sky and sea became deranged – and lends support to Frederick Klee's contention that certain ancient Egyptian hieroglyphs refer to a displacement of the heavens at the time of the Deluge[90]. We have just noted that a tremendous flood was allegedly one of the features of the end of the idyllic primeval age said to have preceded our own.

The above, and other similar recollections of a celestial derangement accompanying the Deluge indicate that before the onset of that calamity the celestial bodies moved differently relative to viewers on Earth. The illustrious Greek astronomer Anaxagoras taught that during the Golden Age the stars revolved in a *tholiform* manner (when stars revolve in the sky in a horizontal plane), a belief shared by another Greek astronomer, Anaximenes, who, however, preferred to say that the stars revolved in a horizontal plane. Diogenes Laertius, who recorded these opinions, added:

> At first the Pole Star, which is continually visible, always appeared in the zenith, but afterwards it acquired a certain declination.[91].

Ancient Japanese cosmogony (theory of the origin of the universe) refers to virtually the same condition, thus:

> ...the father of our present sun and moon is represented as beginning his activities in the newly-created world by repeatedly performing in a horizontal plane... Chinese traditions also refer to this.[92]

Additional confirmation of this earlier celestial arrangement (and of some later alteration to it) was given by the respected Victorian astronomer Richard Proctor, who concluded that, from the position of the aquatic constellations (given watery associations) in the most ancient astronomical systems, celestial rotation at the time of their invention must have been "...in a horizontal position"[93]. The date when these constellations were first devised is still unknown, but all authorities agree that it must have been a remotely ancient one. Certainly by 5100 BC alpha (a) Ursae Majoris or *Dubhe* in the constellation of the Great Bear (Ursa Major) had already long been viewed as a polar star, for it appears engraved upon the walls of the temple of Hathor at Denderah in Egypt, and formed the original orientation-point of that structure[94]. At that date the stars of the constellation of the Dragon (Draco) were circumpolar. It was not until 2000 BC that the stars of Ursa Major – now the principal constellation in the northern sky – became circumpolar too[95].

In this connection it is significant that for latitudes below 51°N today, the stars of Ursa Major 'set' and 'rise', and that at the latitude of the old Egyptian capital Memphis only *Dubhe* always remains above the horizon by some 5°. Nonetheless, within historical times Ursa Major was wholly invisible to residents of the Nile Valley south of Memphis[96] yet the ancient Egyptians knew that the polar axis lay in that constellation during historical times[97]. That they should have been aware of this is not, however, so very surprising when we recall that one of their leading historians, Manetho, asserted that his race possessed records of events dating back as far as 11,542 BC, or, as previously noted, Apollonius thought that by his day 153,075 years of history had passed by.

These formerly different positions of the above-mentioned constellations actually relate to the well-known astronomical phenomenon of the precession of the celestial North Pole which is, of course, matched by an equivalent effect at the celestial South Pole. Concerning these, Sir James Jeans once remarked:

> ...our ancestors of 5,000 years ago saw the heavens turning round a point in the constellation of the Dragon. For the same reasons, our posterity of 5,000 years hence will see the heavens turning round a point in the constellation of Cepheus.[98]

Recent research, however, suggests that something more profound than just a celestial precession has occurred. The precession itself is merely an effect of a more fundamental change.

Studies have shown that at 10,178 BC, or over 12,000 years ago, the celestial pole was inclined at an angle of 30° from its present position[99]. This in turn strongly suggests that the terrestrial axis was then oriented differently from today. If true, that imparts an entirely new significance to the afore-cited statements of Anaxagoras, Anaximenes, Diogenes Laertius and Proctor, and the assertions of the previously mentioned traditions. It also suggests that at the time of the Deluge which allegedly terminated the Golden Age there must have been a change to the tilt of the Earth's axis.

Any axial changes of the type just suggested would, of course, have been attended by various other major natural adjustments on quite literally a global basis. There are now

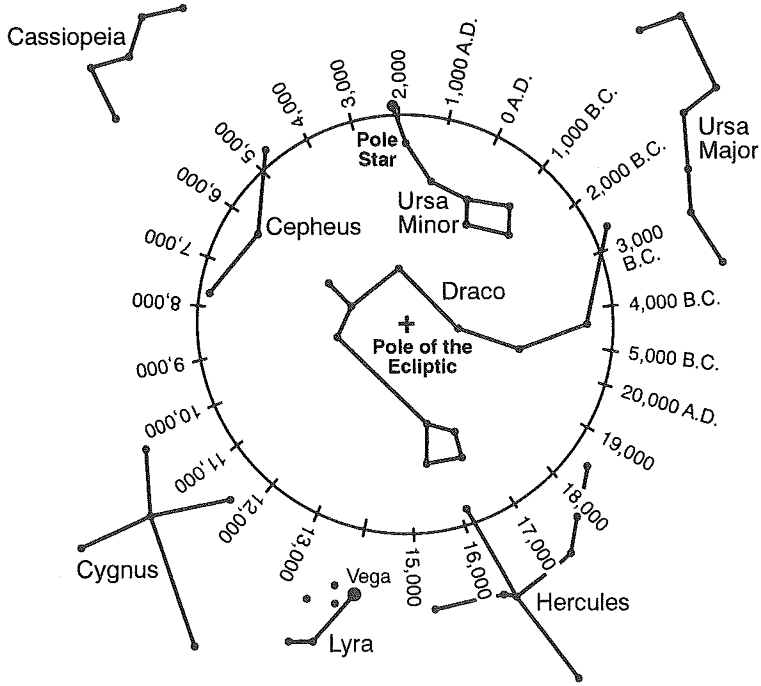


Fig 1.1. Precession of the Polar Axis. *After Sir James Jeans.*

plenty of these on record from different parts of the world, clustered around the date of 10,178 BC, calculated as that when Earth's celestial pole lay at an angle of 30° from its present position.

According to standard Ice Age chronology (see table 1A), the final icy episode of any magnitude was the so-called Younger Dryas which brought the Pleistocene epoch to a close. This occurred between 10,000 and 11,000 years ago when the waters of the North Atlantic warmed by as much as 7°C within a mere 50 years[100], and ended a period of cold dry conditions on Greenland, slightly later at 10,700 years, in as little as 20 years – an estimate lately reduced to an "astonishingly quick 3–5 years"[101] – concomitantly with a rapid retreat of sea-ice in northern waters and a 50% increase in precipitation and snowfall[102].

Recently obtained ice-cores from Greenland reveal even quicker changes. Snowfall there, for example, "doubled rapidly... possibly in one to three years" at the close of Younger Dryas times in response "...to some kind of threshold or trigger in the North Atlantic climatic system"[103]. The effects of these climate changes, described by some recent investigators as *brief* and *dramatic*, were felt all round the North Atlantic basin[104], in Alaska, where they took place between 11,000 and 10,000 years ago[105], and, as in Europe[106], involved marked vegetational changes[107].

Essentially comparable changes also occurred then about the same time much more distantly. Space limitations here preclude the recitation of many details, although we may highlight those from Tibet and China, where climate changes seriously affected Tibetan lake levels and led to long-term aridity across much of the Tibetan plateau, a process commencing "suddenly" about 10,000 years ago[108], and where Chinese climatic conditions and plant life were enormously affected by a northerly displacement of a greatly enhanced monsoonal system which did not occupy its present, more southerly, sphere of operations until about 6,000 years ago[109].

All such data are indicative of seriously, and suddenly, disturbed atmospheric and oceanic circulatory systems of the kind that could be expected to naturally attend an alteration to the angle of Earth's axis – assuming that such a change is possible or actually occurred in the geologically recent past. As later pages show, such a change almost certainly did occur, and, not unexpectedly, involved many other factors in addition to those just mentioned. Before we can consider these, however, it will be necessary to review some further aspects of the general scenario which has unfolded so far.

6
THE PARADOX

It was precisely the kind of traditional backdrop which we have outlined on preceding pages that, confronting the emerging discipline of geology some 170 years ago, clearly indicated to the pioneer geologists that, together with 'drift', 'erratic' boulders and fresh-looking land-surface phenomena, a major physical disturbance had afflicted Earth within geologically very recent times. This perspective remained popular until about 1830, when Charles Lyell, then a young lawyer, published an alternative interpretation, his celebrated 'principles of uniformity'[110].

Like Hutton before him, Lyell argued that no past geological processes radically differed from those operating today. Deposits have accumulated slowly over periods individually lasting many thousands, even millions, of years. Wind, rain and frost had inexorably denuded landscapes just as surely as oceans had sculpted shorelines. The temporal and geographical extent of any former natural upheavals such as earthquakes and volcanic eruptions must of necessity been brief; they were not global events. The world-embracing cataclysms of the 'Catastrophists' were ruled out; 'gradualism' was said to have been the overriding norm. If it had occurred at all, the Deluge was considered to have been a relatively modest event confined to a limited geographical region. The term 'Pleistocene' was coined specifically to embrace the various 'diluvial' (flood-borne) formations – the sands, gravels, muds, silts, *etc* – of the 'Catastrophists', and as a distinctive name for the period when these had been deposited.

Lyell's views, having the special merit of giving a terrestrial rather than a cosmic cause for the present panorama of a debris-strewn world, were quickly held to signify 'uniformitarianism' (as opposed to the until then popular 'catastrophism') and soon came to be accorded a respect only slightly lower than that usually reserved for Holy Writ.

Thus, supporters of Lyell's ideas became known as 'Uniformitarians', and 'uniformitarianism' became a pillar of conventional geological dogma. How the acceptance of 'uniformitarianism' soon afterwards led to the formulation of the Glacial Theory and the idea of an Ice Age will be presented shortly.

In one geological camp we thus have 'Catastrophists' who have long sought to use scientific data to prove the former reality of terrible world disasters – particularly the Deluge of global recollection. They have emphasised that numerous Deluge traditions mention one or more celestial agents as having assailed Earth and having caused that watery calamity, and that prolific evidence capable of being reasonably interpreted as having originated in just such circumstances is available for study. In effect their argument is essentially identical to that presently urged by the proponents of the recently advanced theory of an asteroidal or cometary termination of the Mesozoic Era during late Cretaceous times.

In the opposite camp, 'Uniformitarians' have argued that, despite the evidence of the frozen Siberian carcasses (apparent examples of a catastrophic event which we consider again in greater detail later), recurrent disasters of such magnitude are completely at variance with the normal workings of Nature on Earth. They discern no terrestrial mechanism capable of generating of its own volition a cataclysm as allegedly gigantic as the Deluge, despite the fact that leading Catastrophists like Whiston[111], Donnelly[112], Beaumont[113], Patten[114] and others specifically invoked external (cosmic) causes for that calamity. Since 'uniformitarians' perceive or admit of no physical proof of a conflict between this planet and some other celestial agent, they regard as spurious all claims advocating such an idea. Furthermore, they contend that the factual data regularly used to support 'catastrophist' arguments relates mostly to the widespread action of *ice*, not water.

It is, therefore, paradoxical that a worldwide traditional memory of an appalling watery disaster during the infancy of mankind, involving one or more cosmic visitors, has persisted from earliest historical times. Further, that science, having assembled a veritable library of facts dealing with the very same period, interprets the same evidence as due to quite another cause. The 'catastrophist' and 'uniformitarian' schools of thought are thus apparently diametrically opposed.

As we now shall see, this is not necessarily the case at all.

7

PERSPECTIVES – A QUESTION OF SCALE

In actuality 'uniformitarianism' is 'catastrophism', but on an insignificant and hugely broadened-out scale. There is no hard dividing line separating the two extremes represented by these terms. The word 'scale', however, is the key to this whole scenario: it permits the development of accurate perspectives. Such perspectives, however, are scarcely attainable if the apparently diametrically opposed concepts of 'uniformitarianism' and 'catastrophism' are rigorously compartmentalised and continue to be regarded as incompatible.

Dictionaries define the word 'scale' as the ratio between given sizes or intensities of events and things (both animate and inanimate), and denotes *relative magnitude*. Compared to an ant, for example, a human being is a very large entity, and the ant is enormous compared to a microbe. The same human being is quite small alongside the largest tree or whale, and is almost insignificant compared to a mountain or an ocean. Even the mightiest mountain is no more than a pimple on Earth's crust, and any one of the oceans but a puddle on the planet's uneven surface. Yet even the largest mountain is dwarfed by the smallest ocean.

Although colossal by human standards, Earth itself is a rather modestly-sized planet and, as with all the other planets forming the solar system, is a very small object relative to the Sun around which it orbits. Viewed astronomically, however, the Sun and the solar system is almost invisibly tiny compared to the immensity of the galaxy (to earthbound observers best known as the Milky Way) of which it is a member. The unimaginably vast distances separating the Sun from its orbiting planets, the planets from each other, and the solar system generally from the nearest stars, immediately put into clear spatial perspectives the great event discussed in this book.

Nature itself operates essentially as a series of disasters. These, relative to the organisms and environmental conditions involved at any given moment of time, are no less catastrophic than the frightful disaster described on following pages. For example, natural marine and river erosion constantly destroy, through undercutting, stream banks and coastal cliffs. For organisms inhabiting such places, such physical alterations are frequently lethal and at best decimatory. Again, unseasonably wet weather can rot seeds, fruits and flowers before they can germinate or pollinate successfully. Similarly, prolonged drought can shrivel vegetation or generate fires every bit as calamitous as high winds can remove blossom before it can 'set', or cause chronic 'windburn' to plants at vital youthful stages of their development – in the process stultifying harvests and crops. Moreover, particular combinations of climatic factors can and often do encourage abnormal increases in insect and rodent populations preparatory to insect and vermin plagues.

Viewed locally, and irrespective of whether they occur suddenly, violently or intensely, or operate slowly over many weeks or months (such as the 'Dutch Elm Disease' episode of the 1970s), all these and many other analogous events are catastrophic. They are apparently the underlying cause for the 'survival of the fittest' as defined by Darwin and other evolutionists.

When such episodes are small-scale, or fail to affect human beings significantly, they either pass unnoticed or are generally regarded by irritated farmers, meteorologists and naturalists as normal quirks of Nature. Yet, despite representing miniature catastrophes, they continue to be regarded as natural expressions of 'uniformitarianism'.

If such events manifest as landslides, floods, volcanic eruptions, earthquakes or tsunamis[115] and happen suddenly, violently or with great intensity, or when they occasion appreciable loss of property or 'valued' life (*ie* people, owned livestock, *etc*), they are noticed and bracketed as cataclysms, and the regions they worst affect as 'disaster areas'. It seems to be commonly accepted that such events naturally but sporadically punctuate the uniformitarian norm (as defined by Lyellian dogma), which thus extends to include even such dreadful events as the Krakatau explosion of 1883[116].

Yet none of these 'catastrophes' is individually large or intense enough to terminate a whole geological era or period, or to usher in a new one along the lines postulated by many past 'catastrophist' authors.

Compartmentalisation of traumas like those outlined above, though perhaps convenient for insurance purposes, is demonstrably unstable scientifically. 'Natural disasters' like those just enumerated are relatively no more and no less 'natural' or 'disastrous' than the aforementioned and comparatively innocuous cliff falls, plagues and crop failures. The only difference separating all these events is the intensity and extent of their occurrence. This difference is purely one of *scale*.

Thus, as long as portions of the Earth's crust do not collapse or get up-heaved into mountain ranges, and oceans are not displaced or drained, man seems content to treat all lesser disasters as normal expressions of 'uniformitarianism' – which, of course, they are. Nevertheless, he is quick to categorise anything larger or more severe, such as terrestrial convulsions induced by, say, celestial agencies (which at present we can merely envisage theoretically), as pure 'catastrophism', and places it outside 'uniformitarianism' as we usually conceive it.

Astronomers and astrophysicists, familiar with the near-endless succession of paroxysmal events occurring naturally throughout the universe during the birth, evolution and demise of galaxies, stars and sundry other cosmic bodies, concede that such events are part of the astronomical norm. As such, despite their inherent catastrophic character, they represent 'astronomical uniformitarianism'.

Again, the question of *scale* is once more the overriding factor here.

When, as established by modern astronomical research, cosmic events like supernovae explosions occur comparatively close to the solar system, we are still dealing with 'astronomical uniformitarianism'. Though fortunately infrequent in our sector of the galaxy, it is inevitable that such events will occur sooner or later in the vicinity of the solar system and, in the larger scheme of things, must actually be *expected* to do so. Thus, because Earth is a celestial body, it would, in the event of an encounter with some intrusive celestial object, react according to natural planetary 'laws' which, as we have just indicated, must themselves be a part of 'uniformitarianism' in its widest (cosmic) sense.

It is only when an event of that kind occurs, however, that these more violent aspects of 'uniformitarianism' can manifest themselves on Earth, for they do not and cannot arise of their own volition without external (cosmic) stimuli. Thus, if appropriate circumstances were to occur, the operation of such 'laws' on a watery planet like Earth could, among other things, be expected to cause oceanic displacement on a scale which might well approach the traditional proportions of the Deluge. Such disturbances would be lethal for all preexisting topography and biota, and would rapidly result in the development of conditions where the doctrine of 'survival of the fittest' – so typical of Lyellian 'uniformitarianism' – would be supplanted by that of 'survival of the luckiest'. That, most interestingly, is exactly what so many Deluge traditions around the world expressly state.

Cosmically induced upheavals like these not only differ from conventional uniformitarian disturbances by their enormously greater magnitude, violence and intensity, but from the fact that, in one form or another, they perforce encompass practically the entire globe[117]. However one *wants* to regard the collective testimony of the world's Flood traditions, there is no escaping its almost monotonously recurrent assertion that the Deluge was a *worldwide* event – precisely what a catastrophe generated by cosmic agencies could be expected to induce. In that connection it is hardly necessary to stress that the juxtaposition in numerous traditions of huge terrestrial convulsions and certain celestial bodies at the very time of the Deluge can scarcely be a coincidence or the happy product of traditional imagination.

The reality is, of course, 'uniformitarianism' and 'catastrophism' are merely opposite extremes of an essentially ongoing chain of essentially calamitous natural episodes spanning the observable universe and ranging, as far as we humans are concerned, from the almost-insignificant to the virtually world-shattering. Once this problem of scale is overcome psychologically, comprehension of what follows in this book should grow progressively clearer.

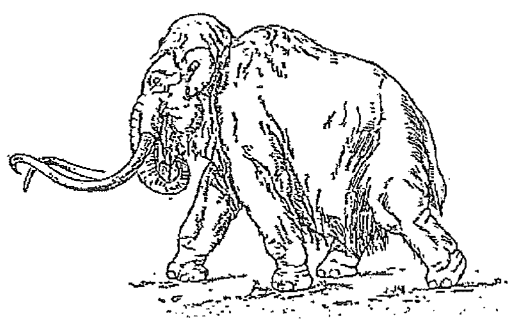
To what extent, then, are the perspectives of the 'catastrophists' and the 'uniformitarians' actually correct? Are the former woefully wrong and the latter right, or is the reverse true? Could the arguments and contentions of both schools of thought be simultaneously partially valid *and* partially erroneous? Is there, in fact, any possibility at all of effectively reconciling such basically different points of view? Believing that there is, we devote the remainder of this book to resolving this seemingly intractable problem.

8
THE BIRTH OF THE GLACIAL THEORY

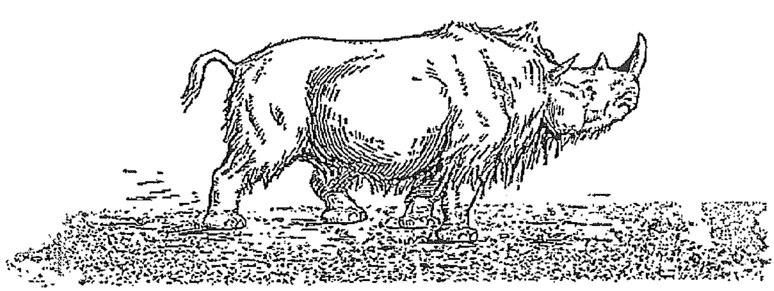
One of the most puzzling facts of Nature confronting late eighteenth and early nineteenth century scholars was the occurrence of the aforementioned frozen animal carcasses of Siberia. Not surprisingly, several earlier authorities, including Pallas[118], Cuvier[119], Erman[120] and D'Archiac[121], who subscribed to the (catastrophist) Diluvial Theory, concluded that a colossal mass of moving water had overwhelmed those creatures.

It was, and still is, widely contended that the preserved hairy coats of these frozen animals served as natural protection against severe cold, and that their owners were former denizens of Arctic latitudes now hosting their remains. This view is still often reflected in artists' reconstructions of these bygone mammals. As modern researches have shown, however, such conclusions have proved to be no more than *assumptions* (see appendix A) and, as we shall see in Part Five, most of the animals now found as frozen carcasses were corpses *before* they were refrigerated.

Nevertheless, it was the coupling of these assumptions with Lyell's then new and superficially attractive theory of 'uniformity' that led early nineteenth century geologists to reconsider the origin of polished and striated rocks, the singular distribution of 'erratic' boulders and the conditions under which the immense 'drift' deposits had accumulated. All these had clearly been produced by an agency or process evidently operating contemporaneously with the deep-freezing of animals in northern Siberia. If, it was reasoned, these latter were animals specially equipped to withstand great cold – as must also have been the *same* species known



Left: Fig 1.2a. The Hairy Mammoth *(Mammuthus primigenius). After Erwin C Christman.*



Right: Fig 1.2b. The Woolly Rhinoceros *(Coelodonta tichorhinus). After Erwin C Christman.*

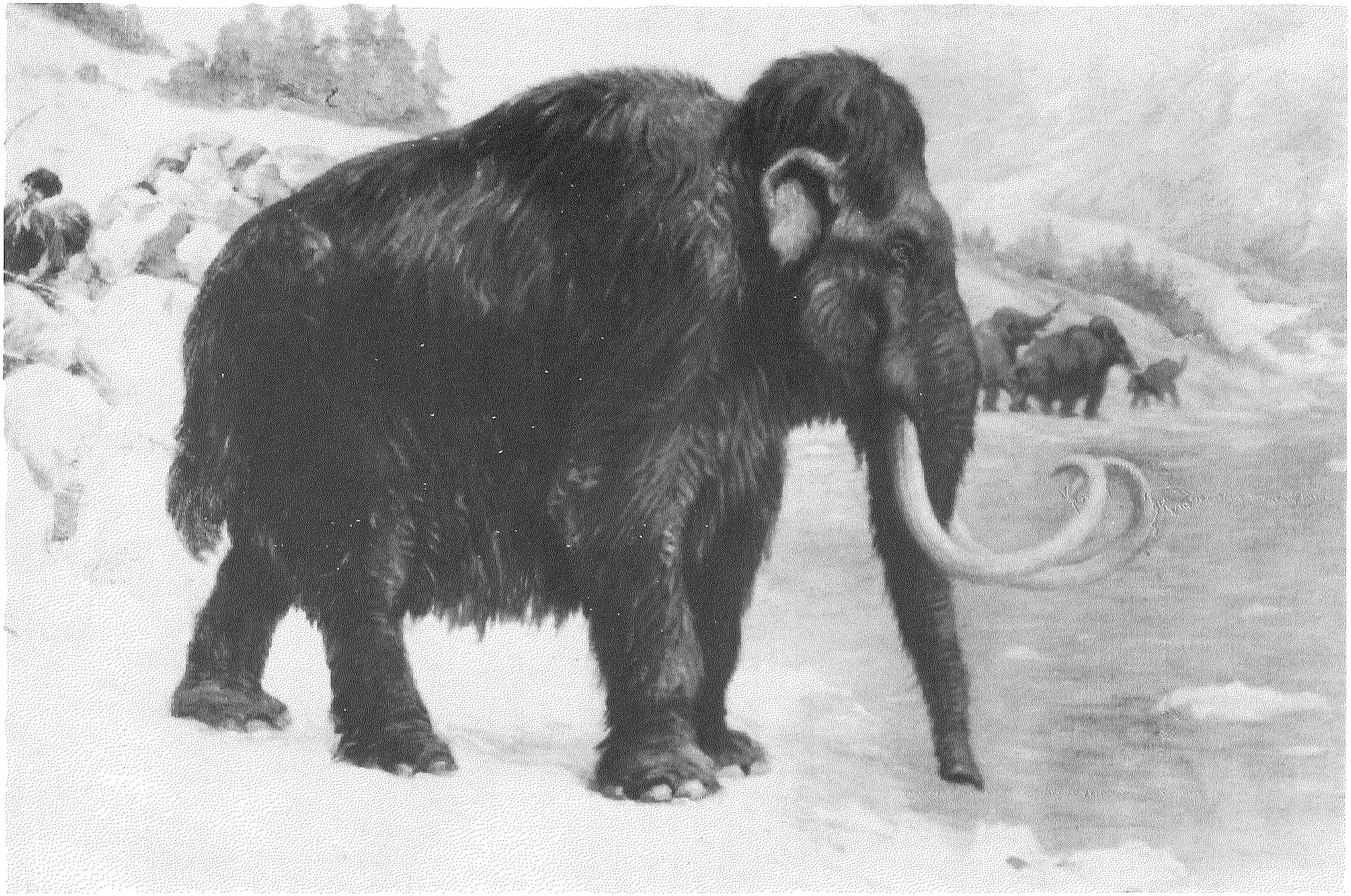


Fig 1.3. Hairy Mammoths. This well-known painting, by Charles R Knight, of mammoths trudging forlornly through Arctic snows, has done much to perpetuate the myth that the Hairy Mammoth lived in and was adapted to these conditions. *Courtesy of American Museum of Natural History, Dept of Library Services. Photo H S Rice.*

further south only from unfrozen bones – then had not all this vast corpus of associated phenomena – in particular the striated and polished rocks – resulted from intense and widespread glaciation? Such glaciation, though now largely melted everywhere except in Arctic Siberia, had *a priori* affected all territories yielding remains of animals *assumed* to have been adapted biologically to icy conditions.

Put another way, did not the occurrence in 'drift' deposits of unfrozen remains of animals identical to those represented by the Siberian carcasses prove that ice had formerly covered all the regions where such remains are now found? Would not the one-time presence of ice across all these regions reconcile the apparent anomalies of the fossil record?

It was decided, therefore, that in the not-so-distant geological past – a factor emphasised by the remarkable freshness and scarcely-fossilised condition of the bones of the 'drift' animals – huge areas of the northern hemisphere must either have been swathed in ice or had experienced temperatures considerably lower than they do today.

In 1821, the Swiss engineer Ignaz Venetz drew attention to evidence he took to be former Alpine glaciation on a huge scale[122]. Shortly afterwards the Norwegian geologist Jens Esmarch similarly advocated far greater landward extensions of the Norwegian glaciers and, by 1832, Prof A Bernhardi had proposed that the North Polar ice had once extended to the southernmost edge of the German plain now dotted with 'erratics'. Just two years later, Johann von Charpentier noted the existence of deep grooves and scratches on many Alpine rock surfaces and boulders and, like a colleague, Karl Schimper, concluded that they were the work of ice and that a veritable Ice Age characterised by numerous large glaciers descending hills and mountains everywhere in central Europe had once been a reality. By virtue of their natural slow movements, glaciers, of course, admirably epitomised Lyell's then recently-published theory of uniformity and gradualism.

Thus, with their constant and remorseless movement, active glaciers (as distinct from those in retreat) were thought to be capable of providing the continuous power necessary to move huge boulders, striate and polish rock surfaces, and deepen or widen older valleys. The stony material excavated by the ice would be carried slowly down to the terminal ends of the glaciers in the normal way and there deposited as moraines (piles of deposited debris) analogous to those still formed by many present glaciers. Earlier investigators professedly saw morainic debris in the many heaps and banks of stones and gravel traceable all over western and central Europe, and the notion soon arose that all these had once been deposited by now vanished glaciers.

By 1836, when the Swiss naturalist Louis Agassiz of Motiers joined Charpentier in his Alpine studies, many ears receptive to the idea of former extensive glaciation already existed in Europe, and a report submitted by Agassiz to the Annual Congress of Swiss Scientists in the July of that year was accordingly well received. Agassiz's report proposed that a profound fall in temperature had occurred *previous* to the upheaval of the Alps and that tremendous masses of ice had smothered land surfaces as far distant as 'erratics' and striated rocks are now distributed. Agassiz expanded his ideas in a larger work published in 1840[123] and it established him as the inventor of the Ice Age, even though, as noted above, Charpentier and Schimper had independently proposed just such an 'age' several years earlier.

After disposing of all previous alternative hypotheses, Agassiz argued that repeated falls of temperature had occurred before the Alpine upheaval and that an immense ice-sheet or *mer de glace* had covered the greater part of northern and western Europe, much of the western end of the Mediterranean as far south as the Atlas Mountains of North Africa, and that a similar glacial mantle had blanketed north-western Asia and much of North America. Only the highest summits protruded above Agassiz's alleged glacial 'sea', principally because their jagged and angular profiles were obviously never rounded or smoothed by ice. Agassiz then envisaged an Alpine rise, an increase in temperature and a melting away of the ice-sheet.

He failed to explain why there had been a lowering of temperature in the first place, merely alluding vaguely to some sort of climatological change. That, if true, was, like the ice, no more than an *effect* of some other cause – a circular argument if ever there was one! It apparently never occurred to Agassiz, nor his many supporters, that such a change must have been occasioned by something *even more radical* than the immense ice accumulations he postulated. Nevertheless, once formed, the ice itself must also have engendered a lowering of temperature across the regions it allegedly covered.

Despite these shortcomings, Agassiz's hypothesis won rapid acceptance in geological circles – one suspects because, to at least some degree, it followed so closely upon the heels of Lyell's by then fashionable and beguilingly logical theory of uniformity. Indeed, it was soon widely held that huge slow-moving glaciers and ice-sheets were sufficient to account for all observable 'drift' phenomena. That extensive, enormously thick, ice-sheets formerly lay across vast tracts of the northern hemisphere during Pleistocene times began to be accepted as having actually occurred. Theory was beginning to be converted into fact.

As scholars pondered the implications of Agassiz's theory it became apparent that as the ice-sheets could not have moved of their own accord, and allegedly buried all but the very highest peaks of known mountain systems in the regions they supposedly blanketed, still higher ground had to exist somewhere within the ice's sphere of advocated operations to supply the impetus to propel them equatorwards. To overcome that problem it was speculated that crustal dislocations resulting in the up-rise of a range of very high mountains had taken place in the far north, at or near the present North Pole. The steep gradients occasioned by the range's great altitude allegedly provided the conditions necessary to push accumulating ice downwards and outwards to the distant margins of the ice-sheets. Later, it was argued, these mountains subsided and the ice, no longer replenished and deprived of motion, melted away.

The scenario just outlined was, of course, not only conjectural but completely false. Science has never found any trace of the imaginary northern mountain range. In retrospect it is astonishing that this unscientific explanation *ever* came to be formulated, yet in a short time both it and the concept of immense thick ice-sheets descending from a hypothetical northern mountain system, to cover all of northern and eastern North America and western and northern Eurasia, was enthusiastically embraced and came to be regarded as virtually established fact. After all, it was argued, did not the slow but irresistible power of enormously thick moving ice ideally explain the observed distribution of the 'erratics', striae and the 'drift' deposits? Such views, albeit somewhat modified, still persist today.

And then an interesting development occurred.

Over a decade later, the Scottish geologist Andrew Ramsay completed studies which suggested that the Pleistocene epoch had hosted *two* glacial ages. Soon afterwards, Oswald Heer, investigating the Pleistocene flora of Switzerland, discovered 'interglacial' deposits containing remains of warm-temperate plants and animals. Independent confirmation of two or more apparently warmer interglacial episodes was also afforded about that time by German evidence. Then, in 1875, Otto Torrell thought he could conclusively show that the numerous north German 'erratics' had been dispersed to their present locations by giant glaciers moving southwards from a central ice-sheet believed to have occupied the Scandinavian plateau.

To confuse matters, several later geologists significantly increased the number of supposed ice ages and interglacials (or interstadials as they are now often called). Prof Penck, for instance, argued for three or four, Prof Geikie for five or six, and Dr Croll for seven. Various later writers have suggested even higher numbers. In contrast, at least two leading American authorities, Wright and Upham, maintained that there was really only one ice age of considerable duration which, periodically expanding and contracting, gave the impression of alternating glacial and interglacial episodes. Ocean levels are also said to have fluctuated appropriately during this alleged cycle of events.

Inevitably, the length of the Pleistocene epoch hosting these events increased every time writers multiplied the number of separate glacial and interglacial episodes. Thus, initially of modest duration, it steadily lengthened to one or two or more million years. *En route* to arriving at that situation, all kinds of estimates of the durations of the supposed glacial and interglacial cycles were proposed, discussed and, as often as not, discarded. Precise agreement was almost never reached. More recently, the great lengths previously advocated for the formation and for the waning of these episodes have begun to be queried, and in some cases drastically reduced on the basis of new evidence. Although this aspect of the Ice Age will be examined more fully later, we may nevertheless recall noting earlier that the growth and decay of some of these glacial and interglacial phases proceeded with remarkable rapidity[124] – quite unlike the process imagined by Agassiz, Penck, Geikie and most earlier glacialists, and quite at variance with the gradualism enshrined in Lyell's famous theory of uniformity.

Thus, through an uneasy mixture of field discoveries, inferences and presumptions, was born the concept of an Ice Age occupying an ever-lengthening Pleistocene period. By now, of course, it will be evident that the whole edifice of the Ice Age of orthodoxy rests upon very shaky ground. That is not to assert that the Ice Age did not exist, but does indicate that it occurred in a form and by a means not properly accommodated by conventional dogma. Moreover, a serious error down the years has been the general acceptance by most older (and many present) glaciologists that the Ice Age, whatever its origin, character and duration, developed and ran its course in a world topographically similar to that of today. As we shall now see, that too was a fallacy, and that the implications of that conclusion are huge and very far reaching.

9
UPHEAVAL

There is absolutely no doubt that the stupendous natural forces connected with mountain-building (orogeny) are closely related to large-scale deformation of the Earth's crust, and that many of the world's highest ranges originated in and even attained their present elevations during crustal disturbances that signalled the end of Pleistocene times. That is not to imply that the Alps or Himalayas, for instance, attained their present form at a single catastrophic stroke, for reliable evidence indicates that the original upthrust of these and other ranges first began millions of years earlier, in some cases as far back as the Mesozoic Era (see table 1A). Varying amounts of increasing elevation occurred sporadically down to the close of the Pleistocene. We do urge, however, that a high percentage of today's major ranges rose to their present heights only at the end of, or after, Pleistocene times. By general consensus of opinion, that event occurred about 11,000 years before the present (see Part Five). Before then, as demonstrated by numerous geological facts and observations, mountains were mostly of very modest elevation. Evidence supporting that contention is both widespread and convincing.

The geological modernity of folded mountains in many parts of Asia was recognised early this century by Dr Bailey Willis when he wrote how they "challenge credulity by their extreme youth"[125]. His conclusions were confirmed by studies of mountain ranges in China, where huge uplifts of the Earth's crust were found to have occurred *since* the glacial period[126]. Similar youthfulness characterises the ranges bordering the western Gobi desert, including all those from the Russian Altai mountains to the Tien Shan range[127]. Indeed, it has been said of this region that:

> The present Gobi basin is relatively young, and was formed coincidentally with the uplift of the Transbaikal ranges.[128]

Certainly within human memory a large inland sea, referred to in ancient Chinese records as the 'Great Han Hai', occupied the Gobi basin. This apparently extended from the Great Khingan Shan in the east to the Tien Shan and Pamir ranges in the west, a distance of some 2,000 miles (3,200km), and from north to south a distance of some 700 miles (1,120km). Its volume was accordingly immense. At the time of the sea's existence, the entire basin apparently lay from two to three thousand feet (600 to 900m) *lower* than it does today, and there is every indication that it was uplifted simultaneously not only with the Pamirs and great ranges of western China but also with the Tibetan plateau immediately to the south. The draining away of the water constituting this inland sea must have been a truly devastating event.

The same upheaval affected the mountainous region of northern China too, where huge lava outpourings occurred on the Great Khingan Shan[129]. Not improbably these events were concurrent with the similarly large basaltic flows on the neighbouring Sikhote-Alin range, and with the spectacular collapse of the sea floor by many thousands of metres, along the eastern shoreline of the present Kamchatka peninsula, all the way south to the islands of Japan[130]. The Bayan Kara Shan range in western China was upheaved some 6,500ft (2,000m), while Minya Konka, one of the world's highest peaks, was uplifted 3,250ft (1,000m), more or less coincidentally with the elevations of the ranges in Yunnan Province by at least 6,500ft (2,000m)[131]. Southwards, the Tibetan Plateau was elevated by a still greater amount – 9,750ft (3,000m). Opinions differ whether this took place in early[132] or late[133] Pleistocene times – but as this uplift is known to have been coincident with the elevation of the Himalayas to their present height, which, according to Flint[134] and others, occurred *at* or *just after* the end of Pleistocene times, we are probably justified in ascribing a like date to the Tibetan disturbances too.

Flint linked this Himalayan uprise with the formation of other major Earth features thus:

> Late Pleistocene uplift occurred in the Himalayan region and in the Alps, and large scale rifting took place in eastern Africa[135].

Among other ranges affected then were "the Cordilleran systems in both North and South America, the Caucasus, and many others"[136]. Wadia confirmed this with regard to Himalayan orogeny when he wrote:

> Evidence of the extreme youth of Himalayan orogeny has multiplied of recent years. The tilting and elevation of the Pleistocene lake and river deposits of the Kashmir valley (Karewa series) containing fossil plants and vertebrates, to a height of 5,000–6,000ft; the dissection of river terraces containing post-Tertiary mammalia to a depth of over 3,000ft and the over-thrusting of the older Himalayan rocks upon Pleistocene gravel and alluvia of the plains have been noted by the Geological Survey of India and other observers[137].

Astonishing as it may seem, this over-thrusting of older upon newer formations was attended by the dragging-up by more than 5,000ft (1,500m) of marine beds containing palaeolithic remains in Kashmir, and occurred during the age of humanity[138]. The Indian geologist M S Krishnan traced evidence for an extraordinarily massive uplift of the Pir Panjal mountains, also in Kashmir, which attained an even greater elevation. He noted:

> The last stage of the uplift, which must have been of the order of 6,000ft, is believed to have occurred since the advent of early man. This upheaval has not only elevated the Pir Panjal and folded and tilted the Karewas, but has also affected the rocks of the Potwar and the Salt range.[139]

Not only were the Himalayas and their satellite ranges affected by this gigantic crustal uplift, but so also were the Pamirs, the Hindu Kush, Karakoram and Kailas ranges, the Kun-lun mountains and the Altai and Tien Shan ranges, all of which rose to their present altitudes geologically *very* recently[140]. After detailed studies of the Nanga-Parbat massif in the western Himalayas, Dr P Finsterwalder concluded that its uprise was immediately *post-glacial*[141]. Such crustal movements understandably affected local natural drainage, rivers there exhibiting repeated proofs of rejuvenation due to uplifted watersheds. The course of the Narbada River, which has been changed by "late earth movements", is a fine instance of this, while the precipitous waterfalls at Jabalpur owe their present spectacular image to the same cause[142].

Comparably vast changes in the elevations of hills and mountains and of a reorganised water pattern took place about the same time in Burma[143] and undoubtedly extended to northern Thailand, Laos and parts of Vietnam as far south as Malaya. Upraised beaches along the latter's coast show:

> ...a recession of the sea and a lowering of sea level of at least 50ft... There is evidence that the sea level has fallen more than 300ft, in the area including Mt Ophir and Kedah Peak, *since*, or during, Pleistocene times.[144] (Our italics).

Might not the elevation of these beaches have resulted as much from an uprise of the land as from a drop in sea level? Such an explanation would accord with Umbgrove's statement that:

> Should one, nevertheless, cling to the theory of submerged continents, the only alternative would be to assume that while vast blocks were being submerged in one area, parts of the ocean floor of almost identical size were being elevated in others[145].

In other words, when portions of the Earth's crust sink in one place, other portions tend to rise elsewhere in compensation.

Space limitations preclude more than the most cursory references to the similar and apparently coeval evidence known from the Philippines[146], various parts of Indonesia[147], the Pacific generally and Australia[148], so suffice here to assert that *much of the topography of all these regions came into being a mere 11,000 years or so ago.*

Before that date it was markedly different.

Much the same can be said of the present Alpine scenery in Europe. Not so long ago, geologically speaking, they were little more than a chain of low hills[149], but, judging from the under-cited remarks of Dr Reginald Daly of Harvard, the processes by which they acquired their present character involved a truly appalling paroxysm of Nature.

> During the building of the Alps gigantic slabs of rock, thousands of feet thick, hundreds of miles long and tens of miles wide, were thrust up and then over, relatively to the rocks beneath. The direction of the relative over-thrusting movement was from Africa towards the main mass of Europe to the north. The visible rocks of the northern Alps of Switzerland have thus been shoved northwards distances in the order of 100 miles. In a sense the Alps used to be on the present site of northern Italy.[150]

In effect, the present Alps represent a crustal shortening of "about 100km"[151], which some authorities have suggested was as much as 600km[152]. This was caused by a variety of interrelated processes including massive over-thrusting of older upon younger strata analogous to that previously noted in the Himalayas. Over-thrusting on a grand scale is common for instance in the Jura mountains[153], while that in the Glarus mountains of east Switzerland is traceable for many miles and is a showpiece of Alpine geology[154]. The Silbern and Glarnisch peaks are arresting examples of *stratal inversion*, and the Roggenstock, the Mönch and the mighty Jungfrau not less so[155].

Although various explanations of the precise *modus operandi* of these processes have been proposed from time to time, their cause and development are still imperfectly understood. Erich Haarmann advocated that the great rock masses were *forced to slide over one another* by their own tremendous weight, but the role played in this process by plutonic melts (layers of molten rocks formed deep within the Earth), such as would permit this, has yet to be clarified. Nonetheless Haarmann's hypothesis is perhaps still the most attractive of those available. Certainly the juggernaut-like progress of billions of tonnes of rock over surface strata, crushing and obliterating everything in its path is almost unimaginable.

Prof Oswald Heer associated this convulsion with the "glacial epoch"[156] during late Pleistocene times. Today, the summits of three of the highest Alpine peaks, Mt Blanc, Monte Rosa and the Matterhorn, respectively stand 15,781ft (4,856m), 15,217ft (4,682m) and 14,691ft (4,520m) above sea level. If we assume the description of the proto-Alps as "low hills" to signify no more than say 2,000ft (600m), the uprise involved must have been as much as 12,000–13,000ft (3,700–4,000m). A stratal uplift of this magnitude is positively staggering, while the heat generated by the physical over-thrusting and inversion of such gigantic rocky masses must have been appalling.

It is unnecessary here to review all the great mountain systems of the world. We may pass on to consider just a few outstanding examples from Africa and the Americas, merely pausing *en route* to note that the elevation of the Norwegian mountains, with their fiords – of which more shortly – is thought to have been late glacial or even post-glacial[157].

Almost certainly the orogeny just discussed was coeval with crustal dislocations along the north-west African coast and in the adjacent Atlas mountains. The latter, in particular the Anti-Atlas, formerly extended into the present Atlantic Ocean at least as far as the Canary Islands. The subsidence of this earlier westerly prolongation of Africa, marked by gross local distortions of strata, occurred in late Pleistocene or *earliest* Holocene times[158]. Significantly, coincidental with this subsidence, the Hoggar (Ahaggar) and Aïr regions of the Sahara far to the south-east were evidently in the process of being abruptly upheaved[159].

Unquestionably, these elevatory and depressive crustal movements, the emptying in some localities of lakes and inland seas and the creation and enlarging of rivers elsewhere were intimately connected with huge tectonic disturbances of the kind that produced the Great Rift Valley of east Africa, a feature commonly assigned to late glacial (Pleistocene) times[160].

These geophysical changes find almost exactly similar parallels in the Americas. Referring to the western Cordilleras of North America, Daly remarked:

> ...the whole Rocky Mountain front, for hundreds of miles, has been pushed up and then out, many miles over the plains.[161]

Writing specifically of Chief Mountain in Montana, he noted how it was:

> ...thrust bodily upon much younger strata of the Great Plains, and then driven over them eastwards, for a distance of at least eight miles. Indeed, the thrust may have been several times eight miles.[162]

Such crustal dislocations embraced enormous areas and titanic tonnage. For example: "All of the Glacier National Park in Montana and all the Rocky Mountain area up to the Yellowhead Pass in Alberta" was moved laterally for many miles[163]. These mountains,

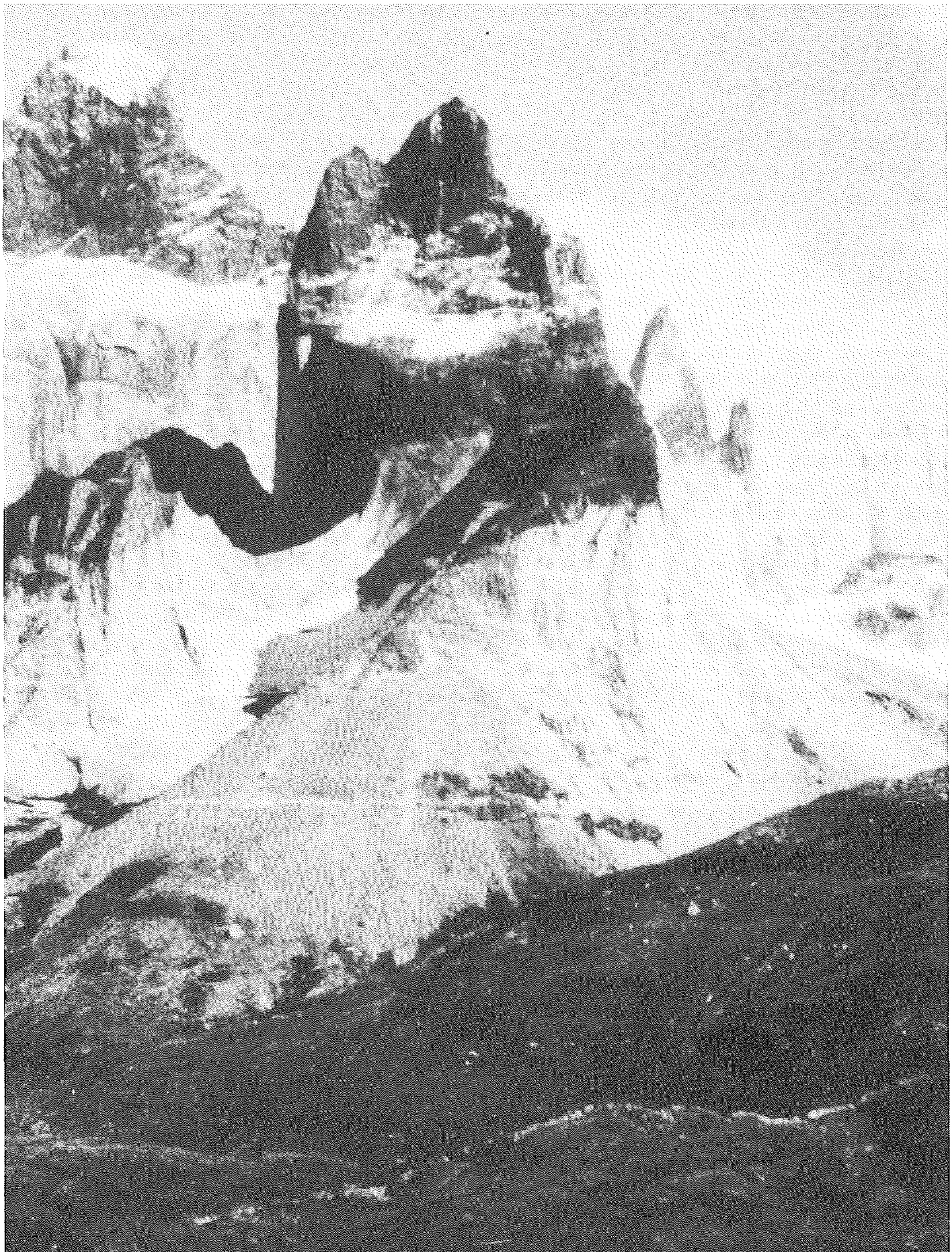


Fig 1.4. Youthful mountain profiles in the high Andes, southern Chile.
Courtesy of P J Michael, Univ of British Columbia, Canada.

therefore, afford strident echoes of the situation already recorded in the Alps and Himalayas and it is certainly no surprise to find Forrest adding:

> There is a good body of evidence, that the elevation of the western part of North America (like that of Norway) was *post*-glacial or *late* glacial.[164] (Our italics).

Considering the Coast Ranges of southern California, another authority observed: "There, within the short limits of the Pleistocene Epoch, strata a mile thick were deposited"[165]. These were later intensely eroded and deformed, being "...finally... uplifted a quarter of a mile above the sea – the last episode is demonstrated by a flight of marine terraces which marches like a cyclopean stairway up the seaward slope of some parts of the range".[166]

This rate of deposition (not to mention the degree of crustal uplift – itself of late or post-glacial age) hugely transcended the norm demanded by Lyell's gradualism, as also did the geologically very recent and cataclysmic stratal contortion and upheaval, by at least 6,500ft (2,000m), of the Cascade Mountains and the Sierra Nevada in Oregon and eastern California[167].

South of the Equator, the mighty Andes everywhere exhibit signs of extreme youthfulness. The longest continuous range on Earth, the Andes are actually very ancient mountains which only acquired their present striking relief at the end of Pleistocene times[168]. This has been described as geologically very rapid and attended by intense vulcanism[169], several of the volcanoes attaining enormous heights. The Andean uplift was immense, with mountain passes in Peru and Bolivia often lying as much as 13,000ft (4,000m) above sea level. Everywhere the rugged and jagged profiles of the Andean peaks bespeak of violent, catastrophic formation.

Confronting us at almost every turn are abundant, indisputable and tellingly consistent evidences of a geologically recent, worldwide orogeny characterised by crustal

Fig 1.5. Geologically youthful fault-grooves in the Peruvian Andes, near Cuzco. Formerly attributed to glacial action, this feature provides evidence of the magnitude of crustal disturbances.
Courtesy of Dr Siegfried Muessig, Los Angeles, California.

dislocations, upthrusts and faulting on a gargantuan scale. Recognition of the truly global dimensions of this mountain-building has been long voiced by geophysicists. Reviewing mountains generally, Dr Walter Bucher of Columbia University has observed:

> Taken in their entirety, the orogenic belts are the result of worldwide stresses that have acted on the crust as a whole. Certainly the pattern of these belts is not what one would expect from wholly independent, purely local changes in the crust".[170]

A possibly even greater authority, Vening-Meinesz, asserted that: "If we examine the pattern of great geosynclines [large geological troughs] over the Earth's surface, we cannot doubt that their cause must have a worldwide character"[171].

Commenting upon the same phenomena, Dr J H F Umbgrove admitted "I feel there is overwhelming evidence that the movements are the expression of a worldwide, active and deep-seated cause..."[172].

A very large number of similar opinions could be cited, together with a large array of varying hypotheses explaining the causes of orogeny. It is, unnecessary to indulge in this here, although we would again emphasise the general agreement that some worldwide cause was responsible for the phenomena just discussed. Suffice it to observe that something acting on a planetary scale and with staggering power was basically responsible for these titanic crustal disturbances in times geologically *very* recent, described by one writer as: "A remarkable and stupendous period – a period so startling that it might justly be accepted with hesitation, were not the conception unavoidable before a series of facts as extraordinary as itself"[173].

10
COLLAPSE

We have already noted that crustal subsidences, sometimes amounting to veritable collapses, occurred in some regions simultaneously with the late Pleistocene elevation of mountains elsewhere. They were evidently part and parcel of the same terrible world calamity, and a few words about them will be appropriate here.

Both the Canaries and the Azores experienced widespread volcanic activity during late Pleistocene times, the sea floor round the Azores in particular being covered by lava. Unlike the Canary and Madeira islands, the Azores are situated on the eastern slope of the Mid-Atlantic Ridge. Since the great ocean basins either side of it are only thinly coated with sediments and in places are actually barren of them[174], it is generally regarded as very youthful[175]. The Mid-Atlantic Ridge is also directly associated with a great world-encircling fracture complex which we will discuss shortly. Tachylite, a lava which naturally disintegrates in sea water within 15,000 years of eruption, lies on the sea-bed around the Azores and apparently dates from outpourings less than 13,000 years ago. How much younger than that date is unknown. Notwithstanding this, may we not wonder if all these islands were once a part of an Atlantic plateau extending westwards of the Anti-Atlas mountains – previously noted as having formerly extended to the Canary Islands – which submerged as recently as the late Pleistocene? That such possibilities should be seriously considered finds support in the discovery of geologically very young beach sand in two deep-sea cores procured in this area from depths of 10,500ft (3,250m) and 18,440ft (5,700m), indicating that the region was *above* sea level at no very remote period. The noted oceanographer Maurice Ewing concluded from this evidence that:

> Either the land must have sunk two or three miles, or the sea must once have been two or three miles lower than now. Either conclusion is startling[176]. ...If the sea was once two miles lower, where would all the extra water have gone?[177]

Only the greatest conceivable disturbance could have produced crustal faults and collapses as great as these.

By the well-developed method of echo-sounding, an expedition in which Dr Ewing took a prominent part measured the thickness of the sedimentary ooze on the slopes of the foothills of the Mid-Atlantic Ridge. These showed:

> ...thousands of feet of sediment on the foothills of the Ridge. Surprisingly, however, in the great flat plains on either side of the Ridge, this sediment appears to lie less than 100ft thick... Always it has been thought that the sediment must be extremely thick, since it had been accumulating for countless ages... But on the level basins that flank the Mid-Atlantic Ridge our signals came back too close together to measure the time between them... They show the sediment in the basins is less than 100ft thick.[178]

Granitic and sedimentary rocks which must originally have been "part of a continent" were dredged up near the Mid-Atlantic Ridge from a depth of 3,600ft (1100m). They exhibited deep scratches and striations similar to those stones in 'drift' formations commonly attributed to glacial action. However, in the same area there were found "...some loosely consolidated mud stones, so soft and weak that they would not have held together in the iron grasp of a glacier. How they got there is another riddle to be solved by further research"[179]. As discovered earlier, it seems highly questionable that there ever was a glacial age of the type clearly envisaged by Ewing and other geologists.

Together with many other geological and topographic formations on the bed of the Atlantic these mud stones were formed not underwater but in the open air, and must, despite their present fragile state, date from a time when that portion of the ocean floor was above sea level. A precisely similar conclusion has been reached by another writer respecting the Mid-Atlantic Ridge itself. He wrote:

> ...the inequalities, the mountains and valleys of its surface, could never have been produced in accordance with any laws for the deposition of sediment, nor by submarine elevation; but, on the contrary, must have been carved by agencies acting above the water level.[180]

Although writing in the 1920s, the celebrated French geologist Pierre Termier spoke of a now-vanished North Atlantic landmass in terms as valid now as then. He stated:

> The conclusion is inevitable: the land which existed about 900km to the north of the Azores and, perhaps, embracing these isles, was plunged into the deep, in times so comparatively recent that geologists call it 'the present', and actually it is as if it all happened for us but yesterday.[181]

It may not be unreasonable, especially in view of confirmatory biological evidence to be detailed later, to regard the volcanic upheavals traced on the bed of the Atlantic around the Azores as having occurred synchronously with the breakup and subsidence of *Appalachia*, the name given by geologists to a continental landmass in the North Atlantic also known as *North Atlantis*[182]. Now reposing some two miles (3.2km) below the level of the adjacent continental shelves[183], *Appalachia* connected Europe and North America via Greenland and Iceland (see map 1B). The fact that the degree of its submergence accords closely with that of the ocean basins flanking the Mid-Atlantic Ridge as determined by Ewing, is particularly noteworthy. Although it is now impossible to estimate the true extent of *Appalachia*, it must, as Brewster observed, have been:

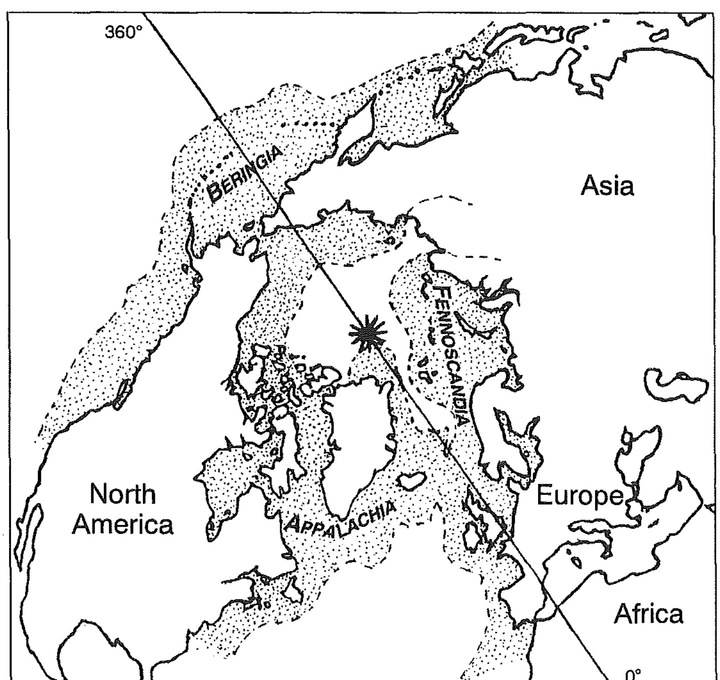
> ...a large continent, for the sand and gravel and mud which the rivers washed out to sea and the waves ground up on the shore have built up most of half a dozen big states [in North America], while in some places the deposits are a mile thick.[184]

Like many others, Prof Scharff of Dublin argued that this landmass foundered during late Tertiary times, excepting the Azores and the Madeiras which were:

> ...still connected in early Pleistocene (Ice Age) times with the continents of Europe and Africa, at a time when man had already made his appearance in western Europe, and was able to reach the islands by land[185]

In Geikie's opinion, however, certain biological evidence – discussed more fully later – shows that continuous land united Greenland and north-west Europe as late as post-glacial times, a view shared by Prof Judd[186]; and Forrest was among those who concluded that this landmass "...sank beneath the sea at the end of the Ice Age"[187].

It is also relevant that a truly colossal amount of sea-bed scour, or erosion, has been traced between Greenland and North America and ascribed to a time loosely termed as 'glacial'[188]. Presumably these crustal disturbances – collapses, for they were nothing less – occurred more or less simultaneously with the subsidence of the entire North Atlantic floor between Greenland and Norway by some 9,000ft (2750m), a convulsion which Forrest believed took place "since the Ice Age"[189]. In our submission these tremendous changes occurred synchronously with the break-up and drowning of the greater part of Fennoscandia, a now-submerged northern landmass formerly



Map 1B. General outline of the old northern landmasses of Appalachia, Beringia and Fennoscandia, which submerged approximately 11,000 years ago. *Modified William-Olsson projection. Scale 1:130,000,000.*

connecting Spitzbergen with northern Eurasia (map 1B).

Leaving the Atlantic for the Indian Ocean we find in the latter interesting evidence for the geologically recent submergence of another extensive landmass or series of large islands which Wallace called the great Southern Continent[190]. This submergence was apparently yet another facet of the global catastrophe under discussion and, as in so many other areas, here also it was accompanied by stupendous volcanic activity. Records of this were gathered by the Swedish survey ship *Albatross* in 1947, when, for several hundred miles south-east of Sri Lanka, it sailed over a vast and continuous plateau of hardened lava. This filled almost all the earlier valleys on the sea-bed and gave the ocean floor there a singularly level surface. One recent authority regarded this lava as being very probably the undersea counterpart of the Deccan trap of India[191], where basaltic lava several thousand feet thick continuously covers an area of not less than 250,000 square miles (647,500 km^2). According to H F Blanford, the eruption of this material may have been synchronous with the sinking of Wallace's Southern Continent, of which he believed the Seychelles, Mauritius, the Adas Bank, the Laccadives, Maldives and Chagos island groups, and the Saya de Malha (Mulha) are the last surviving remnants[192]. To Blanford's list can also be added Sri Lanka, for it is believed to have been severed from the Indian state of Madras "in sub-recent times"[193].

In passing, we should note that considerable botanical and zoological evidence exists supporting the geologically-recent reality of extensive land in the southern Indian Ocean, and over much of present-day Oceania. Concerning the latter, Prof Scharff has written:

> ...Dr von Ihering goes so far as to positively state that in his opinion the Polynesian Islands are not volcanic eruptions of the sea floor, which being without life were successively peopled from Australia and the neighbouring islands, but the remains of a great Pacific continent, which was in early times connected with other continental masses.[194]

That the subsidence of this pan-Pacific landmass occurred within the memory of humanity appears to be borne out by ancient Maori recollections of *Hawaiki*, their ancestral 'fatherland' which, though properly outside the immediate concern of geophysics, certainly represents curious but peculiarly telling auxiliary records of this disaster. S P Smith summarised these memories as follows:

> In some of these epithets of the ancient fatherland, it is clear to me that a continent rather than an island is referred to, and this is the description given to me of *Hawaiki-nui*, by Tare Watere Te Kahu, a very learned member of the Ngai-Tahu tribe... '*Hawaiki-nui* was a mainland (*Tua Whenua*) with vast plains on the side towards the sea and a high range of snowy mountains on the inland side; through this country ran the river *Tohinga*'[195].

Numerous geological and palaeontological facts also apparently point to the former and rather recent existence of this old Pacific continent, while the severity of the cataclysm which overwhelmed it may be gauged by the staggeringly large crustal dislocations of 'late Pleistocene' date in central Westland, New Zealand. There, the vertical crustal uplift east of the great fault in the Southern Alps (South Island) is estimated to have been as much as 58,500ft (18,000m) with a horizontal displacement of similar magnitude[196]. Positively stupefying, this crustal change represents a catastrophic action so huge that, even by itself, it would have caused worldwide repercussions. That it was merely a part of still greater crustal disturbances having ramifications far beyond New Zealand underscores the giant scale of these events in Oceania during times usually stated as terminal Pleistocene. These changes extended even to the northernmost Pacific, where a continental-sized landmass, occupying the whole of the Bering Straits and the ocean-floor immediately south of it, foundered at the end of

Pleistocene times. The scale of the subsidence of its western sector, particularly along the eastern coastline of the Kamchatka peninsula, was spectacular. Science knows this sunken land as Beringia (see map 1B).

We may not err far in assuming that such tremendous crustal disorders occurred more or less simultaneously with the subsidence of Appalachia, Fennoscandia and the great sunken continent in the south Indian Ocean, and with the uprise of the many major mountain ranges previously mentioned. We shall now see that this was almost certainly so.

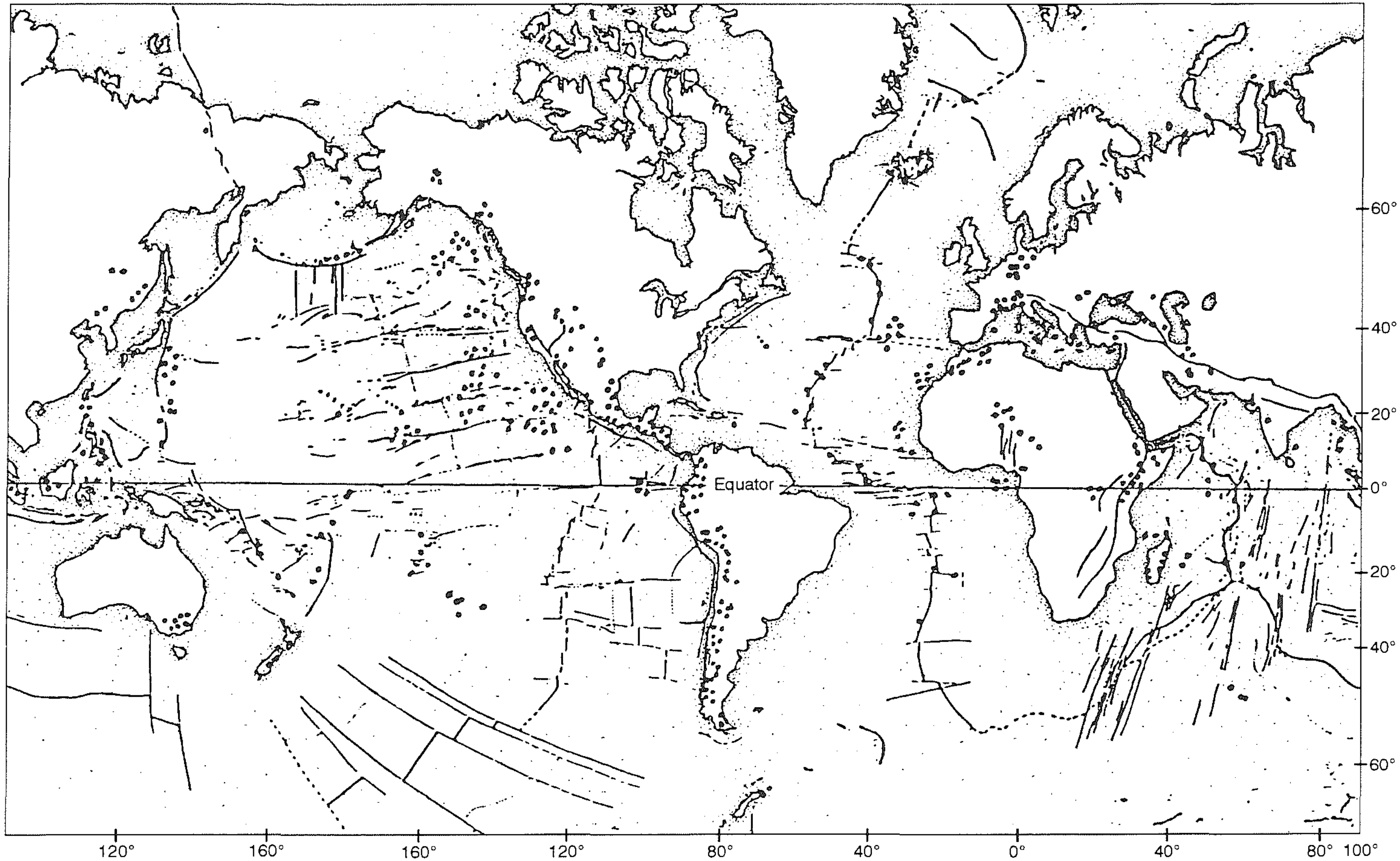
11
SHATTER

The formation of certain salient topographical features, such as fiords, are usually attributed in the majority of textbooks to the action of moving ice. Detailed field studies of the well-developed fiord systems of Greenland[197], the Hebrides[198] and Scandinavia[199] have tended to favour quite another explanation, namely that they had a tectonic origin, are really gigantic cracks in the Earth's crust, occupied and partially modified by glaciers *only at a later date*. It has been discovered that glaciers do not hollow fiords, but, through the transportation of stony debris from higher to lower levels, tend instead to choke fiord mouths and diminish or even nullify thereby the alleged excavating power of glacier ice[200]. Numerous students of fiords are agreed on this matter. Certainly ice cannot have easily produced those fiords which are open at *both* ends[201], or extend across sea-floors!

Acceptance of a tectonic origin for fiords also eliminates the necessity of attributing immensely long periods of time for their formation, such as would be required had ice excavated them. This is an important point.

Fiords also appear to be inseparably linked to a more fundamental crustal fracture complex encircling the globe, to which submarine canyons, deep-sea trenches and the celebrated Great Rift Valley of Africa all belong (see map 1C). All seem to be connected with a huge crack which traverses the Earth's crust for over 40,000 miles (64,000km) on a long meandering course[202]. Nearly all the fractures associated with this giant crack show geologically youthful images. Many deep-sea trenches, for example, contain little in the way of in-filling sediments, and the walls of many fractures are sharp and angular. General agreement exists that this fracturing occurred on a planetary scale and everywhere at about the same time[203]. Some authorities have also argued that, for the observable effects to have been produced, the Earth's axis must formerly have been inclined in a more vertical plane than at present[204]. This also is an important point relative to the classical references to axial orientation in the legendary Golden Age and Proctor's observation on the polar inclination obtaining when the aquatic constellations were invented (see I: 5. *A Displaced Axis?*).

Dictionaries define *excoriation* as the stripping or removal of skin by abrasion. Here, we apply this process to the surface of the Earth's skin, its crust or lithosphere, in that it has caused the sudden fissuring and violent break-up of many surface rocks predating those classified as Pleistocene. This fissuring occurred alike on land and under the sea, its extent being worldwide and clearly linked to



Map 1C. Map of Pleistocene world fracture complex, showing major faults and deep-sea trenches. Dots represent principal centres of coincident vulcanism.
After Shepard, Emery, Menard et al.

acute crustal dislocation. Numerous submarine valleys are actually great crustal fractures now partially filled by sediments, and are intimately associated with the collapse of areas now forming ocean basins and the faulting and submergence of the continental shelves. It is particularly interesting to note some renowned authorities suggesting that such profound changes might have been due to external influence exerted by some stellar body – a cosmic visitor[205].

Other fractures and rock fissures are demonstrably connected with the massive late Pleistocene orogeny previously reviewed. The Gangetic Trough, for instance, evidently originated with the elevation of the Himalayas and the Tibetan plateau to their present height. The fact that the Gangetic Trough is 1,200 miles (1,900km) long, averages 250 miles (400km) in width, and is over 6,500ft (2,000m) deep, indicates the colossal power of the forces producing both it and the associated orogeny. It is a Pleistocene feature, yet, although the mighty River Ganges now flows along it, the trough itself is largely choked by Pleistocene debris of enormous thickness[206]. Gravity surveys have indicated that these in-filling deposits are about 6,500ft (2,000m) thick[207], and "...cannot be earlier than sub-Recent" in age[208].

Many further similar examples could be given from around the world, but such repetition would add little and would result in unnecessarily irksome reading. Suffice it here to observe that the foregoing evidence clearly shows that the end of the Pleistocene epoch, approximately 11,000 years ago, was characterised by gigantic and violent crustal convulsions which, viewed globally, were nothing short of cataclysmic. They did not punctuate a comparatively inert world in which the sub-polar latitudes lay under tremendously thick slow-moving ice-sheets. The sheer volume and extent of the strata affected by these disorders and the great heights and depths to which strata were redistributed indicates that, if the ice-sheets of orthodoxy really existed, then the ice must have covered regions which were either in the process of being enormously upheaved, displaced, vertically faulted and fissured, or subsided to remarkable depths. None of these unstable crustal conditions could have been conducive to the formation or maintenance of ice-sheets like those conventionally envisaged.

Special note should be taken of the repeated datings of these crustal derangements by acknowledged authorities: 'late Pleistocene', 'terminal Pleistocene', 'end of the Ice Age', 'post-glacial', and so on. Although Agassiz and other early advocates of the Ice Age argued that the ice developed before the rise of the Alps and other high ranges, modern glacialists all agree that high mountainous land is necessary to provide (and replenish) the snow from which glacier ice is derived, to supposedly produce the various geological phenomena allegedly characteristic of glacial conditions. If, however, most of the world's present major ranges attained their existing elevations a mere 11,000 years or so ago, where was the high land attracting heavy snowfalls and providing the ice and the motive power for the alleged ice-sheets specifically stated to have *preceded* the modern uplands?

Did ice in another guise cause the supposed glacial phenomena, distribute the 'drift' and disperse the 'erratics'? Rather than ice-sheets, abnormal numbers of 'drift'-laden icebergs were at one time conjectured as having floated equatorwards from polar regions, depositing 'erratics' and 'drift' and polishing and striating rock surfaces as they did so. That hypothesis was eventually discarded, as no reasonable mechanism could be determined which would generate excessive numbers of icebergs for a limited (glacial) period, cease doing so for a following (interglacial) period, and then reactivate the cycle again – not once but several times. Modern icebergs, moreover, carry little stony debris and very few rocks that are describable as 'erratics'. It is certainly unscientific to suppose without good evidence that icebergs behaved differently in the past or were burdened with stony cargoes vastly different from those they carry today.

A closer look at conventional Ice Age concepts, at the capacity of large masses of ice and at the geological phenomena commonly attributed to large scale ice action, suggests that the Ice Age, if it ever really existed, must have done so *after* the majority of the above-mentioned crustal disturbances had taken place. Certainly the shattering of the Earth's crust had already occurred by that time.

12
AN ICY CHIMERA

Inevitably the cause of the series of presumed ice advances and retreats epitomising the supposed glacial and interglacial episodes has long puzzled Earth scientists and astronomers, who, down the years, have made many attempts to explain them, rationally. Rather conveniently, these explanations have fallen into eight more or less distinct categories, thus:

- ***Geophysical Theories***: 1. continental drift (the slow drifting of crustal continents toward or away from each other); 2. polar wandering (slow changes in the Earth's axis of rotation); 3. crustal sliding.
- ***Land-Water Changes***: 1. oceanic changes (relocated oceans, rearranged oceanic circulation or changed directions of ocean currents); 2. landmass altitude changes (larger land areas brought above the permanent snow line, feeding the growth of ice-sheets).
- ***Glaciological Theories***: periodic melting of basal ice layers of natural ice-caps, causing massive surging of ice leading to formation of huge peripheral ice-shelves which, in turn, displace sea water sufficiently to produce sudden rises in world sea levels.
- ***Atmospheric Changes***: 1. variations in carbon dioxide content in the atmosphere (reduction of amount of CO_2) and reduced rate of absorption by the atmosphere of long-wave radiation, causing atmospheric cooling; 2. variations in suspended volumes of volcanic and other dust in the atmosphere; 3. variations in ozone content.
- ***Meteorological Changes***: regarded as a secondary mechanism for promoting glaciation once the latter has commenced.
- ***Axial and Orbital Changes***: 1. alterations in axial tilt of the Earth; 2. the 'Drayson Effect' (periodical axial changes leading to loss of terrestrial equilibrium); 3. changes in the length of the Earth's orbit around the sun.
- ***Solar Emission Alterations***: changes in the intensity or composition of solar emissions received by the Earth.
- ***Astronomical Theories***: 1. excessively cold regions in space traversed by the solar system (and thus the Earth) during late Pleistocene times; 2. collisions or near-misses with astronomical bodies disrupting the pre-glacial terrestrial environment (planets, moons, comets, asteroids and meteor showers have all been proposed as candidates).

Both 'uniformitarian' and 'catastrophist' explanations feature in this list. All are essentially speculative, and none adequately explains the basic mechanism by which Pleistocene ocean levels (traceable from physical evidence) apparently oscillated by as much as 975ft (300m). Considering the shaky alliance between assumptions, conjecture and a misconceived topographical background long embodied in orthodox Ice Age discussion, it is little wonder that all these explanations have failed to account for all aspects of the so-called Ice Age enigma, In their present form they are incapable of doing so.

Space limitations regrettably preclude detailed analyses of these often ingenious hypotheses, so we shall pass on to briefly consider: (a) the most commonly offered description of the Ice Age itself, and (b) some of the many reasons why, so the evidence tells us, the notion of the Ice Age can never have been more than a grand illusion.

The classic definition of the Ice Age centres on the concept of extensive, continuous, and often enormously thick ice-sheets smothering virtually all polar latitudes down to approximately 50° N and S latitude, with the greatest icy accumulations apparently occurring in the northern hemisphere. This concept reached its greatest development in the writings of various late nineteenth century glacialists, of whom Geikie[209], Dawkins[210], Croll[211] and Penck[212] were especially prominent. Although later research has signally emended those views, from time to time the outmoded hypothesis they represented still finds its way into textbooks about Earth history, and persists in being the popular concept of the Ice Age generally.

More up-to-date views of the Ice Age world, in discarding the near-hemispheric ice-sheets of the earlier theorists, have replaced those with a series of much smaller fluctuating ice-sheets radiating out from separate northern ice domes, with ice-free regions, some little more than corridors, existing between them. The retention of the term 'glacial', initially devised to accurately reflect the nature of the icy model postulated by nineteenth century glacialists, and its application to modern Ice Age concepts, although technically correct, unfortunately still tends to perpetuate a false (the discarded) panorama for interested modern layreaders as yet familiar only with the older nineteenth century Ice Age doctrines. Certainly very few of the multitude of facts and details nullifying the earlier views which we are about to review have percolated down to them.

Thus, not only has much of this painstakingly amassed evidence largely failed to filter down to society generally, but so also have the modified (more modern) perspectives of the Ice Age now promoted in scientific circles. Accordingly, much of what follows, though factually correct, may at first seem not merely novel but startling and perhaps even disturbing, as cherished conventions fracture and totter.

Today, the world's coldest known land region is north-eastern Siberia. There, if anywhere, we might expect huge ice-sheets to have developed if the Ice Age theory possessed validity. Yet comparatively very few areas of Siberia exhibit signs of significant glaciation, either past or present. Clearly great cold does not of itself necessarily promote the development of ice-sheets. Antarctica and Greenland, however, both of which are *less* cold than Siberia, possess such sheets. Later we shall examine why this is so.

Interestingly, as in neighbouring Alaska to the East, thin rock pinnacles still stand unglaciated at several Siberian localities which thick ice, had it once existed, would unquestionably have ground down and demolished. The same observation applies to the broken stumps and roots of large trees which, like the mammoth carcasses found in the same general region (of which more anon)[213], have remained frozen solid ever since the day they perished, are still in the positions in which they originally grew. Some are even replete with their original leaves, flowers and fruits[214], albeit in permanently frozen and blackened condition. These, too, should have been scoured away had ice-sheets ever mantled and passed over Siberia. But these remains have *not* been destroyed any more than have the many thousands of others found as jumbled masses on several of the Arctic islands north of the Siberian mainland[215] or encountered in similar confusion in the frozen ground of neighbouring Alaska[216].

Again, in stark contrast to orthodox Ice Age theory, even many northern areas outside Siberia said to have lain under the *thickest* parts of the alleged ice-sheets afford scant evidence of glaciation or ice-sculpturing of any sort, and in numerous cases are actually devoid of it. The Sverdrup Islands[217], northernmost Greenland[218] and many of the islands of the Canadian Arctic[219], not to mention practically the whole of Alaska, are cases in point. Spitzbergen is another[220].

As the following selection of information amply demonstrates, northern latitudes have yielded several unexpected discoveries totally at variance with the tenet of vast sprawling North Polar ice-sheets. Their collective message is a singular one.

Firstly, numerous marine shells, often of currently-existing species, lie at high elevations on several islands in Arctic Canada[221]. They should have been pulverised had ice-sheets ever crept across those territories, for in no instance do they appear to have been deposited where they are now found since alleged Ice Age times.

Secondly, among the most telling details in this category are the numerous enclaves of unglaciated territory within regions which, glacialists long argued, supposedly lay under thick, continuous ice-sheets, not once but on *several* successive occasions. In addition to the molluscan testimony just noted, we should carefully mark that no evidence is known from southern Scotland of glaciation antedating the so-called latest observable ice advance, which glacialists call the Weichselian advance. Indeed, it has lately been urged that not only was southern Scottish topography much the same before the Ice Age as it is now[222], but also that south-western Scotland suffered less glacial erosion than surrounding regions because of its generally lower altitude[223] – despite glacialists depicting that area as a major centre of glaciation on Ice Age maps of Britain (see map 1D).

Farther north, deeply weathered, undisturbed, soils in Aberdeenshire were seemingly never glaciated, while further north still, on the North Sea bed near the Shetland islands, supposed glacial deposits dated as Weichselian are unexpectedly thin or *absent altogether*[224]. Again, in the Frigg Field area (59°N, 2°E) midway between the Shetlands and Norway, sea-floor cores are devoid of identifiable glacial deposits. This discovery has suggested that:

> ...some part of the northern North Sea was ice-free in the late Weichselian glacial advance, but this is difficult to reconcile with the suggestion that Shetland was glaciated in the Weichselian by ice which came from the east – probably from Scandinavia.[225]

Similar problems surround the presence of demonstrably British 'erratic' boulders of porphyry, limestone and sandstone on and just south of the Dogger Bank area of the North Sea, because the Weichselian ice sheet alleged to have transported them there is commonly envisaged as having advanced from the direction of Norway to the north-east[226]. These 'erratics' can only have travelled from the north-west *against* the supposed direction of the Weichselian ice-flow.

Significantly, comparable evidence occurs in the Outer Hebrides on the other side of the British Isles. There, rock striae indicate that whatever scored them proceeded from the north-west. Hebridean glaciation is usually held to have advanced from the north-east, the very *opposite* direction[227].

Data from the Faeroe islands, even farther north, cast further doubts on the very existence of former extensive ice-sheets in the North Sea region. Deposits attributed to ice action have been interpreted there as due to local ice, "...rather than to an ice-sheet advancing from the north or having contact with the Norwegian *mer de glace*"[228].

On mainland Britain, several 'drift'-less areas in northern England – south of York, for example[229] – reinforce the general picture now emerging, as does the apparent failure of any ice to have crossed the North Sea to terrain north of the Humber[230].

During so-called Weichselian times the Norwegian mountains were supposedly the centre of a regular *mer de glace* which, at its maximum, stretched south-westwards to embrace not only the Faeroes, Shetlands and Orkneys, mainland Scotland and Wales, all but southernmost England and the entire North Sea area, but also the whole of Eire. As previously noted, many parts of this extensive region were apparently never glaciated at all – a detail parallelled by the *absence* of detectable glaciation on the Lofoten islands

Map 1D. The British Isles showing the supposed maximum southern limits of the pre-Weichselian glaciations and the Weichselian glaciation, and the centres from which ice is alleged to have radiated, according to conventional glacial theory. *Compiled from several sources.*

(68°N, 15°E)[231] and the unglaciated character of innumerable jagged rocks off Norway's western coast[232]. Moreover, the lower deposits occupying the adjacent Norwegian deep-sea trench are also apparently non-glacial[233].

Why is glacial evidence absent from parts of mainland Britain and the bed of the North Sea if an ice-sheet allegedly mantled that entire region? Was it because, as intimated earlier, glacial action actually never occurred there?

Notable reinterpretations of alleged glacial deposits in England and Ireland have also recently been proposed. At Ipswich in Suffolk, well known glacial sequences formerly considered as representative of three glacial phases are now regarded as typifying only one[234]. Again, despite a supposedly well-established stratigraphy (identification of the relative position of layers of deposits), there is now little evidence that in Northern Ireland 'drift' deposits are much older than 10,000 years BP[235], a date commonly stated to be that when the Ice Age finally *ended*.

Comparable evidence is also known from mainland Europe, the North Atlantic, the Arctic Ocean and North America – but as we have already noted several examples from some of these regions we need mention here only a small selection of additional instances.

In Europe, the Alpine record of glaciation – the earliest studies of which, remember, initiated the concept of an Ice Age – shows it to be not only *very youthful*[236], but also surprisingly sparse. Indeed, except for deposits of Weichselian date, the overall record there is "very spotty"[237].

It is a very well known fact that much of the world's rainfall occurs when wind-blown, moisture-laden air rises over upland areas, and that when this concerns mountains or high hills the moisture often descends not as rain but as snow. Especially relevant to this is the conclusion reached by the celebrated glacialist Albrecht Penck, that Alpine snowfall during Ice Age times was not appreciably heavier than that of today[238]. If that were indeed so, it would be illogical to postulate that immense ice-sheets developed then in and around the Alps if they do not do so now. But other important factors are involved and should be considered here.

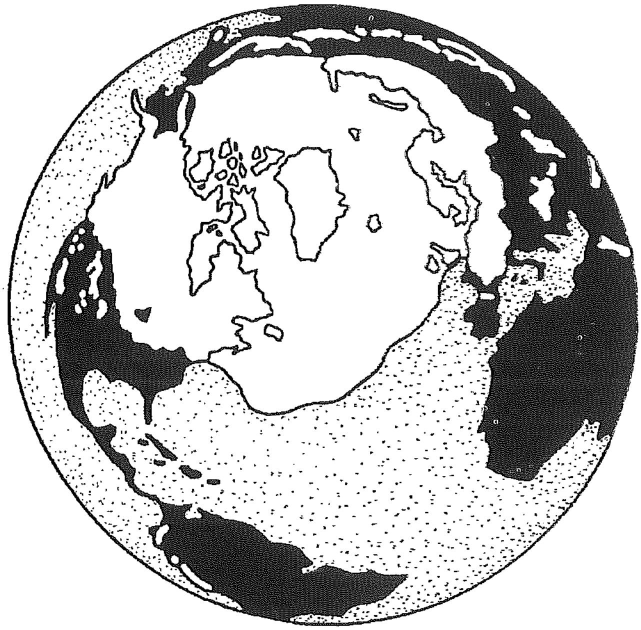
The Alps attained their present height suddenly and violently in times so recent that their upthrust actually post-dated the era normally assigned to the Ice Age itself. Thus the Alps, as we know them, hardly existed when the Ice Age is supposed to have occurred. They were merely a "chain of low hills". This means that, if the Alps were formerly much lower, they were unlikely to have attracted the heavier snowfalls required to underpin the formation of the huge ice-sheets of conventional Ice Age dogma.

If the Alps, Rockies, Himalayas and other major mountain ranges rose to their present elevations only at the close of the Pleistocene epoch – during or just after the final stages (the Younger Dryas episode) of the supposed Ice Age, we can scarcely continue to associate the development of massive ice-sheets with mountain systems generally too low to have acted as effective causal agents of such glaciation. Significantly, no ice-sheets of any magnitude are presently developing in or around the world's greatest mountain ranges, themselves *all* now much higher than in Pleistocene times. As we shall see later, the great ice-sheets of Greenland and Antarctica have formed as a result of the operation of other factors.

Thus, if many of today's highest mountains were much lower when the alleged Ice Age was reputedly at its zenith, how did so much ice, if it actually existed, manage to accumulate? Indeed, we can take a step further and ask *whether the ice-sheets so beloved of glacialists ever existed at all*!

In addition to the above-mentioned objections, many more exist which echo the same query. A look at some of these is educational.

Claims that glacial deposits exist on the floor of the Barents Sea, north of Norway, have lately been dismissed as incorrect. No glacial mantle ever existed there, and none ever connected Scandinavia, Novaya Zemlya, Franz Josef Land or Spitzbergen[239]. The aforementioned detail that Spitzbergen was apparently never glaciated is thus found to be entirely compatible with the absence of glacial deposits on the surrounding sea-floor.



Map 1E. Map of alleged maximum extent of Pleistocene glaciation in the Northern Hemisphere. *After W C Putnam.*

Yet innumerable maps of the Ice Age have long persisted in depicting the region embracing all these lands, as also that of the Alps, as buried under enormous ice-sheets (see map 1E).

Earlier, we drew attention to the remarkable speed with which the final stage of the Ice Age – the Younger Dryas episode of late Weichselian times – came to an end, and how its closing stages were linked to abrupt increases in snowfall and radical oceanic, climatic and botanical changes across much of the northern hemisphere.

Initially it might be considered reasonable to expect the end of an Ice Age to herald warmer conditions, but widespread investigations have shown that the reverse actually happened: temperatures generally *fell* as the effects attending the termination of the Younger Dryas episode (or Alleröd as it is sometimes referred to) were experienced globally[240].

Sea-surface temperatures, for example, dropped in the North Atlantic[241], in the western North Pacific[242], in the South China Sea[243] and even in the tropical Sulu Sea between the Philippines and northern Borneo (Kalimantan)[244], where marine cores indicate a "pronounced cooling of surface waters during Younger Dryas times" in tandem with an increased summer monsoonal regime in central China[245].

Late Pleistocene sediments in deep-sea cores obtained from the bed of the central North Atlantic contain the remains of planktonic foraminifera – minute marine organisms – which collectively exhibit faunal patterns so complex that they *cannot have resulted from temperature oscillations* like those commonly associated with glacial cycles[246]. Similar puzzles have been afforded by marine cores from the Caribbean basin. These show a former mixing of top and bottom ocean-water layers *ten times faster* than the speed at which the succession of glacial and interglacial episodes is supposed to have taken place. It was, therefore, concluded that:

> ...because of the unique character of deep-sea sedimentation, a change in the average would require major alterations to the

physiography of the earth and/or in the biological balance of the high seas.[247]

As shown by other aforementioned data, that is precisely what the general record of Younger Dryas times repeatedly urges. Effects of changes like these were widespread. They were, for example, felt around Hudson Bay[248], across Atlantic Canada[249] and in the northeastern USA[250], and occurred even as far south as South America and Antarctica[251].

The demonstrably global extent of these environmental changes, which inevitably affected plants and land animals in many latitudes, is parallelled by a similar worldwide concordance of their general dates of occurrence.

In southern Chile, for example, where these changes impoverished older beetle populations[252], their effects took place about 10,000 years BP[253], approximately at the time when North Atlantic sea-surface temperatures dropped[254]. Tibet became suddenly wetter[255], and the vegetation in north-western USA underwent marked changes[256]. Very clearly something important occurred during or just before the 10,000 years BP datum indicated, something large enough to affect practically the whole of Earth's environmental conditions and huge numbers of the planet's natural inhabitants.

13
INESCAPABLE EVIDENCE

To those accustomed to the now well-established notion of a Pleistocene Ice Age like that advocated by Agassiz and championed so forcefully by Geikie and others in the last century, or who are aware of the modifications made to it this century, the substance and abundance of the foregoing interrelated details may well astonish. After all, has not the idea of an Ice Age been carefully investigated from every angle by armies of experts in multitudes of concerned disciplines for over 150 years? Although the actual cause of the Ice Age is still uncertain the reality of such an age is surely beyond dispute? Surely so many specialists cannot all have consistently misread the record for so long?

The underlying problem, of course, has been the continued acceptance of the constraints inherent in Lyell's 'uniformitarianism', with its insistence upon terrestrial agencies being the sole generators of observable topographical and atmospheric changes, irrespective of the individual scale, speed or intensity of these. A major outcome of this entrenched perspective has been the steady accumulation of unaccommodatable data diametrically opposed to, or at least highly bruising of, Lyellian concepts and the notion of an Ice Age.

Dispassionate consideration of this 'anomalous' data leads unerringly to the realisation that: 'uniformitarianism', while certainly not a fallacious doctrine, is yet no more than *a particular aspect* of a wider whole – which we discussed earlier in Part One: 7 *Perspectives – a question of scale*; also, that something other than ice, operating in a worldwide capacity, was responsible for the deposition of 'drift' and the creation of other supposedly Ice Age phenomena.

Probably no clearer account of the supposed deposition of 'drift' material by large slow moving ice-sheets like those of conventional Ice Age theory can be cited than that given a few years ago by L Dudley Stamp, who, recognising two major effects of glaciation, wrote:

> One of the two major effects of glaciation is... the sweeping bare of large tracts of the country, and the time which has elapsed sinsce has generally been inadequate for the formation of a complete soil mantle. There are large tracts of bare rock: soils which have been formed are characterised by immature profiles, whilst the interference with the pre-glacial drainage has resulted in water-logging over huge tracts and the consequent development of extensive bogs...
>
> The other major result of glaciation is the deposition on lower ground or on marginal areas of the material swept from the highlands. The mantle of glacial deposits which results is conveniently referred to under the comprehensive term 'drift'. Drift deposits are of the most varied character, and although two types may be very closely related in geological origin they may be so different in lithological characters [rock composition] as to give rise to land forms, soils and vegetation of the most contrasted types.[257]

Like those of all conventional glacialists, Stamp's summary, though factually accurate respecting the variability and distribution of 'drift' deposits generally, is a typically uniformitarian explanation of the relevant phenomena. In it the Ice Age is assumed to have been an indisputable fact, whereas it never was nor has been more than an ingenious theory. Slow ice movements are advocated; ice is so completely accepted as having been the 'drift'-producing agent that it is spoken of as having certainly produced both it and the obviously attendant geological effects; the scale and extent of the supposed ice-sheets are inferred from the scale and extent of the 'drift' deposits allegedly produced by them – a circular argument. Nor does Stamp's exposition satisfactorily account for the presence in some areas of 'drift' on hill summits only. As we shall now see, these assumptions, while superficially attractive, are seriously at odds with a whole range of recorded facts.

Particularly interesting and certainly perplexing is the well-established fact that many allegedly glaciated hills and mountains in the northern hemisphere are scored and striated from top to bottom on their northern sides only. In North America this remarkable condition is quite common[258]. It would thus seem that ice-sheets glaciated the northern and north-western faces of these eminences as they slowly crawled up them but failed to glaciate the southern slopes as they presumably accelerated down them – an effect completely opposite to that allegedly generated by downward-moving masses of ice – for example, that of glaciers. In any case, as shown below, ice cannot *ascend* hills.

Of further relevance is the fact that deposits of gravel and other 'drift' materials sometimes occur only on the northern and north-western flanks of hills, in some instances showing every indication of having been actually *plastered up* against the hillsides with great force[259]. Many cases of this occur on both sides of the Atlantic. In Labrador, for example, 'erratic' boulders have been rammed into hillsides apparently with much violence[260]. Rather interestingly, eastern Labrador, together with Newfoundland, was apparently *never* glaciated[261].

A *strange selectivity* arises here.

Also noteworthy is the occurrence of so-called 'drift' materials at localities far beyond the limits of the most extensively conceived ice-sheets. Thus, if ice action genuinely distributed all the 'drift' deposits within the supposed limits of the greatest ice-sheets then it somehow also contrived to do so in many areas ice is supposed never to have reached.

Large 'erratic' boulders in the Sahara Desert; on the Mongolian plains, and in subtropical Uruguay constitute a parallel anomaly. And when it is discovered that it is possible to produce rock striae like those usually attributed to ice action (see figs 1.6–1.9) by such dissimilar agents as drift-sand[262], fast-moving *nuées ardentes* (swiftly flowing, high temperature, gaseous clouds erupted from volcanoes, see fig 1.8), snow, mudslides[263] and high pressure grit-charged steam[264], we are obliged to seriously question

Fig 1.6. A rock at Appley Bridge near Wigan, England, showing surface striations commonly ascribed to ice-action.
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the alleged glacial origin of striae generally, particularly when, as in numerous instances, they, too, occur far outside the furthest traceable limits of supposed bygone ice-sheets.

Still other 'peculiarities' are exhibited by geological phenomena associated with Ice Age doctrine. Scrutinised more closely these also reveal yet more doubts about the former reality of an Ice Age like that favoured by orthodoxy. Eroded and fragmentary shells occur within the 'drift' deposits on Moel Tryfaen, a mountain in North Wales rising 1,300ft (400m) above sea level. Perplexingly the species represented include not only northern but also temperate and southern forms adapted to very varied habitats. Some required deep and others shallow water, some sandy and others muddy water, and some were peculiar to shingly and others to a bare rocky environment[265].

In contrast to the above we now perceive an *unnatural generality* in the evidence.

In stating that ice could never have brought together so varied a molluscan assemblage as this, it is hardly necessary to add that water could have – in which case the enveloping 'drift' deposits must have been similarly water-borne. Such a conclusion was reached by the great English geologist Roderick Murchison with regard to the 'drift' deposits of Russia[266], and by many of the earlier American geologists respecting the same beds in the USA. One of these geologists, Prof Andrews, as cited by Howorth, remarked that many:

> ...gravel hills are sharp and conical and interspersed with deep circular valleys without outlets, from which the region has obtained the popular name of the Potash Kettles... It would seem to be an unavoidable inference that our drift of this region not only came from the north, but it came in a vast sweep of water deep enough to cover gravel hills 800ft high, and with velocity enough to throw coarse material into lofty and steep summits.[267]

Again, it may be asked how is it possible to ascribe to ice in any form the simultaneous

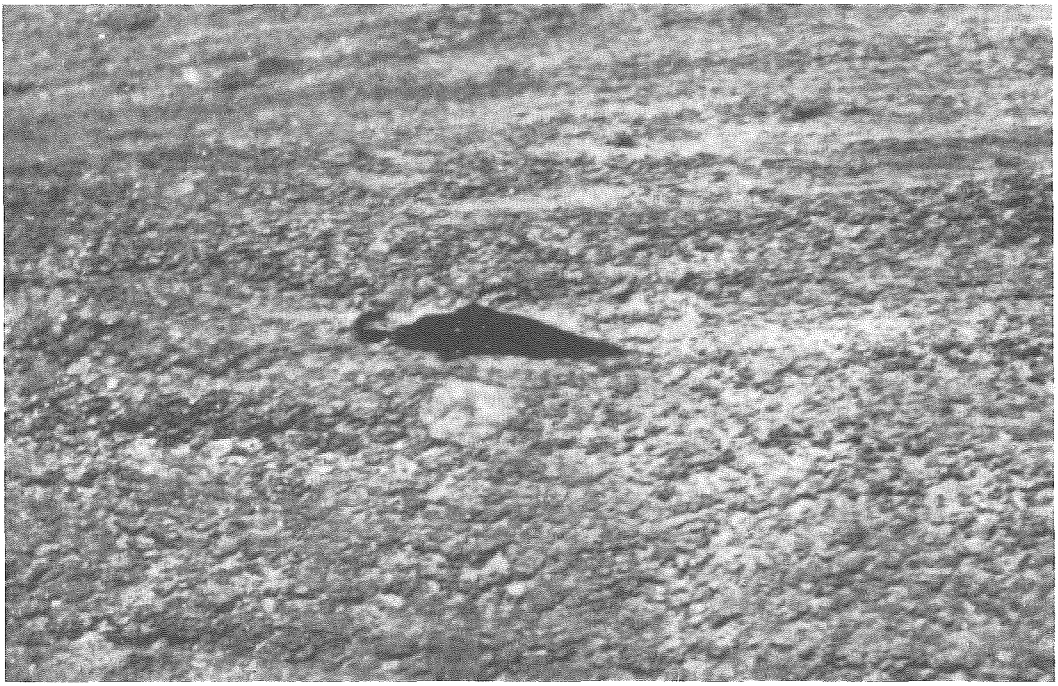

Fig 1.7. Rock striated by sand-blast, Mont Pelée. *By permission of the Geological Society of America Bulletin, (vol 20, 1908, pl 39, fig 1), and R S L, Oxford (Geol Per 21).*

Fig 1.8. Rock surface striated by nuées ardentes action during the 1929–32 eruption of Mont Pelée. *By permission of the Carnegie Inst, Washington DC. From F A Perret's The Eruption of Mont Pelée 1929–1932.*

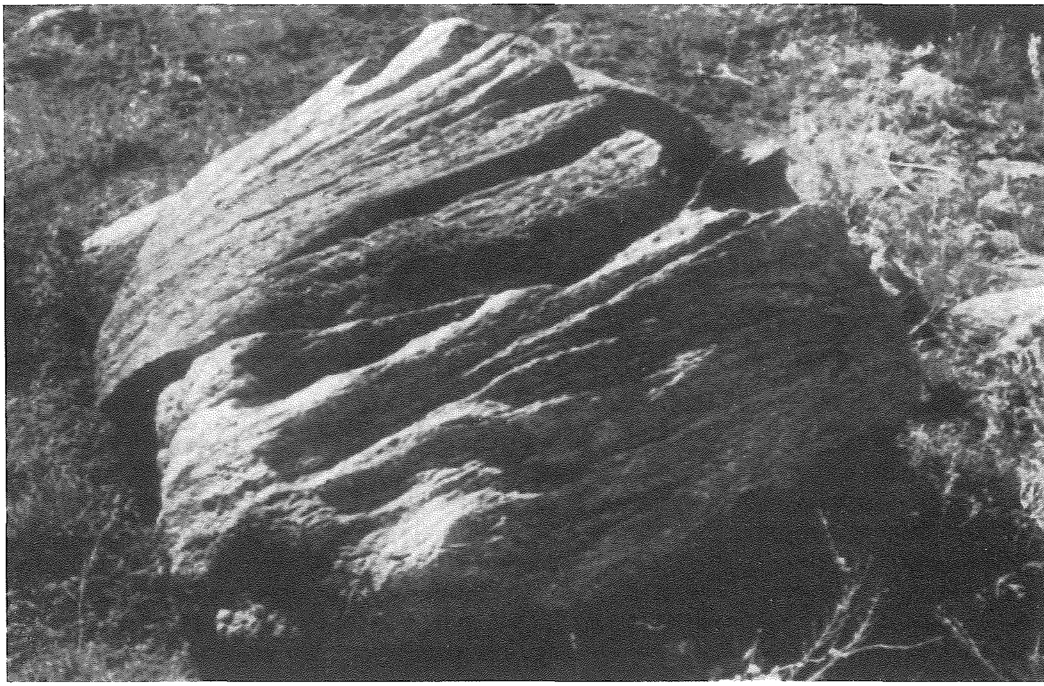

Fig 1.9. Rock striations produced by wind action, Wyoming. From R P Sharp's *"Pleistocene ventifacts east of the Big Horn Mountains, Wyoming", Journal of Geology, vol 57, 1949, by permission of Univ of Chicago Press and R S L, Oxford.*

Fig 1.10. Alleged glacial rock-grooves in crystalline strata at Val Camonica, north Italy. *From W G Putnam's Geology, 1964. With permission from Oxford Univ Press.*

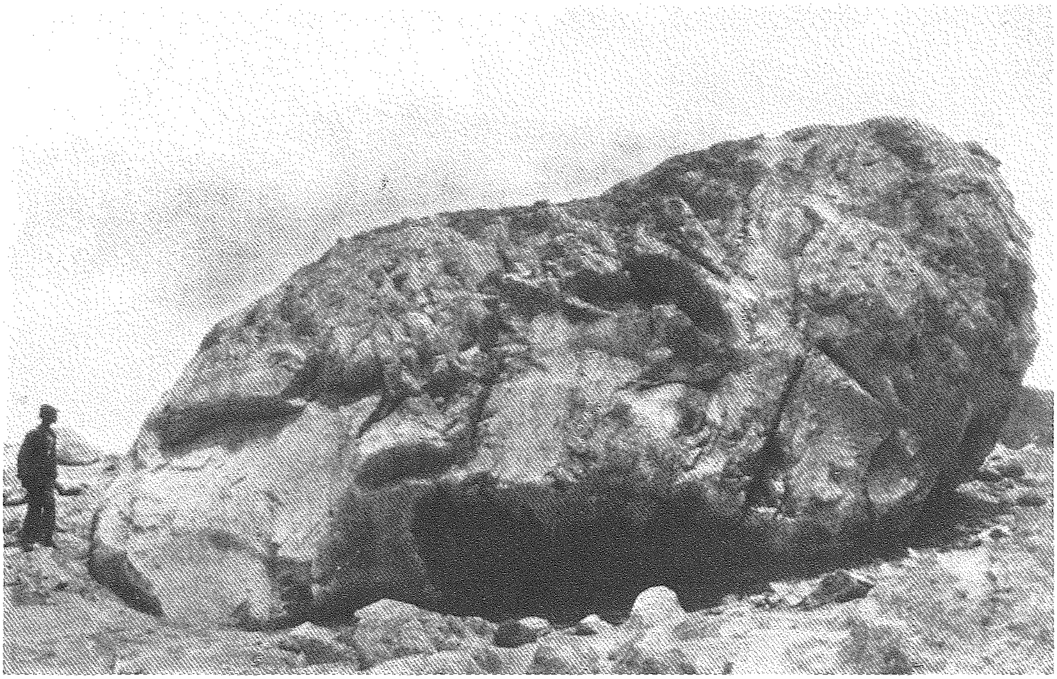

Fig 1.11. A giant boulder transported aerially a distance of three miles (5km) by nuées ardentes, near Mont Pelée. From F A Perret's *"The Eruption of Mont Pelée, 1929–1932", by permission of the Carnegie Institution, Washington DC.*

dumping of huge 'erratics' at all kinds of elevations alongside thick accumulations of 'drift' containing delicate shells when, at other localities, and at equally varied heights, other 'erratics', occurring far from shells and 'drift' of any kind, repose directly upon bare, polished and striated rock surfaces attributed to the *same* icy process supposedly responsible elsewhere for depositing the 'drift' and the organic remains (shells included) it often encloses?

If ice was responsible for the above phenomena, the remorseless grinding and scouring of everything in its line of advance should have been as capable of removing all small stones and grit, not to mention fragile shells, as it was of wrenching off from parent bedrock the huge stones deposited as 'erratics' with, it sometimes seems, great violence. But it didn't.

Nor, we may point out, did ice-sheets allegedly capable of producing results like those just enumerated ever invade the regions inhabited by the *southern* shell species. Nevertheless, the same species occur in 'drift' deposits at many places located in temperate zones supposedly laid down by ice-sheets said to have proceeded *from* the north. Here we have another example of 'inferred' ice action and direction of operation at variance with field evidence.

Puzzling though the evidence is, ice assuredly never simultaneously transported to the same locality so many climatically-undifferentiated shell species – and Moel Tryfaen is but one of several very similar instances elsewhere. It follows therefore that ice did not accumulate the enveloping 'drift' deposits either, or those like it elsewhere. Nor, as further corollary, can it have dispersed the 'erratic' boulders or striated rock surfaces intimately associated with the 'drift' beds.

And, it may also be asked, why do the 'erratics' and the 'drift' (as in Eire for example[268]) sometimes abound on the *higher* peaks only to be absent from adjacent *lower* ground? Such effects are scarcely those of normal 'uniformitarian' actions.

Indeed, the longer such problems are pondered the less likely it seems that ice could,

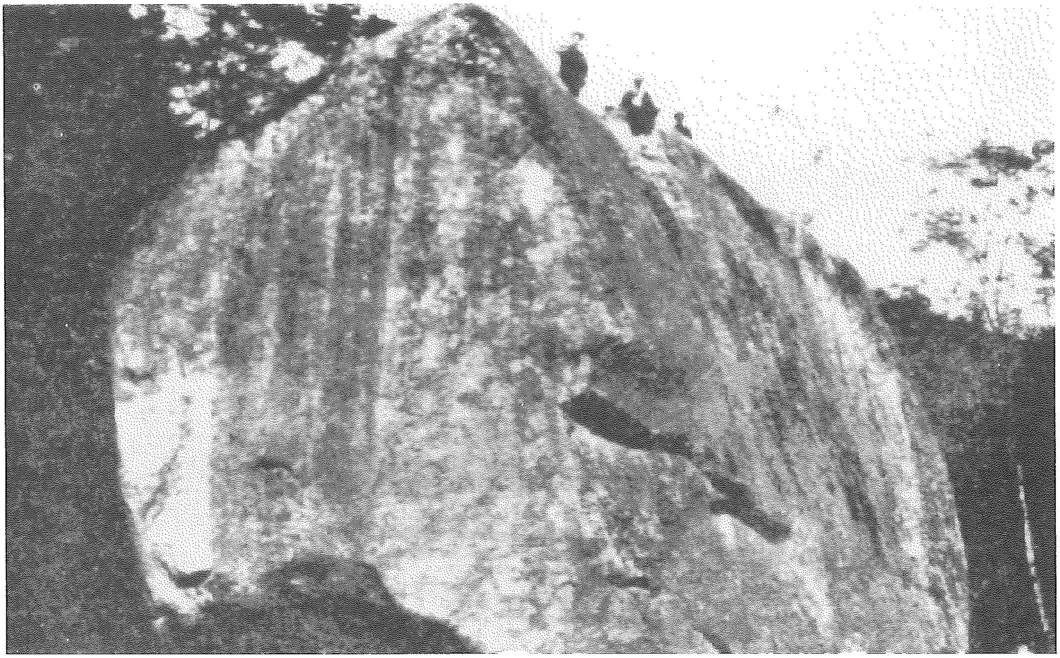

Fig 1.12. The giant erratic Madison Boulder at Conway, New Hampshire, estimated to weigh not less than 10,000 tonnes. The human figures show the boulder's great size. *Photo: R A Daly, "The Changing World of the Ice Age", 1934, by permission of Yale Univ Press.*

under any conceivable circumstances, have caused such effects, and indications mount up that the supposed Ice Age of Pleistocene times was really *no more than an icy chimera.* If so, then the validity of the Pleistocene period itself, as a distinct geological division, is also called into question.

But before the Ice Age is pre-emptorally jettisoned here as the causal agent behind all the above-mentioned phenomena, let us be certain that all normal actions of ice have been duly considered and abandoned as untenable for sound reasons. Nothing less satisfies.

As presently understood, the physics of ice suggests that, on attaining a sufficient thickness, the supposed ice-sheets of the Ice Age must have moved under the influence of gravity, and that, due to the enormous weight of the ice, the movement would have been downwards – from higher to lower levels. Due to the composition of ice, this movement or flow would have to be viscous (semi-fluid or sticky). This means that *only* the basal layers of the ice-sheet would have moved on downhill gradients, and that *only* its upper layers would have moved over flat country. Sir Henry Howorth emphasised this when he wrote:

> A more important and far-reaching difficulty... is the proved incapacity of glacier ice, as of any other viscous body, to travel over enormous stretches of level country, and up and down long hills, as it must have done if the glacial theory is to become the final and effective explanation of a large part of the drift phenomena.[269]

Glacialists, however, have usually argued that glaciers do not behave in the same way as ice-sheets (such as those on Greenland and in Antarctica), a point also dealt with by Howorth as follows:

> It is... useless to quote glaciers to the ice men. They repudiate glaciers as tests altogether [a long way from Agassiz's and Charpentier's original ideas: authors], just as they repudiate laboratory experiments upon ice. With

Fig 1.13. Two huge erratic boulders on the beach near Greyabbey, Co Down, Ulster. The nearest weighs over 500 tonnes. *By courtesy of Dept of Geology, Ulster Museum.*

Fig 1.14. Erratic boulder near Nairn, Scottish Highlands.

them all inductive methods and arguments fail, since they always reply that the ice they appeal to is something entirely different to the ice of glaciers. It is ice-sheets they rely upon, portentous ice-sheets such as no longer exist anywhere. A Saturnian postulate, in fact, is their platform, and not a mundane one. Yet it ought to be a condition even of such a transcendental postulate as this that the ice in an ice-sheet should act in accordance with, and not contrary to, the nature and the physical qualities of ice. If it does not, the appeal ceases to be a scientific appeal, and it is, in fact, very largely an unscientific appeal which is continually being made by this noisy, clamorous school of writers, who never verify their premises and make assumptions as readily as they abandon them.

An ice-sheet is only a great mass of ice after all; a mass of ice which, instead of lying on a mountain slope or being embayed in a valley or on a plane surface, is supposed to have smothered and covered a stretch of uneven country and swathed it in a continuous mantle, Such a mass of ice cannot acquire properties not possessed by other ice. If it moves it must move according to the mechanics of ice and, as we have seen, ice moves in no other fashion than by the influence of gravity.[270]

At this juncture we interject the observation that to advocate causes in the past which differed from those of present experience, so far as ice is concerned, is actually contrary to the uniformitarian principles glacialists claim to uphold. Considering ice as a solid, Howorth went on to note:

> If a solid be so heavy and so big that it requires more than a certain force to move it, it will *crush* rather than move, that is to say, the whole thrust will be dissipated by the object being reduced to pulp, or even liquid, which will flow away rather than move *en masse*.[271]

Many earlier glacialists spoke of these ice-sheets being hundreds, perhaps thousands of feet thick. Howorth, complaining at such extravagances, exposed their shortcomings thus:

> ...it is not possible to pile up a mass of ice to an indefinite height, or to force a mass of ice of greater length than about seven miles along a level surface by any pressure, however obtained, without its crushing, and without, therefore, the thrusting force being dissipated.[272]

A glance at map 1E showing alleged glaciation in the Northern Hemisphere shows that the extent of these ice-sheets greatly exceeds "about seven miles", that the topography of considerable areas (especially in North America) was essentially flat or level, and that in other regions allegedly mantled by ice-sheets it was singularly rugged. Thus, according to ice physics, these ice-sheets should not have been capable of moving over either level or rugged terrain. The properties of ice preclude this.

The excavating and demolition powers of thick moving ice, relative to the glacialist's assumption that ice-sheets broke up the surface strata they supposedly over-rode, were also discussed by Howorth, who observed:

> Ice is much softer and more easily crushed than the great majority of rocks, and would itself be crushed and reduced to slush by its own pressure long before the rock upon which it stands could itself be broken... We must always remember the kinds of materials upon which the supposed crushing was effected. These are not lumps of soft rock showing crushed outlines, but clean broken and shattered masses with their surfaces still raw and unhealed, consisting of the hardest crystalline rocks such as granites, seynites, porphyries, *etc*, as well as limestones, sandstones and chalk, and we are asked to believe that the same ice-sheets which thus shattered such intractable materials *in situ* after passing on a few yards travelled over beds of laminated and stratified sand and loam with such a gentle touch as not to disturb the laminations...
>
> The word *impossible* is not a favourite of mine, but I am bound to say that, if it is... applied to any physical operation, I know of none where it seems so applicable as to the process appealed to by the ultra-glacialists for the manufacture of drift by an ice-sheet smashing its own bed.[273]

Very interestingly, ice is protective as well as destructive. The incalculable power of thick ice moving continuously down a gradient is, of course, well known, and such ice may well have planed off rock surfaces, scored and striated others, and removed previous loose boulders and unconsolidated surface deposits obstructing its downward course. But to achieve this the ice *must* be moving. On reaching level terrain the ice-flow would speedily cease. It has long been established that glaciers on descending-to-level ground quickly lose their forward momentum. Stationary, ice fails to significantly injure even fragile shells or loose accumulations of soft sand or grits. It simply stagnates and, very often, slowly melts away. Thus ice on level terrain, being, as we have just noted, unable to move in any direction of its own volition, would tend to actually *protect* rather than abrade any land surface it mantled. Indeed, the great ice-sheet presently covering the land surface of Antarctica appears to play an almost totally protective role[274]. The ice there also exhibits a notable *absence* of stony debris in the glaciers and icebergs so typical of that southern continent, despite the fact that its sub-ice topography is in places known to be ruggedly mountainous. Consequently there is a singular scarcity of surface moraines in Antarctica – a certain pointer to the near-minimal surface scour presently occurring there. Yet, during so-called Ice Age times, great ice-sheets like that of Antarctica are stated to have caused spectacular land surface damage on virtually a hemispheric scale!

While on the subject of 'scour' and 'debris' relative to ice action, two further points of marked significance merit close attention here.

If, relative to different types of terrain, the aforementioned orthodox contentions re-

Table 1B

Conventional Euro-American Quaternary subdivisions

Common subdivisions of Quaternary glacial deposits recognised in Europe and America. Not to scale.

	Years B P	ALPS	NORTHERN EUROPE	BRITISH ISLES	NORTH AMERICA	NORTHERN EUROPE	BRITISH ISLES	NORTH AMERICA
	9,000						Flandrian	Recent
	10,000			Devensian				
HOLOCENE	10,270		Late					
	10,350		Upper Dryas Weichselian					
	10,900	Würm						
	11,600				Wisconsonian	Alleröd		
	12,200		Middle Dryas					
	12,400							
	13,000		Lower Dryas			Bolling		
	14,250 ?		Mid-					
UPPER	25,000		Weichselian					
PLEISTOCENE	30,000							
	45,000							
	50,000		Early					
	70,000		Weichselian					
	97,000					Eonian	Ipswichian	Sangamon
	140,000 ?							
		Riss	Saale	Wolstonian	Illinoian			
						Solstein	Hoxnian	Yarmouth
MIDDLE PLEISTOCENE		Mindel	Elater	Anglian Lowestoftian	Kansan			
							Cromerian	
				Beestonian				Aftonian
	600,000 ?						Pastonian	
		Gunz	hiatus					
	1,600,000 ?			Bavertian	Nebraskan			
LOWER PLEISTOCENE							Antian	
				Thurian	Pre-			
	2,050,000 ?		hiatus		Nebraskan		Ludhamian	
		Donau						
	2,450,000 ?						Waltonian	

specting ice action during the Ice Age really do represent the norm of glacial behaviour, then why did ice fail to remove the unconsolidated 'drift' deposits from many of the higher peaks – which the ice allegedly smothered or overrode – and yet sweep bare much of the nearby lower ground where large accumulations of 'drift' should logically occur? The field evidence on this matter seems to be diametrically opposed to the acknowledged normal processes of ice action on gradients and level surfaces as described above. Indeed, in terms of modern glacier action, the 'drift' actually exhibits characteristics fatally at variance with that action, even if applied to the most conservative Ice Age scenario.

It is undoubtedly noteworthy that neither mountain glaciers generally, nor the Antarctic or Greenland ice-sheets, are now accumulating extensive 'drift'-like deposits. Moreover, present glacier moraines contain angular rocks *unlike* the usually rounded stones and boulders in the 'drift' itself. These latter are themselves usually rounder than that other vexatious Ice Age phenomenon, the 'erratics' – the significance of this point will become clearer later in this book. It can be truly held, therefore, that modern glacial (glacier) deposits possess virtually no typical 'drift'-like features and should be more accurately described as 'heterogeneous (unstratified) muck'.

Again, although moraines are today found at the foot of many glaciers, it does not necessarily signify that every moraine associated with 'drift' deposits was actually produced by glacial action. A receding sea-tide will leave what is essentially a moraine upon a beach, and at least one good record is known of a morainic structure formed by unusually severe cloudbursts – moraines which covered several acres and contained trees, soil, stones and boulders weighing up to an estimated 100 tonnes each[275].

As repeatedly recorded, 'drift' is often encountered in the most unexpected places. The collective effect of such distribution is the *very opposite* of that which could be anticipated from thick ice-sheets allegedly disintegrating the rock surfaces they are said to have over-ridden. Such theoretical ice movements could be expected to sweep bare all hillsides and summits, accumulating the resultant debris ('drift') in valleys and on lower ground. That the 'drift' was often not deposited and distributed in that fashion only serves to support the aforementioned fact that ice (even as huge sheets) does not and cannot naturally *ascend* gradients (let alone the steep inclines and summits of lofty hills and mountains). Nor, as Howorth and others have stressed, should we expect ice – under whatever guise – to have behaved differently in the past.

If, therefore, past and present ice movements were essentially identical, the ice-sheets of glacial theory could have flowed *down* gradients only, or for strictly limited distances across generally flat countryside. From this it follows that the succession of glacial advances and retreats envisaged by glacialists as typifying Pleistocene times, and supposed to have ebbed and flowed across hundreds, even thousands of miles of diverse terrain, were more or less physical impossibilities, In short, they cannot have actually existed. Thus the distinctive names awarded this alternating cycle of glacial advances and retreats (see table 1B) also become largely meaningless.

Numerous lines of enquiry converge upon the startling fact that the Ice Age of orthodoxy is no more than the shaky theory it always has been and its alleged former reality, as conceived by its advocates, just a wonderful myth. There was indeed an 'ice age', but, as shown later in this book, it occurred at a later date and was of comparatively brief duration.

If, as demonstrated, the great ice-sheets so beloved of glacialists never existed, because the uplands so necessary for their development and maintenance were either too low or non-existent during alleged Ice Age times, and because ice, even very thick ice, cannot behave in the manner required by glacial theory, it follows that other geological phenomena commonly ascribed to massive ice-action were caused by some other agency or combination of circumstances. Among such phenomena may be mentioned moraines, striated rocks, rock flutings, giant surface grooves, cirques (bowl-shaped hollows at the top of valleys), hanging valleys (tributary valleys hanging high above valleys they feed into), *roches moutonnées* (polished rock surfaces), kettle-holes (small bowl-like depressions), drumlins (oval hillocks), eskers (long gravel ridges), kames (sand-gravel ridges), 'erratic' boulders and various other types of surface denudation. It is, therefore, unnecessary to consider these features here, although we shall return to them later when we identify the agencies which unquestionably caused them.

14
TURMOIL UNLEASHED

The idea of huge circumpolar ice-sheets relentlessly creeping for thousands of years across extensive swathes of land rendered desolate and frigid, and in which nothing very sudden occurred (save, perhaps, the collapse of large pieces of ice), has long been an essentially uniformitarian concept. The occurrence of so much ice has often been regarded more as a *biological* than as a geophysical catastrophe, but one which, operating so slowly in most regions, has come to be thought of as gradual. Neither the biological nor the geological record, however, support this view, for both reflect catastrophe and destruction on a global scale.

It is widely agreed that, towards the close of Pleistocene times, profound climatic deterioration occurred worldwide. Numerous life-forms previously dominant or very prolific either became extinct or greatly depleted numerically. This change affected the animal and vegetable kingdoms equally, marking in fact a Great Divide in the terrestrial biological record. From a uniformitarian standpoint, this was a truly extraordinary occurrence representing a real catastrophe.

So widespread is the evidence for these changes, and so apparently indiscriminate the annihilation of diverse animal groups, that the closing stages of the Pleistocene period might justifiably be styled an age of wholesale slaughter. In the words of Prof L C Eiseley, the phenomenon drives "...the biologist to despair as he surveys the extinction of so many species and genera in the closing Pleistocene"[276]. Considering these exterminations further, he added:

> We are not dealing with a single, isolated relict species but with a considerable variety of Pleistocene forms, all of which must be accorded, in the light of cultural evidence, an approximately similar time of extinction[277]

In Europe immense herds of diverse animals utterly vanished off the face of the Earth for no obvious biological reason. They were seemingly virile, numerically strong faunal groups, well adapted to their natural environment, yet, geologically speaking, they disappeared with frightening abruptness. The same biological decimation was enacted simultaneously in Australasia, Asia and Africa. Of the latter G E Pilgrim noted:

> ...at approximately the same time we witness a similar extinction of the mammal faunas of Africa and Asia, though in their case this may not have been caused by glacial conditions.[278]

What conditions could these have been? Conditions acting as effectively outside the alleged limits of the hypothetical polar ice-sheets as within them, and on a hemispheric scale.

In the New World, for example, practically the whole Pleistocene mammalian fauna was wiped out or reduced to a pitiful vestige of its former greatness. Among the mammals so affected were:

> ...all the camels, all the horses, all the ground sloths, two genera of musk-oxen, peccaries, certain antelopes, a giant bison with a horn spread of six feet, a giant beaver-like animal, a stag-moose and several kinds of cats, some of which were of lion-size.[279]

Additions to this list include several types of elephants, including the mammoth and the mastodon (though a few individuals are known to have survived Pleistocene times in North America), all the northern rhinoceroses, giant armadillos, several kinds of bear, numerous members of the canine family, tapirs, a variety of rodents, and various large flightless birds.

Coincident with this dreadful slaughter upon the land was the deposition far inland of myriads of contemporary marine shells, and the stranding at great elevations of marine mammals such as whales, porpoises, walruses and seals. Elsewhere, vast forests were flattened and buried under equally vast accumulations of sand or mud or piled up in broken and twisted heaps. At some localities plant remains were packed so densely and in such abundance as to form lignite (soft brown coal akin to peat) beds of great extent[280], while at others animal and plant remains were mixed together in inexpressible confusion as heterogeneous masses. In Alaska, for example, thick frozen deposits of volcanic ash, silts, sands, boulders, lenticles and ribbons of unmelted ice, and countless relics of late Pleistocene animals and plants lie jumbled together in no discernible order, This amazing deposit, usually referred to as 'muck', has been described by Dr Rainey as containing:

> ...enormous numbers of frozen bones of extinct animals, such as the mammoth,

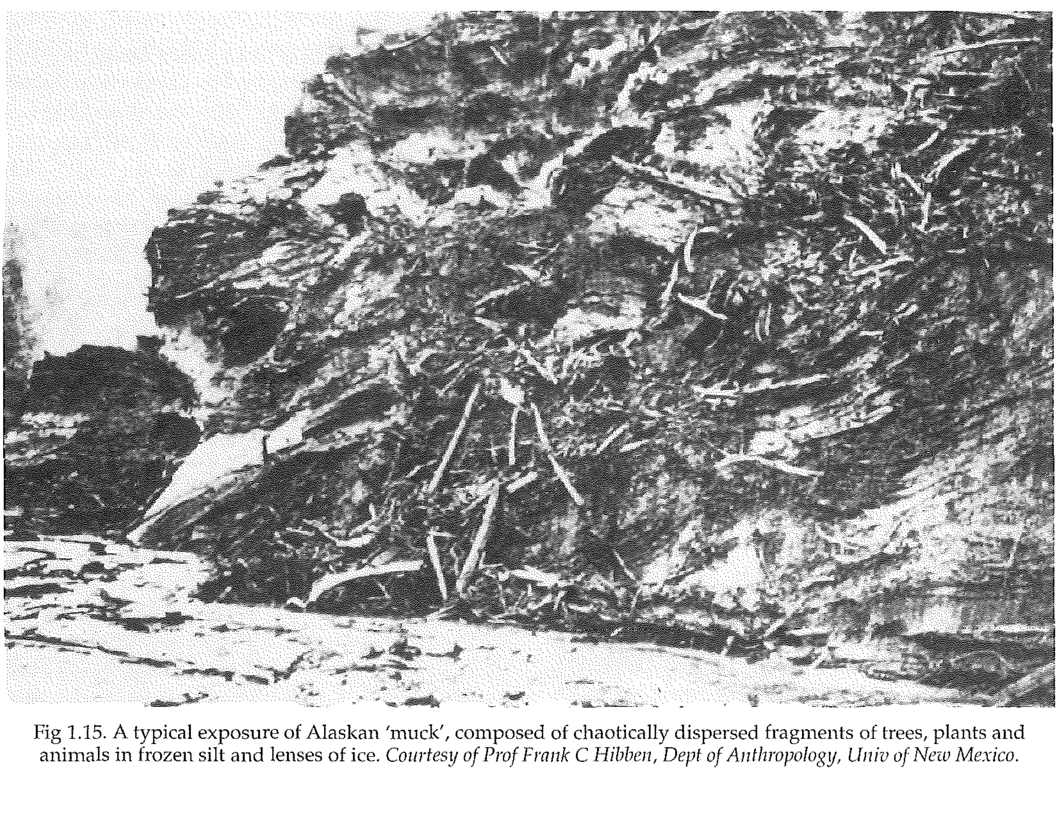

Fig 1.15. A typical exposure of Alaskan 'muck', composed of chaotically dispersed fragments of trees, plants and animals in frozen silt and lenses of ice. *Courtesy of Prof Frank C Hibben, Dept of Anthropology, Univ of New Mexico.*

> mastodon, super bison and horse, as well as brush, stumps, moss and freshwater molluscs.[281]

Hibben described these deposits in very similar language:

> In many places, Alaskan muck is packed with animal bones and debris in trainload lots. Bones of mammoths, mastodons, several kinds of bison, horses, wolves, bears, and lions tell a story of a faunal population... within this frozen mass lie the twisted parts of animals and trees intermingled with lenses of ice and layers of peat and mosses. It looks as though in the midst of some cataclysmic catastrophe of ten thousand years ago the whole Alaskan world of living animals and plants was suddenly frozen in mid-motion in a grim charade.[282]

In another publication, the same author commented:

> Although the formation of the deposits of muck is not clear, there is ample evidence that at least portions of this material were deposited under catastrophic conditions. Mammal remains are for the most part dismembered and disarticulated, even though some fragments yet retain, in their frozen state, portions of ligaments, skin, hair and flesh. Twisted and torn trees are piled in splintered masses... at least four considerable layers of volcanic ash may be traced in these deposits, although they are extremely warped and distorted.[283]

Hibben also suggested that this volcanic ash contributed to the wholesale death and destruction we have been reviewing. He wrote:

> One of the most interesting theories of the Pleistocene end is that which explains this ancient tragedy by worldwide, earth-shaking volcanic eruptions of catastrophic violence. This bizarre idea, queerly enough, has considerable support, especially in the Alaskan and Siberian regions. Interspersed in the muck depths, and sometimes through the very piles of bones and tusks themselves, are layers of volcanic ash. There is no doubt that coincidental with the end of the Pleistocene animals, at least in Alaska, there were volcanic eruptions of tremendous proportions... Toxic clouds of gas from volcanic upheavals could well cause death on a gigantic scale...[284]

We shall later have a few words to say about late Pleistocene vulcanicity worldwide, so we merely mention here that at least 76 major volcanoes, both currently active and recently extinct, exist today in the Aleutian islands immediately south-west of Alaska alone. Many of these appear to have been active around late Pleistocene times.

Hibben's observations also introduce the element of great heat into the argument surrounding the problematical origin of the so-called Ice Age. Discussing the problem from the viewpoint of physics, the celebrated Victorian physicist John Tyndall, as long ago as 1883, stressed that "...the enormous extension of glaciers in bygone ages demonstrates just as rigidly, the operation of heat as well as the action of cold"[285].

Although Tyndall has since been proved wrong on some counts, his remarks respecting great heat required for the formation of widespread ice-sheets are still correct and have been upheld by nearly all later geophysicists. Among these was Dr Donald Menzel of Harvard who, after examining the problem from an astronomical viewpoint, opined:

> If solar variability caused the ice ages, I should prefer to believe that increased warmth brought them on, whereas a diminution of heat caused them to stop.[286]

So, even if they really existed, the huge ice-sheets of Pleistocene times needed great heat for their formation, an element conceivably provided by many volcanoes erupting simultaneously. Such an event, if it actually occurred, must also have generated tremendous atmospheric pollution and hurricane force winds[287]. That it did occur seems to be indisputably established from the massive late Pleistocene vulcanism traceable not only in Alaska but, as shown later, in many other regions both north and south of the equator. Such extensive vulcanism must obviously have been due to some still more fundamental cause.

The frightful hurricanes just alluded to were doubtless primary factors in the demise of so much insect and bird life during late Pleistocene times – for what agency other than extremely violent winds could have brought together in one place such dissimilar avian species as the following? They included: Grebes, herons, bitterns, storks, wood ibises, spoonbills, swans, various geese (including the snow goose), ducks, American vultures, kites, many kinds of hawks, falcons, eagles, caracaras, the *Teratornis*, quails, cranes, partridges, turkeys, rails, gallinules, parrots, coots, plovers, turnstones, woodcock, snipes, surf-scooters, stilts, sandpipers, barn owls, seven other owl species, flycatchers, woodpeckers, swallows, jays, crows, magpies, titmice, chickadees, ravens, mockingbirds, waxwings, thrashers, meadowlarks, shrikes, two species of blackbird, redwings, orioles, finches, sparrows and buntings[288]. Remains of all these birds were discovered in the late Pleistocene tar-seeps at McKittrick in California, and the asphalt pits at Rancho La Brea in the same state.

This extraordinary assemblage is not an isolated freak occurrence. In late Pleistocene deposits at San Pedro, also in California, the following mixed bird assemblage was found with the remains of camel, bison, a ground-sloth, various rodents and the mammals known as *Felis*, *Megalonyx* and *Aenocyon*: loon, ancient murrolet, black-footed albatross, black-vented shearwater, fulmar, Brandt's cormorant, green-winged teal, mallard duck, cinnamon teal, white-fronted goose, surf-scooter, Californian quail, turkey vulture and western meadowlark[289]. All but the first, second and fourth species are still in existence, although like the equivalents from Rancho La Brea and McKittrick they are now spread over many different latitudes and occupy very different habitats. It is more than probable that most if not all these birds never originally dwelt together in the places where we now find their bones. They were brought together from various directions involuntarily by irresistible winds and buried in a common grave by, it would appear, catastrophic agencies.

Again, how does one correlate the extremely varied remains in the lignite deposits at Geiseltal in Germany with the theory of uniformity? Although now regarded as partially of Tertiary and partially of Pleistocene age[290], the tropical plants, insects and animals embedded in them do not square with the equivalents typical of the steppe conditions often stated to have been characteristic of that latitude during late Pleistocene times. The amazing preservation of the soft parts of many of these organisms suggests a very recent origin of the entire assemblage. The insect fauna, for example, is a *modern* one. It occurs "...in present Africa, in East Asia and in America in various regions, preserved in almost original purity"[291].

Complete insects, however, are rarities. The vast majority have been torn apart – and suddenly at that, because the process of fossilisation of all surviving parts with silica invading the tissues must have been virtually instantaneous (*'Fast blitzschnell'* – German), and was undoubtedly responsible for preserving the membranes and original colours of these insects so marvelously[292].

For the vertebrated animals (animals with a spinal column) these lignites are a veritable graveyard. The bones of giant constrictor snakes, East African salamanders, crocodiles, South American condor, an Indo-Australian bird, marsupial mammals, apes, as well as, paradoxically, mammals from northern steppe habitats, lie buried together in no particular order[293].

The plant remains are also perplexing. Fungi and algae still attached to leaves impressed into the lignites are today found only on plants in Brazil, the Cameroons and Java[294]. Chlorophyll is also preserved in many of the leaves which, numbering literally billions, form huge beds within these lignites. The leaves belong to plants from all parts of the world, not just from one or two climatic zones only. The leaves are also mostly shredded so that only their fine fibres or nervous systems remain intact. The fibres often retain their original green (chlorophyllic) colour, and indicate that the leaves must have been rapidly excluded from contact with air and light, and buried almost immediately they were stripped from the parent plants[295]. Many of the plant species concerned *still flourish in the tropics today.*

Only some tremendous hurricane acting in concert with vast surging masses of water could have transported and accumulated these remains at Geiseltal – a hurricane and a deluge operating on a scale and with a ferocity far beyond that of which modern humanity has any experience.

These remarkable faunal and floral assemblages at McKittrick, Rancho La Brea and Geiseltal form singular parallels with the aforementioned shell assemblages found in the 'drift' at Moel Tryfaen in North Wales. Further examples, not detailed here, are also known from other parts of the world. The process responsible for these effects clearly operated not only at many widely-sundered localities and at more or less the same point in Earth history, but affected plants, invertebrates, insects and land, sea and air animals equally. In other words, it acted globally and indiscriminately. Allied with the phenomena found in Alaska, a repeating pattern of wholesale destruction, often involving organisms which could never have lived in the vicinity of huge ice-sheets, emerges worldwide. It was a time when appalling carnage and tremendous natural disturbances occurred hand in hand. Put bluntly, it was a time of unbridled turmoil.

15
EVIDENCE FROM THE ARCTIC

Not as spectacular, perhaps, as the animal fossils discovered in Alaska and Siberian Russia, the equivalent botanical evidence from the Arctic is nevertheless of similar importance. Above all, it represents essentially sedentary life which mostly lived and died where its remains now occur. Adapted to well-defined climatic zones and altitudinal habitats, plants faithfully reflect the meteorological conditions which must have formerly prevailed where their fossils now repose. Taken as a whole, the flora constitutes a natural living background against which normally more mobile life-forms – for example, insects, molluscs and vertebrated animals – live and die. Plant cover in one form or another is virtually a prerequisite haven for such mobile organisms and, amongst other things, functions locally as a partial humidity control. Its importance for other life-forms cannot be over-emphasised.

The former existence of a warm, equable region traditionally sited somewhere in the north – often specifically at or near the North Pole itself – would, we may reasonably infer, have been clothed with abundant vegetation by the very nature of such a climatic regime. Much irrefutable evidence indicates that it was so. Palaeobotanists are well aware that a milder climate formerly prevailed throughout much of the present Arctic.

Numerous discoveries of warmth-loving plant remains assigned a Miocene or Pliocene date have been made at many northern localities, including Spitzbergen, the east and west coasts of Greenland, the islands comprising Kong Karl Land, Ellesmere Island, Banks Island and Alaska. Virtually identical remains occur on the Kamchatka peninsula of eastern Siberia, now lying well south of the Arctic Circle. Further consideration of these remains leads to some interesting conclusions.

Today, the winter temperature at 81°N, which is well inside the Arctic Circle, can and does drop from, −40°C to a still lower figure at the Pole itself, although even this does not reach that of the 'Cold Pole' in Siberia where, in the Oymyakon-Verkhoyansk basins, temperatures as low as –70°C have been recorded[296]. Conversely, the summer temperatures in latitude 81°N reach a cool 3°C[297].

Such severe temperature fluctuations obviously restrict the type and range of vegetation capable of surviving these extremes. Thus, if conventional concepts of lengthy Pleistocene glaciations and interglacial episodes are correct, these northern plant assemblages can have changed but little for hundreds of thousands of years. Plant records immediately preceding Pleistocene times, however, reveal that a markedly different flora flourished then in present Arctic latitudes, showing these to have been far warmer than they are today, and that many of the genera and species hardly differed from those which now thrive much further south. The findings of Prof F E Weiss, quoted by H E Forrest, stressed this:

> It has been shown by Heer, Unger, Ettinghausen and others that many plants of the Miocene period are so closely related to those of today that they cannot be distinguished as separate species (*eg Taxodium disticum*), and in most cases the living species are very closely related to those of the Miocene period [which is generally believed to have ended at least ten million years ago! – authors]

Miocene	**Recent**
Populus balsaminoides	*Populus balsamifera*
Platanus aceroides	*Platanus occidentalis*
Sequoia sternbergii	*Sequoia gigantea*
Sequoia langsdorfii	*Sequoia sempervirens*

> This indicates that there has been very little change since that period and we must consider the distribution of plants today in the light of that which existed in the Tertiary period. The remains from that period also show that the species occurring at that time had a much wider distribution, in the Northern Hemisphere at all events, than is the case nowadays. We may take it that the circumpolar flora of that time was most nearly related to the existing flora of north-east America, including as it did such genera as *Liquidambar*, *Vitis*, *Magnolia* and *Liriodendron*.[298]

It is more than curious that the existing flora of Greenland shows that flowering plants, which are said to have survived there from pre-glacial times, indicate that this so-called glacial epoch must have been *much less severe* than commonly believed[299], especially as Greenland is conventionally stated to have been repeatedly buried under enormously thick ice-sheets in Ice Age times, which obliterated everything in their path.

Early scientific expeditions to Spitzbergen discovered and collected 136 specimens of Miocene plants representing species of fir, spruce, marsh cypress, hazel, elm, sequoia, liquidambar, gingkos, tulip trees, magnolia and freshwater plants[300]. A similar picture came to light near Disko island off western Greenland where pine cones, acorns and other plants were discovered last century[301]. Further finds elsewhere in Arctic America concerned temperate-zone trees such as walnut, beech, oak, poplar, lime – some with fruit still on the branches – maple, magnolia, cypress, plane trees and conifers[302]. Some remains represented tropical ferns and the breadfruit[303]. Rather unexpectedly, many of these remains occurred in a sparry iron ore[304], a fact which will later assume much significance. Elaborating upon this evidence Sir Charles Lyell remarked:

> Professor Heer has examined the various collections of fossil plants that have been obtained in Northern Greenland (latitude 70°N), Iceland, Spitzbergen and other parts of the Arctic regions, and has determined that they are of Miocene age, and indicate a temperate climate. The Arctic Miocene flora now comprises 194 species, and that of Greenland 137 species, of which 46, or exactly one third, are identical with plants found in the Miocene beds of Central Europe. Considerably more than half the number are trees, which is more remark-

> able since at the present day trees do not exist in any part of Greenland even 10° further south. More than 30 species of *Coniferae* have been found, including several sequoias (allied to the gigantic Wellingtonia of California)... also beeches, oaks, planes, maples, walnuts, limes and even a Magnolia... andromeda, hazel, blackthorn, holly, dogwood and hawthorn. A species of zamia (*zamites*) grew in the swamps, with *potamogeton*, *sparganium* and *menyanthes*, while ivy and vines twined round the forest trees, and broad-leaved ferns grew beneath their shade. Even in Spitzbergen, as far north as latitude 78°, no less than 95 species of fossil plants have been obtained, including hazel, poplar, alder, beech, plane-tree and lime. Such a vigorous growth of trees within 12° of the Pole, where now a dwarf willow and a few herbaceous plants form the only vegetation and where the ground is covered with almost perpetual snow and ice, is truly remarkable. The identity of so many of the fossils with Miocene species of central Europe not only proves that the climate of Greenland was much warmer than it is now, but also renders it probable that a much more uniform climate prevailed over the entire Northern Hemisphere[305].

While adding further botanical species to these impressive lists, modern research has merely confirmed the Miocene character and luxuriance of these ancient northern forests. It was, however, this same evidence which, last century, prompted the view that the terrestrial axis must have changed since Miocene times[306]. The great Swedish geographer, Nordenskiöld, concluded that summer temperatures then at latitude 78°N must have attained at least 14–15°C to have permitted the survival of these plants[307]. He was, however, greatly puzzled at being unable to find any transitional plants in northern latitudes which bridged the Miocene/Pliocene/postglacial gap[308]. Everywhere there seemed to be a *sudden* change from an older Miocene/Pliocene flora to a modern (post-glacial) one, in which plant types linking the two regimes were conspicuously absent. Nordenskiold eventually decided that, without leaving one transitional plant to be found today, the glacial scour of the Ice Age must have ground up or carried away all evidence of such vegetation in northern latitudes[309]. Nordenskiöld subscribed, of course, to the then-fashionable theory of immensely thick ice-sheets mantling great regions of the northern hemisphere.

Iceland was also formerly milder than it is today. The presence there in clays described as 'very late Pleistocene' of large trees such as oak, maple, sequoia, spruce and others is irrefutable proof of this. Collectively, they point to a former mean annual temperature of 11°C. It has been suggested that these trees flourished during an "interglacial warm period"[310], yet their mode of interment within the clays bespeaks of sudden agitated conditions, the very reverse of those supposedly typifying the so-called interglacial episodes. Interestingly, P E P Norton concluded, after studying the remains of shells and pieces of wood in deposits assigned a late Pleistocene or early Holocene age at Tjornes in northern Iceland, that they had been accumulated under violently agitated circumstances[311]. Dated as being 11,000–12,500 years old, these fossils indicate that this part of Iceland remained unglaciated[312] at a time elswhere alleged to have featured prodigious ice-sheets which, by then said to have been slowly melting, still dominated many northern landscapes.

The aforementioned absence of glaciation of sizable areas of Arctic Canada may have been still greater than generally conceded; for although Cornwallis and Devon islands at 75°32'N are commonly believed to have been glaciated and are depicted as being so on maps reconstructing Ice Age times, Grinnell Land still further north at the polar end of Ellesmere Island, Banks Island and Prince Patrick Island all yield evidence militating against the notion that they were ever glaciated at all.

On the contrary, immense quantities of ancient permanently frozen wood, pine cones and acorns lie at an elevation of some 150ft (46m) above present sea level near the centre of Banks Island. One of the trees discovered there had apparently grown on the spot and retained many of its leaves, albeit blackened and withered[313]. Significantly, no oaks now flourish within several hundred miles of this island, so where have the acorns come from? Eleven other trees found on Banks Island were later identified as conifers of North American type, and two species of flowering plants were also recognised among this debris[314].

Supposed driftwood, much of it semi-fossil, was also encountered last century along the shores of Banks Island, at some places as much as 580ft (177m) above sea level[315]. Sir Robert McClure, who made many of these discoveries, found traces of former immense forests at several other localities on the island, about which Robert Damon of Weymouth wrote as follows:

> Sir Robert McClure mentions, in his narrative of the discovery of the north-west passage, the existence of a fossil forest on Banks Land, latitude 74°25′, where, for a depth of 40ft, the cliff was composed of one mass of fossil trees... 120 miles further north... [existed]... a similar kind of fossil forest.[316]

McClure met with comparable remains of ancient trees still further North, at latitude 76°12N, on Prince Patrick Island, where trunks as much as 4ft (1.3m) in circumference occurred. Some were so ancient that the wood had lost its combustibility and refused to burn[317].

Although Geikie thought these trees were probably referable to the Miocene period[318], the fact that they were superficially in a condition which, in other circumstances, would be regarded as combustible, suggests that they, too, were not properly fossilised and not, therefore, referable to such a remotely distant period as the Miocene. Nevertheless, these trees may indeed have represented typical Miocene species which, as we have repeatedly noticed, seemingly survived almost unchanged across many presently Arctic regions from the Miocene period down to late Pleistocene times – despite the intervention between those temporal extremes of the whole of the Pliocene and Pleistocene epochs (see table 1A). Such possibilities are enormously enhanced when we again note, as Nordenskiöld and other palaeobotanists also have, that in Arctic lands the change from an older Miocene/Pliocene flora to a modern (post-glacial) one, without transitional botanical species, was not only abrupt but occurred geologically very recently indeed.

If, as previously argued, the glacial and interglacial successions typifying conventional Ice Age times never actually existed, and if, as has also been suggested, some kind of post-Miocene axial shift has occurred, then Nordenskiöld's problem respecting the hiatus in the Arctic botanical record evaporates, for no transitional plants ever existed either, and the traceable changes were fundamentally environmental ones. Plants, being sensitive environmental 'thermometers', merely reflected those changes. Abrupt changes inevitably *precluded* the development of transitional plant species.

What this really means is that, while a rich and diverse botanical assemblage now preserved in sub-fossil form at various Arctic sites represents an ancient Miocene/Pliocene flora, the discovered specimens of it do *not* date from such distant times but are remnants of the *last* representatives of that flora which perished during the widespread environmental changes experienced across these northern latitudes at the close of Pleistocene times. Very significantly, as we shall shortly discover, a geologically late survival of ancient biota is duplicated in the record of the sub-fossilised animals entombed in the Pleistocene rock fissures and bone caves further south, where Miocene and Pliocene species sometimes lie cheek-by-jowl with Pleistocene and even modern (existing) species.

Further aspects of these profound northern changes and of the orthodox reconstructions of Ice Age times also exist which briefly merit consideration.

Among the more important of these are the conditions existing on either side of the northern end of the Nares Strait, the narrow channel which, straddling latitude 82°N, separates north-western Greenland from Grinnell Land on Ellesmere Island. There, conditions believedly typical of glacial and interglacial episodes of Ice Age times exist side by side[319], for despite its far northern location Grinnell Land features little permanent ice and hosts a considerable variety of plants which grow upon non-glacial soils, whereas Greenland, across the Strait, is perpetually smothered in snow and ice.

Here is an instance where glacial and so-called interglacial conditions do not, as in most Ice Age models, have to be successive. Given the appropriate conditions, they can be coeval. That such contrasting conditions can actually exist in such close geographical proximity on opposite sides of the Nares Strait is due largely to the warm waters of the western branch of the Gulf Stream flowing northwards up Davis Strait as far as Grinnell Land and influencing conditions there conducive to plant growth. Such conditions, however, are apparently exceptional, for, as shown earlier, the existence in alleged Ice Age times of extensive and lengthy glacial and interglacial episodes during conditions of near-hemispheric extent is no longer really tenable. The evidence supposedly representative of them requires alternative interpretation.

Here, a further point concerning soils also arises.

If Grinnell Land, as presumed by orthodox Ice Age dogma (but contrary to field evidence), was formerly glaciated by thick scouring ice-sheets, why did the ice not remove that region's original (old) soil – as has apparently occurred across much of northern mainland Canada (although not on many of that country's Arctic islands, where the aforementioned tree and plant remains testify so eloquently to its retention)? Enormous ice sheets of the type so commonly a part of standard Ice Age scenarios should have scoured away all such soil and all the botanical remains just discussed.

It has long been known that glacial soils are generally sterile and, for lengthy periods following their deposition, do not encourage plant growth. Highlighting this point many years ago, the American naturalist McGee, as cited by Howorth, observed:

> ...crude soils, such as fresh glacial clays from some yards beneath the surface, are not adapted to the support of luxuriant vegetation.[320]

Drawing upon the conclusions of several earlier authorities, McGee added:

> ...of the valleys laid bare at the glacial period, those whose glaciers retreated first present a richer and more varied vegetation than those which remained a long time covered with ice... The western slope of the Rocky Mountains exhibits abundant traces of glaciation evidently quite recent, geologically speaking, though it may well be doubted whether the glaciers have existed within many centuries, yet scarcely any vegetation has sprung up on the light glacial soil.[321])

Here, therefore, is a further detail suggesting that Grinnell Land, and probably much of Ellesmere Island as a whole, was never extensively glaciated, if at all.

But the absence of appreciable soils across huge northern stretches (the Canadian-, Hudson Bay- or Laurentian-Shield[322]) of mainland Canada, as also parts of western Siberia[323] and Finland[324], if not removed by ice that seemingly never was, must have resulted from the operation of other agencies. Wind and water are the only two alternative agents which could conceivably have produced the observable effects. Their operation, however, would have had to have been on a stupendous scale.

Together with the frozen soils of 'unglaciated' Alaska and eastern Siberia, with their abundant refrigerated relics of flowering and fruit-bearing trees and plants belonging to species now unable to grow in such high latitudes, the botanical testimony of the Canadian Arctic islands indicates the richness of the flora that formerly flourished in Arctic latitudes under climatic conditions clearly very different from those now extant there. Nor do we need reminding that the cessation of those conditions was apparently sudden, complete, and occurred at the very close of so-called Ice Age (Younger Dryas) times with astonishing rapidity (see I:5 *A Displaced Axis?*); or that an equable pre-catastrophic Golden Age traditionally existing during the 'childhood of humanity' in northern latitudes, where life existed in serenity. The traditional end of this paradisical world is consistently described as sudden and violent – a not unexpected fate of an era terminated by agencies which, on the basis of the aforementioned astronomical data, perhaps involved a change to the tilt of Earth's rotational axis. As we shall see later, a surprisingly large number of scholars have discussed this possibility. One scarcely needs to add that any such axial change would inevitably have generated major climatic changes and would have engendered biological destructions of exactly the magnitude the aforementioned evidence indicates.

16
AN INTERIM SUMMARY

Having now reached a point where the validity and significance of several diverse but related aspects of recent Earth history have been outlined in some detail, it may, before continuing further, be useful here to recapitulate the main themes discussed and the conclusions reached, especially as these collectively form the terrestrial background against which the awesome saga traced throughout the remainder of this book originally unfolded.

We have seen that humanity's age-old preoccupation with world history has steadily evolved from simple beliefs featuring a succession of ill-defined World Ages (or World Suns) – each allegedly terminating catastrophically – and that the most widely remembered and recent of these events was the Great Flood or Deluge of traditional and scriptural histories.

The interrelated questions of the 'date of Creation' and the 'age of the Earth' figured prominently in the deliberations of many classical and post-classical historians who, until the late 1820s, regarded the Deluge as not only real but as an important datum in practically all their historical schemes. They freely used the terms 'antediluvian' and 'post-diluvian' to denote pre-Flood and post-Flood events, peoples and things.

Irrespective of the particular strata from which they were obtained, fossils, which had apparently fascinated people since prehistoric times, were widely regarded as the physical remnants of antediluvian creatures drowned in the Deluge, although some thinkers realised quite early on that certain fossils represented organisms which had left no living descendants, and that some apparently belonged to eras so distant from ours that these were already immensely ancient even before the Deluge. Estimates of the real age of the world were regularly recalculated and slowly extended from a few thousand years to hundreds of thousands, and ultimately to millions of years – sufficient time, in the opinion of some adventurous scholars, in which pre-Adamites (people before Adam, the traditional 'first' man) could have lived or evolved.

Astronomical discoveries during the late 1600s and early 1700s revealed the periodicity of many comets and the existence of gravity, for the first time. William Whiston, who was cognizant of these discoveries and a friend of many who had made them, was seemingly the earliest to have proposed the idea that a comet, passing close to Earth, had gravitationally displaced the oceans and caused them to overflow their natural basins as a vast worldwide Flood. This theory was set out in a book which, published in 1696, showed how the Deluge could have occurred through the 'geo-physics' involved, and how it could have been a cosmically rather than a terrestrially-induced event.

Through providing a hitherto-missing workable mechanism – a defensible cause, as against that traditionally invoking unverifiable 'divine wrath' – confirming on the basis of cold scientific facts the apparent veracity of the scriptural and traditional accounts of a tremendous prehistoric Flood, Whiston's book accordingly became very influential and, in the process, initiated the 'scientific' foundation of the 'Catastrophist' school of thought.

During the 130 years or so following Whiston's book, the hypothesis of a comet-induced Deluge was enthusiastically cultivated by scientists and churchmen alike. The theory seemed to satisfactorily embrace both their sets of beliefs. Ultimately, however, their application of the theory to a whole range of natural phenomena became ever more forced and unlikely, and a point was eventually reached where 'catastrophism', as represented by Whiston's hypothesis, had clearly overstepped its mark and reached absurd proportions. Academicians reacted by seeking alternative, less sensational explanations.

Re-studies of many natural phenomena eventually resulted in the appearance during the early 1830s of Charles Lyell's now famous 'Theory of Uniformity', in which the extravagances of the catastrophists were discarded in favour of slow, gradual changes extending over immense periods of time. The age of the Earth thus grew longer still, and Lyell's new approach (actually built in part on earlier but at that time insufficiently noticed similar ideas advanced by James Hutton and William Smith) was swiftly acclaimed – one suspects as much as a relief from previous rampant 'catastrophism' as from any general recognition of 'uniformity's' inherent merits.

From Lyell's work sprang the 'uniformitarian' school of thought, which has ever since been in opposition to that of the catastrophists and has assumed ascendancy over it. It should be noted, however, that 'catastrophism' has never entirely died out, and has recently received support from some eminent sources[325].

But even before, and after, Lyell's day, naturalists acknowledged that certain geological phenomena existed which bespoke of sudden and violent changes – the very opposite of the calm uniformitarian norm. The phenomena included polished and striated rocks, 'erratic' boulders, extensive unstratified 'drift' deposits, abruptly frozen mammoth and rhinoceros carcasses in Siberia, and an astonishing profusion of unreasonably jumbled bony remains of countless incompatible animals in caves and rock fissures on every continent. Although fuller consideration of these remarkable burials occurs in Part Two, neither they nor the other anomalies just listed could be readily accounted for by uniformitarian tenets, especially as in almost every case they were primarily surface phenomena and therefore geologically youthful. Lengthy ages of serene conditions could never have produced them.

Nevertheless, less than ten years after the publication of Lyell's theory, another was proposed which, amongst other things, was thought to satisfactorily explain most of this anomalous material on non-catastrophic grounds. This was the Ice Age or glacial theory of the Swiss geologist Louis Agassiz. Like Lyell's, it was destined to become exceedingly influential in geological and biological circles.

Giant glaciers and huge ice-sheets smothering all but the highest peaks in northern lands were the main features in Agassiz's hypothesis. Ice, not Deluge waters, had purportedly striated and polished hard rocks, distributed the 'erratics' and had deposited the unconsolidated 'drift'. Thus, wherever such phenomena existed, that was where prodigious quantities of ice formerly existed and produced these effects. Above all, ice is *slow-acting*.

Though still exceptional, the frozen Siberian animal carcasses were, as they belonged to species also entombed *unfrozen* in geologically youthful 'drift' deposits elsewhere, quickly regarded as being similarly youthful. The relevant individuals, it was reasoned, must have belonged to animals which had lived and died in glacial conditions. Geologists invented a special epoch, the 'Pleistocene', to accommodate all such material.

The champions of ice as a causal agent for so many 'Pleistocene phenomena' could, it seemed, adequately account even for apparent anomalies like these. Accordingly, the Deluge ceased to be regarded as the cause of the 'drift' and associated geological phenomena, and was no longer recognised as an important benchmark in history. If it had ever occurred it probably had been a local event of scant significance outside the region it affected.

Encouraged by the apparent merits of Agassiz's theory, geologists everywhere renewed their studies of geological evidence previously ascribed to diluvial action. The outcome was a number of important, and sometimes diametrically opposed, developments.

Several separate alleged ice advances (stadials), alternating with ice retreats (interstadials) were professedly recognised. Elaborate schemes, in which the advances were generally envisaged as having been from polar latitudes equatorwards, were devised to explain these. To accommodate these stadials and interstadials, which, *a priori*, were imagined as lengthy episodes due to the usual slow actions of ice, the 'Pleistocene' period lengthened again. Some modern estimates of its duration make this span as much as three million years[326].

Particular attention was paid to what had actually caused the Ice age. Many explanations were proposed and discarded. None met all the necessary criteria – a situation still the case today.

Extended field studies also began to reveal serious defects in Agassiz's hypothesis. 'Erratic' boulders and 'drift' deposits were discovered in regions that even the most massive ice-sheets could never have reached. These, however, were also *essentially identical* to the 'erratics' and 'drift' of more northern areas where large accumulations of ice could most certainly once have existed. Conversely, 'drift' was found to be singularly *absent* from many northern localities where, if Ice Age theory was correct, it should occur.

Wind, water, mud-slides and various volcanic actions, as well as other agencies, began to be recognised as equally capable of scoring and striating rocks under given conditions. The predominant orientation of rock striations was surprisingly consistent throughout much of the northern hemisphere, and was sometimes associated with 'drift' deposits confined to northern or north-western mountain slopes, or to areas devoid of 'drift' altogether. In many areas striae affected older topographical features in ways that frequently negated all known ice behaviour.

Extraordinary accumulations of incompatible organisms – shells, birds, mammals, plants and so on – were encountered in 'drift' deposits hundreds, even thousands, of miles *too far* north of their present habitats. Southwards-moving ice could hardly have transported such remains to the localities yielding them. Elsewhere, extensive debris of ancient forests were met with in northern lands now far too cold to support any such vegetation, yet the immense ice-sheets of conventional Ice Age dogma had somehow avoided them and failed to scour away their trunks and branches as it had allegedly scoured away rocks elsewhere when accumulating the 'drift' deposits.

The orthodox concept of immense sprawling polar ice-sheets which, after long ages, slowly melted away, is, like the modified versions of it developed since, so full of fatal shortcomings and so at variance with inescapable field evidence, that the standard notion of the Ice Age must now be regarded as fundamentally flawed and almost certainly a chimera. Indeed, any application of it hemispherically, as was formerly common practice, is undoubtedly fallacious. Nevertheless, something – if not ice – had to have occurred which created and distributed so widely the so-called 'glacial' phenomena – and geologically lately at that, as the phenomena themselves are demonstrably youthful too.

Geologists have established that a similar modernity characterised the shattering, collapse and upheaval of many sizable portions of the Earth's crust, as well as the concomitant elevation of most of our planet's highest mountain ranges. Many highly competent authorities have been united in describing these huge disturbances in graphically catastrophic terms, dating them as having occurred 'at the end of the Ice Age', 'at the close of the Pleistocene epoch' or 'in sub-Recent times' – quite the reverse of what could be reasonably expected of uninterrupted uniformitarian conditions.

It is clear that before the onset of these disturbances world topography differed appreciably from that of today. The Alps were simply 'a chain of low hills'; the proto-Rockies, if they truly existed, were actually located considerably farther west; the Gobi desert was allegedly a great inland sea. A full list of these changes is impressively long and everywhere reflects the effects of a worldwide catastrophe.

In whatever guise even a small pre-catastrophic Ice Age might have existed, it, like the full-blown chimerical one disposed of above, certainly never sprawled across topographies familiar to modern people.

Palaeontologists and biologists have likewise reached generally similar conclusions respecting the demise of countless plants and animals on all continents 'at the close of the Pleistocene epoch'. Extinctions then were sudden, violent, frighteningly wholesale, indiscriminate and very extensive. Science has also determined, as will be elaborated on more fully anon, that many of the animals concerned were *not* adapted to the widespread glacial conditions supposedly typical of many regions immediately preceding these extinctions, but were more suited to *milder* and *gentler* regimes. The refrigerated evidence of warm/temperate vegetation from Arctic lands independently and strikingly supports that scenario, and suggests that some alteration of the axial tilt of the Earth may have attended the aforementioned crustal disturbances. They also intimate that the earliest histories which refer to remotely ancient times epitomised by a Golden Age may, after all, allude to some long-forgotten reality.

Evidence thus converges from numerous directions to support the conclusion that, on the testimony of radio-carbon and other dating techniques, immense physical and climatic changes occurred on Earth some 11,000 years or so ago – when an Ice Age that probably never was came to an end, and an apparently typical uniformitarian regime was abruptly terminated.

The collective and unavoidable message of these and other innumerable details is that, at some stage, colossal masses of water played a very important (although not the only) role in effecting these changes. This again suggests that the many surviving accounts of a worldwide Deluge long ago may yet be found to rest upon a substratum of now dimly-remembered fact.

Be that as it may, however, geophysics (as presently understood) reveals that Earth is seemingly incapable of generating of its own volition physical convulsions of the type and magnitude registered naturally in recent Earth history. Some other cause must have arisen – a cause powerful enough to affect the entire globe more or less simultaneously – to satisfactorily meet all relevant criteria. Only some closely-approaching cosmic object of considerable size could activate the titanic forces which, though part and parcel of a wider, more profound, universal uniformitarianism, only become naturally unleashed during such confrontations, and would be necessary to produce such gargantuan topographical and biological changes so rapidly and extensively on Earth.

The relationships between apparently incompatible uniformitarian and catastrophic regimes of the kinds just mentioned have been shown to be extremes of what, in reality, is a single astronomical or cosmic 'norm', manifesting itself on Earth only at the times of cosmic confrontations. A question of relative scale is directly involved – nothing more and nothing less. In such a context, the 'catastrophism' and 'uniformitarianism' of previous historians is not merely unreal, but a serious stumbling-block to a fuller and more lasting understanding of recent Earth history.

Finally, that many ancient Deluge accounts also describe the Flood as one of the results of a tremendous celestial conflict certainly cannot be without significance, and indicate that singular prospects now confront us at almost every turn.

Table 1C

Synopsis of major global geophysical changes during 'late Pleistocene' times

Region	Formation of deserts	Dried-up rivers/lakes/seas	Changed natural drainage/lake levels	Disappearance of land-bridges/land-masses	Raised beaches	Coastal warping	Marine displacements	Vulcanism	Fissures and fractures	Stratal inversion	Overthrusting of older over younger strata	Crustal tilting	Crustal shortening	Lateral crustal displacement	Orogeny and faulting	Sea-floor collapse	Land subsidence	Elevation
ARCTIC	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
Jan Mayen Islands	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	■
Bear Island	□	□	□	■	□	□	□	□	□	□	□	□	□	□	□	□	□	■
Spitzbergen	□	□	■	■	■	□	□	■	■	□	□	■	□	■	□	□	□	■
Kong Karl Land	□	□	□	■	□	□	□	□	□	□	□	□	□	□	□	□	□	■
Franz Josef Land	□	□	□	■	■	□	□	□	□	□	□	■	□	□	■	□	□	■
White Sea	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	■	□
Kola Peninsula	□	□	□	□	■	□	■	□	□	□	□	□	□	□	□	□	■	■
Kanin Peninsula/R. Ob	□	□	□	□	■	□	■	□	□	□	□	□	□	□	□	□	■	■
Novaya Zemlya	□	□	□	■	□	□	□	■	■	□	□	□	□	□	□	□	□	■
Vaygach Islands	□	□	□	■	■	■	□	□	□	□	□	□	□	□	□	□	□	■
Barents Sea	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	■	□	□
Kara Sea	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□	□
Laptev Sea	□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	■	□	■
New Siberian Islands	□	□	□	■	□	□	□	□	□	□	□	■	□	□	□	□	□	■
Verkhoyansk foldbelt	□	□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□	□
Bering Strait	□	□	□	■	□	□	□	■	□	□	□	□	□	□	□	□	■	□
Chukchee coast	□	□	□	■	□	□	□	□	□	□	□	□	□	□	□	□	■	■
Anadyr Bay	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	■	■
Ural Mts.	□	□	■	□	□	□	□	□	□	□	□	■	□	■	■	□	□	■
St Lawrence Islands	□	□	□	■	■	□	□	■	□	□	□	□	□	□	□	□	□	■
Seaward Peninsula	□	□	□	■	□	■	□	■	□	□	□	□	□	□	□	□	□	■
South Alaska coast	□	□	□	■	□	□	□	□	□	□	□	□	□	□	□	□	■	□
Alaskan Range	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■
Gulf of Alaska	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□
Aleutian Islands	□	□	□	■	□	□	□	■	□	□	□	□	□	□	□	□	■	□
Canadian Archipelago	□	□	□	□	■	□	■	□	■	□	□	□	□	□	□	□	□	■
NORTH ATLANTIC	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
GREENLAND	□	□	□	■	■	□	□	□	■	□	□	□	□	□	□	□	■	■
Davis Strait	□	□	□	■	□	□	□	□	■	□	□	□	□	□	□	■	■	□
Carey Islands	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□	□	□	■
ICELAND	□	□	□	■	■	□	□	■	■	□	□	□	□	□	□	□	□	■
Appalachia	□	□	□	■	□	□	□	□	□	□	□	□	□	□	□	□	■	□
Azores	□	□	□	■	□	□	□	■	□	□	□	□	□	□	□	□	■	□
Canary Islands	□	□	□	■	□	□	□	■	□	□	□	□	□	□	□	□	■	□
Mid-Atlantic Ridge	□	□	□	□	□	□	□	■	■	□	□	□	□	□	□	■	□	□
General	□	□	□	□	□	□	□	■	■	□	□	□	□	□	□	■	□	□
EUROPE	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
BRITISH ISLES	□	□	□	■	■	■	■	□	■	□	□	■	□	□	□	□	□	■
Irish Sea	□	□	□	■	□	□	□	□	■	□	□	□	□	□	□	■	□	□
North Sea	□	□	□	■	□	□	□	□	■	□	□	□	□	□	□	■	■	□
NORWAY	□	□	□	■	■	□	□	□	■	□	□	■	□	□	■	□	■	■
Skagerrak	□	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	■	□
SWEDEN	□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□	■	□
FINLAND	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□
Alps	□	□	□	□	□	□	□	■	□	■	■	□	■	□	■	□	□	■
POLAND	□	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□
Carpathian Mountains	□	□	□	□	□	□	□	□	□	□	■	□	□	■	□	□	□	■
Ural Mountains	□	□	□	□	□	□	□	□	■	□	□	□	□	■	■	□	□	■
Gibraltar	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	■
Aegean Sea	□	□	□	■	□	□	□	□	□	□	□	□	□	□	□	■	■	□
Aral Sea	□	■	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□

Table 1C (Continued)

Synopsis of major global geophysical changes during 'late Pleistocene' times

Region	Formation of deserts	Dried-up rivers/lakes/seas	Changed natural drainage/lake levels	Disappearance of land-bridges/land-masses	Raised beaches	Coastal warping	Marine displacements	Vulcanism	Fissures and fractures	Stratal inversion	Overthrusting of older over younger strata	Crustal tilting	Crustal shortening	Lateral crustal displacement	Orogeny and faulting	Sea-floor collapse	Land subsidence	Elevation
ASIA	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
IRAN	■	■	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□
Altai Mountains	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■
Tibetan Plateau	□	■	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■
Tien Shan	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■
Gobi Basin	■	■	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■
Pamirs	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■
Hindu Kush	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■
Karakoram	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■
Kailas Mountains	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■
Kuenlun Mountains	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■
Alai Mountains	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■
Himalayas	□	□	■	□	□	□	□	□	□	■	■	■	□	□	□	□	□	■
Pir Panjal	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■
Assam Valley	□	□	□	□	□	□	□	□	□	□	□	□	■	■	□	□	□	□
Nanga-Parbat	□	□	■	□	□	□	□	□	□	■	■	□	□	□	□	□	□	■
Naga, Patkai	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■
Bombay	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□
Arakan coast	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□
Palk Strait	□	□	□	■	□	□	□	□	□	□	□	□	□	□	□	□	■	□
BURMA	□	□	■	□	■	□	□	□	□	□	□	□	□	□	□	□	□	■
THAILAND	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□	□	□	■
MALAYA	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□	□	□	■
LAOS	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□	□	□	■
VIETNAM	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□	□	□	■
Kamchatka Peninsula	□	□	□	■	■	□	□	■	□	□	□	□	□	□	□	■	□	■
Bayan Kara Shan	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■
Minya Konka	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■
Yunnan Province	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■
Great Khingan Shan	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	■
Sikhote-Alin Mountains	□	□	□	□	■	□	□	■	□	□	□	□	□	□	□	□	□	■
Sea of Japan	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□
Yellow Sea	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□
Hainan Islands	□	□	□	■	□	□	□	□	□	□	□	□	□	□	□	□	□	□
JAPAN	□	□	□	■	□	□	□	■	□	□	□	□	□	□	□	■	■	□
Sea of Okhotsk	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□
Kuril Islands	□	□	□	■	□	□	□	■	□	□	□	□	□	□	□	■	□	□
PACIFIC OCEAN	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
Mindanao Islands	□	□	□	■	■	□	□	□	□	□	□	□	□	□	□	□	□	■
PHILIPPINES	□	□	□	■	□	□	□	■	□	□	□	□	□	□	□	□	■	□
Asian coastline	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	■	□
MARIANAS	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□
Hawaii	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	■	□
General	□	□	□	■	□	□	□	■	■	□	□	□	□	□	□	■	■	□

Table 1C (Continued)

Formation of deserts	Dried-up rivers/lakes/seas	Changed natural drainage/lake levels	Disappearance of land-bridges/land-masses	Raised beaches	Coastal warping	Marine displacements	Vulcanism	Fissures and fractures	Stratal inversion	Overthrusting of older over younger strata	Crustal tilting	Crustal shortening	Lateral crustal displacement	Orogeny and faulting	Sea-floor collapse	Land subsidence	Elevation	
□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	**THE AMERICAS**
□	□	□	□	□	□	□	■	□	□	■	□	□	■	□	□	□	■	Rocky Mountains
□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	Coast Ranges
□	□	□	□	□	□	□	■	□	□	□	□	■	□	□	□	□	■	Cascade Mountains
□	□	□	□	□	□	□	■	□	□	□	□	■	□	□	□	□	■	Sierra Nevada
■	□	■	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	Colorado
■	□	■	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	Salt Lake valley
□	□	□	□	□	□	□	■	■	□	□	□	□	□	□	□	□	□	Grand Canyon
□	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	■	St Lawrence valley
□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□	■	■	East Coast
□	□	□	□	■	□	□	□	□	□	□	□	□	□	□	□	□	■	Bermuda
□	□	□	□	■	□	□	□	□	□	□	□	□	□	□	□	■	■	Florida
□	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	■	Gulf of Mexico
□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□	EL SALVADOR
□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	■	□	HONDURAS
□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	■	NICARAGUA
□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	■	GUATEMALA
□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	■	COSTA RICA
□	□	□	■	□	□	□	□	■	□	□	□	□	■	□	■	■	■	Caribbean area
□	□	□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□	Venezuelan Basin
□	□	□	□	□	□	□	■	□	□	□	□	□	□	■	□	□	■	Andes
□	□	□	□	□	□	□	■	□	□	□	□	□	□	■	□	□	■	COLOMBIA
□	□	□	□	■	■	□	■	□	□	■	□	□	□	■	□	□	■	EQUADOR
□	□	□	□	■	■	□	■	□	□	□	■	□	□	■	□	□	■	PERU
□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□	□	■	Lake Titicaca
□	□	□	□	■	□	□	■	□	□	□	■	□	□	■	□	□	■	BOLIVIA
□	□	□	□	■	■	□	■	■	□	□	□	□	□	■	□	□	■	CHILE
□	□	□	□	□	□	□	■	□	□	■	□	□	□	■	□	□	□	ARGENTINA
□	□	■	□	□	□	□	□	□	□	□	□	□	□	□	□	■	■	GUYANA
□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	**AFRICA**
□	□	□	□	□	■	■	□	□	□	□	□	□	□	□	□	■	■	West Coast
□	□	□	■	□	□	□	□	□	□	□	□	□	□	□	□	■	□	Anti-Atlas Mountains
□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	Atlas Mountains
■	■	■	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	Sahara
□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	Aïr
□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	■	Hoggar
□	□	■	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	Lake Chad
□	■	■	□	□	□	□	■	■	□	□	□	□	□	□	□	□	■	ETHIOPIA
□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	SOMALIA
□	□	□	□	□	□	□	■	■	□	□	□	□	□	□	□	□	□	Great Rift Valley
□	□	■	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	Lake Albert
□	■	■	□	■	□	□	□	□	□	□	■	□	□	□	□	□	□	KENYA
□	□	■	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	Lake Victoria
□	□	■	□	□	□	□	■	□	□	□	■	□	□	■	□	□	■	TANZANIA
□	□	□	□	□	■	□	□	□	□	□	■	□	□	□	□	□	■	SOUTH AFRICA
■	■	■	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	Namibian Desert
■	■	■	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	Kalahari Desert
□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	**AUSTRALASIA & OCEANIA**
□	□	□	■	□	□	□	■	■	□	□	□	□	□	□	□	■	□	Indian Ocean
□	□	□	■	■	□	□	■	□	□	□	□	□	□	■	□	■	■	INDONESIA
□	□	□	□	■	□	□	■	□	□	□	□	□	□	□	□	□	■	NEW HEBRIDES
□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	Adelaide - South Australia
□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	Blue Mountains (NSW)
□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	Eastern Highlands
□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□	New South Wales
□	□	□	□	■	■	□	□	□	□	□	□	□	□	□	□	□	□	York Peninsula
□	□	□	■	□	□	□	□	□	□	□	■	□	□	□	□	■	□	Torres Strait
□	□	□	■	□	□	□	□	□	□	□	□	□	□	□	□	■	□	Bass Strait
□	□	□	■	□	□	□	■	■	□	□	□	□	□	□	□	□	□	NEW ZEALAND
□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	■	South Antarctic Peninsula

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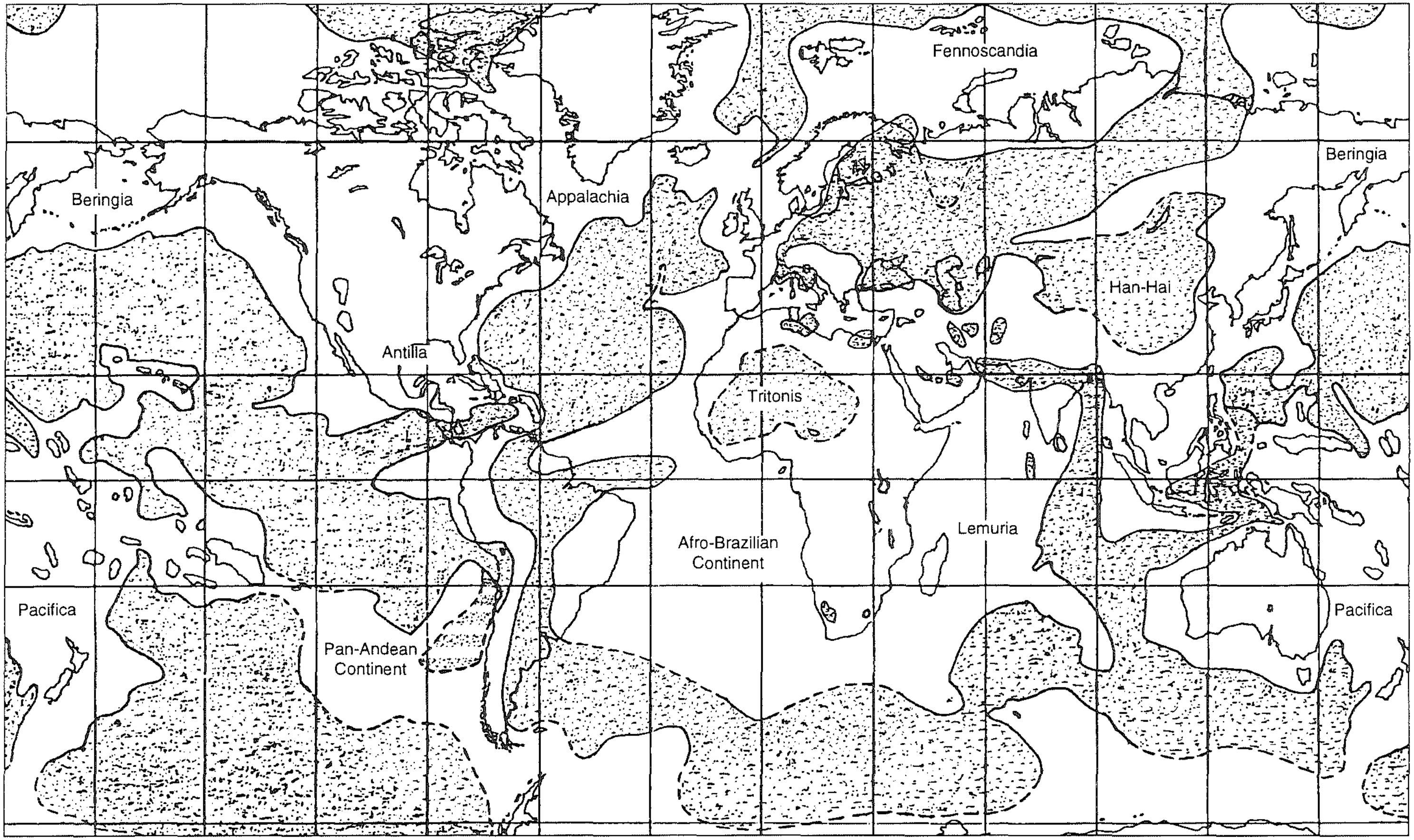
Part Two

PREMATURE EXTINCTION



Map 2A. A tentative reconstruction of the pre-catastrophic 'Pleistocene' world.

1
The Testimony of Biology

The enormous geophysical disturbances described in Part One inevitably made dreadful and often fatal inroads into animal and plant life almost everywhere, the evidence collectively afforded by their remains representing a truly astonishing story.

Forming an older but now largely destroyed biological assemblage, the geologically recent date of the demise of animal and plant life is indicated by the scarcely-fossilised condition of its remains. Moreover, the present distribution of various *identical* or closely-allied *living* species, sometimes inhabiting widely-sundered land regions no longer physically connected, is seemingly contrary to their natural dissemination. These regions, therefore, must formerly have been either geographically more continuous or environmentally more favourable to the uninterrupted spread of the biota concerned – and geologically recently, at that. Both living and numerous lately-defunct species thus represent opposite sides of the same biological coin. Of these, the living forms are the scattered descendants of biota which survived the terrible disturbances of some 11,500 years ago, whereas the extinct forms represent the annihilated victims of those convulsions.

As noted previously, almost all traditional recollections of a lost primeval northern homeland provide it with a marvelously equable climate and a wonderful diversity of plant and animal life, and agree that it ultimately perished in a sudden disaster of great magnitude. Also, as mentioned before, much palaeobotanical evidence exists in northern latitudes supporting these contentions.

The loss of these northern tracts naturally resulted in new topographical conditions and a highly modified oceanic and meteorological circulation worldwide. The evidence of the fossils, therefore, is not merely an adjunct of this disaster, but eloquent testimony to both pre-catastrophic environmental conditions and the awesome forces responsible for their termination.

These same fossils, moreover, throw much light on the present and sometimes unexpectedly disjointed distribution of innumerable life-forms in all hemispheres. Indeed, failure to recognise a sudden terminating calamity of geologically recent date renders comprehension of how many existing organisms attained their present distribution extremely difficult, if not actually impossible.

Scrutiny of our biological coin, therefore, yields much information germane to our main theme. We begin with some of the evidence concerning still extant plant species from Europe and the general Atlantic region.

2
A LOST EURO-AMERICAN FLORA

In central Europe, lignite beds containing the remains of so-called Pleistocene mammals have been found in the north-eastern Carpathians[1], while at Sprottau in Silesia cones of *Pinus sylvestris* lie alongside the bones of mammoths[2]. Remains of the same or allied conifers have also been encountered at many places in central and southern Germany. At Leffe, for instance, *Pinus* occurs with larch, hazelnut, horse-chestnut, waternut, and an extinct tree (*Juglans tephrodes*) resembling the American black walnut. Remnants of conifers have also been discovered at Imberg in Bavaria; alongside birch and willow in Savoy; and at Erzgebirge in Upper Saxony. In the same region, fragments of the so-called *ague-trefoil* have been found at Steinbach; birch and *Vaccinea uliginosum* at Kolbermoor in Bavaria; and those trees in company with willow, hazelnut, white oak, *Vibernum*, and a large assemblage of other plants, at Lauenburg[3].

Abundant remains of similarly aged plants including birch, willow and *Polygonum* have also been found at the Swiss localities of Schmerzenbach, Bonstetten, Schönenberg, and Hedingen; while near Lake Zürich, extensive lignite beds representing luxuriant vegetation, and containing the bones of mammoth, hippopotamus, rhinoceros, bear and other contemporary animals[4], underlie and are overlain by 'drift' deposits.

Some of these lignites – known as *Schieferkohle* or brown coal – are so youthful that wood debris in them is sometimes found *unmineralised*, as in Styria[5], or *uncrushed*, as in Bavaria[6].

Numerous central European plants in so-called Ice Age times were thus clearly warm-temperate species hardly differing from those *still* thriving there today; and they were accompanied by mainly herbivorous animals seemingly adapted to feeding on them, even though the mammoth has long been considered an 'arctic' type. The apparent enigma of believedly warm and cold climate organisms sharing common graves is repeated on virtually every continent.

Professor Scharff once made some very pertinent remarks about Pleistocene plants occurring in the present Alpine region, thus:

> The severity of the climate during the Glacial period is often assumed from the occurrence in Pleistocene strata of such plants as *Dryas octopetala*, some species of willow, dwarf birch, and others, which are now found in high latitudes and in the Alps, but are, as a rule, absent from the plain of Northern Europe. Professor J Geikie... believes... that an Arctic flora took possession of England as soon as the climate enabled it to live in the country. Arctic plants, according to this explanation... were the first immigrants to reconquer the dreary, plantless wastes and make it habitable for mammals.
>
> Fortunately these views do not at all agree with those of many of our leading European botanists... Professor Warming is of the opinion that the main mass of the present flora of Greenland survived the glaciation period in that country; whilst Professor Drude has shown that all plant life could not possibly have been destroyed in northern countries. He maintains that the greater part of the Arctic floral elements which unite Greenland and Scandinavia must have survived the glacial period in these countries in sheltered localities.[7]

Momentarily laying aside the fact that Scharff and the undermentioned authorities tried to explain this botanical evidence *within* the framework of orthodox Ice Age concepts, we should note that Col W H Fielden reached the following significant conclusion regarding various Arctic plants:

> To my mind, it seems indisputable that several plants now confined to the polar area must have originated there, and have outlived the period of greatest ice development in that region.[8]

Similar views about the 'pre-glacial' origin of much polar vegetation and of what is commonly known as the Alpine flora were also held by the botanist John Ball, who enquired:

> Is it credible that in the short interval since the close of the glacial period, hundreds of very distinct species and several genera have been developed on the Alps, and, what is no less hard to conceive, that several of these non-Arctic species and genera should still more recently have been distributed at wide intervals throughout a discontinuous mountain chain some 1,500 miles in length, from the Pyrenees to the Eastern Carpathians?[9]

Scharff, agreeing with these opinions, boldly stated:

> The glacial or Alpine flora is very old, and must have originated long before the Ice Age.[10]

That these plants survived the supposed severity of glacial conditions has puzzled many observers, especially orthodox glacialists. Many therefore concluded that these plants flourished outside the limits of the alleged glaciations and only later colonised Alpine areas.

A notable advocate of this solution was Professor A Engler, one of the foremost nineteenth century authorities on the geographical distribution of plants. He noted that several typically Siberian plants which today also occupy the Alps, the Caucasus and the Carpathians are entirely absent from the Scandinavian mountains, where, if anywhere in northern Europe, we should expect to find them[11]. Alpine-like plants, however, occur in Lappland, a *low*-lying tract immediately north-east of the Scandinavian highlands. Interestingly, Lappland hosts virtually three-quarters of all known circumpolar plants, and these collectively indicate that one or more land routes formerly existed between northwestern Europe and Greenland[12]. The main route was almost certainly the aforementioned landmass of Fennoscandia.

Significantly, another leading Victorian botanist, Professor F Krasan, believed that many plants now inhabiting the high Alps flourished at sea level during Pliocene times. He stressed that:

> Especially the evergreen species exhibit the impression of an originally mild climate – of a climate without winter frosts – for otherwise the plants would have developed into species with deciduous leaves.[13]

Note that modern geology envisages the Alps as: "...only a chain of low hills during most of the Pliocene"[14], and that, together with the Scandinavian mountains and most of the world's other major ranges, they rose to their present elevation only during late 'Pleistocene' times.

Thus, generally lower landmasses (including now-submerged tracts which then united regions now separated by water), together with the absence of the vast northern ice-sheets of conventional Ice Age theory (see Part One), not only encouraged more genial climates nearly everywhere, but provided almost exactly the conditions postulated by Krasan and others, best suited for evergreen plants. These factors, in turn, again suggest geologically recent crustal changes and a coeval shift of the terrestrial axis.

To those who would ask why Alpine vegetation, if originating at low altitudes during a climatically equable era, is now largely confined to cold Arctic latitudes or high mountainous regions, we refer them to the eminently reasonable explanation advanced by Scharff as long ago as 1899[15].

In western Europe we find many examples of trees and plants formerly thriving at localities now apparently inimicable to them. In its wild state the box tree was once widespread in north-western France and central Europe, whereas today it is found only around Lyons. Similarly, the grey willow, found in 'drift' deposits from Algeria to the depths of Germany and the British Isles, previously had a much greater range, but is now rare in the south, occurring only near water in very damp valleys. It is, however, correspondingly abundant in the north. Considering such facts, the noted botanist Count Saporta concluded:

> ...there has been a double retreat in opposite directions, showing that then the differences between the north and south of Europe were less accentuated.[16]

It is unnecessary here to cite all the studies made of these west European floral migrations and retreats. It suffices for present purposes to refer interested readers to the works of Lubbock[17], Geikie[18], de Mortillet[19], F E Zeuner[20], R G West[21], and Nilsson[22], who, between them, span the development of knowledge in this particular field of enquiry and provide numerous instructive examples.

Many discoveries in west European 'drift' deposits have concerned the remains of large maple and coniferous trees. The latter, especially, have been repeatedly encountered in Britain. At Wawne in Holderness, for example, drainage works last century exposed a buried forest, composed mainly of "gigantic pines"[23]; while others, lying horizontally 9ft (2.8m) below ground level, in company with the bones of horse, hippopotamus, mammoth, red deer and bovids, were found near Leeds in Yorkshire in 1852[24]. Innumerable roots of enormous size and the prostrate trunks of giant fir, oak, alder and hazel trees – complete in some instances with leaves, berries and nuts – mixed with mammoth bones, were discovered under thick layers of peaty-earth at low-tide level on the shore between Sutton and Cleethorpes last century[25]. The Rev Edward Trollope, who reported these finds, contended that a great flood had overwhelmed these organisms[26]. An essentially similar discovery occurred at Northampton in 1859[27].

The geographical preferences of the following plants, common to western Europe and large areas of North America, also signify the former existence of at least one land route to account for their present distribution. These plants include *Calluna*, *Leerzia*, the sedge *Carex extensa*, *Lobelia dortmanna*, *Eriocaulon septangulare*, and the water-weeds *Alisma*, *Lemna*, *Potamogeton* and *Myriophyllum*. Of these, the first four enjoy wide distribution across western Europe. *Eriocaulon*, however, is restricted to colonies near the coast of Donegal and south-west Ireland, reappearing only on the Scottish islands of Coll and Skye. Again, the freshwater genus *Naias flexilis*, while present in most North American streams and ponds, occurs in Europe only in south-west Ireland, Galway, the Isle of Skye, Perthshire and Esthwaite Water in Cumbria.

To all these may be added the American strand-plant *Spartina stricta*, which, in Europe, thrives now only in south-western regions, and *Scheucheria palustris* which, although well established in Canadian bogs from Labrador to British Columbia, has only the most tenuous toehold in westernmost Europe[28]. Commenting upon this evidence, Forrest said:

> In particular, it is difficult to believe that water-weeds such as *Potamogeton*, *Lemna*, *Alisma* and *Myriophyllum* could have reached their present habitats by an Arctic route. If, however, they were denizens of the lakes and marshes of an Atlantean continent in Miocene and Pliocene times, their distribution is accounted for quite naturally.[29]

Incidentally, Forrest's Atlantean continent corresponded with Appalachia, mentioned in Part One.

These and numerous similar discoveries all over Europe reveal a now largely vanished flora which was formerly far more varied than its few surviving members, and which, in geologically very recent times, extended much further north than it could do so today.

3
The Saga in the Atlantic

Turning to the former extent of analogous flora in and around the present Atlantic, we find that they, too, occupied now vanished tracts which disappeared simultaneously with their European counterparts. Reviewing the Atlantic flora generally, Scharff concluded that the Azores and Madeira islands were directly united to mainland Europe until at least 'glacial' times[30], by which, of course, he meant down to the time of the great catastrophe under consideration.

One of the plants closely studied by Scharff was the orchid *Spiranthes*, which flourishes today only in North America and Ireland[31]. *Spiranthes* is apparently a relict member of what has been called the North Atlantic Arctic flora, the present disjointed distribution of which suggests original dissemination via islands or land-routes now far below Atlantic waters[32].

Those who doubt such explanations, and favour a comparatively great age for the Atlantic basin, are reminded that many authorities – including Prof Neumayer, and Dr von Thering[33], Prof E Hull[34], Dr Lloyd Praeger[35] and others – have postulated geologically recent transatlantic connections in order to adequately account for present biological distributions, and that modern oceanographic and geological researches testify among other things to both a temporally recent prolongation of the Anti-Atlas mountains of Morocco to the Canary Islands, and to an apparent western extension of Africa as far as the Azores. The fact that *Adiantum reniforme*, a type of broom known to have flourished in Portugal during Pliocene times, now thrives *only* on the Azores and Canary islands[36], thus becomes explicable.

Plants common only to the Atlantic isles and western Europe actually run into hundreds:

> There are in the Azores 480 known species of flowering plants and ferns, of which no less than 440 are also found in Europe, Madeira, or the Canary Islands; while 40 are peculiar to the Azores, but are more or less closely allied to European species.[37]

The western extremity of the transatlantic land-route passing through Madeira and the Canaries seems to have lain in what today is the Caribbean region, while the route itself may have formed the northern edge of Termier's previously noted Africo-Brazilian continent as:

> A connection between the flora of Madeira and that of the West Indies and tropical America has been inferred by the presence in the former of six ferns found nowhere in Europe or North Africa, but existing on the islands of the east coast of America or on the Isthmus of Panama. A further relationship to that continent is to be traced by the presence in Madeira of the beautiful erinaceous tree *Clethra arborea*, belonging to a genus which is otherwise wholly American; and of a *Persea*, a tree laurel, also an American genus.[38]

A few degrees below the equator off northeastern Brazil, the island of Fernando de Noronha bears a flora and fauna closely allied to that of the Caribbean[39]. Interestingly, the seaweeds around the island are "related chiefly to those of the Mexican Gulf"[40].

Further south, at latitude 20°20'S, about 600 miles (960km) east of Brazil, on the

Table 2A
Present distribution of some geographically isolated plants indicative of lost continental landmasses in Oceania and the southern hemisphere

After Guppy, Scharff, Moseley *et al*

		Atlantic Isles			Africa			Indian Ocean						Asia					Australasia					Pacific Islands														Amer-icas		
Genus and species	**Type of plant**	South Trinidad	South Georgia	Tristan da Cunha	Southern Africa	Equatorial Africa	East Africa	Madagascar	Rodriguez Island	Mauritius	Marion Island	Kerguelen Island	Heard/McDonald Group	Indian Archipelago	Burma	Malaysia	Java	Borneo (Kalimantan)	Australia	Tasmania	New Zealand	New Guinea/Papua	Solomon Islands	Marquesas Islands	New Caledonia	New Hebrides	Keeling Atoll	Wallis Islands	Cambier Island	Fiji	Tahiti	Tonga	Samoa	Rarotonga	Paumatu Archipelago	Hawaii	Pitcairn Island	South America	West Indies	North America
Pringlea antiscorbutica	Kerguelen cabbage	□	□	□	□	□	□	□	□	□	■	■	■	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
Juncus	Ground plant	□	■	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□	□
Nertea	Alpine plant	□	□	■	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
Geranium	Alpine plant	□	□	□	□	■	□	■	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□
Sanicula	Alpine plant	□	□	□	□	■	□	■	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□
Lobelia anceps	Tree lobelia	□	□	□	■	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□	■	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□	□
Lobelia spp	Small shrubs	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□	■	□	□	□	□
Schiedea	Shrub	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□	■	□	□
Alsinidendron	Shrub	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□	■	□	□
Polygonium glabrum	Aquatic/semi-aquatic	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	■	■	□	□	□	■	□	□	□	□
Pisonia umbellifera	Seaside shrub	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□	■	□	□	□	□	□	■	□	□	■	□	■	□	□	□	□	□	□	□	□
Haplopetalon	Shrub	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□
Couthovia	Tree	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□
Eucalyptus	Tree	□	□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
Luzula campestris	Alpine plant	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□	■	□	□	□	□
Coprosoma	Upland plant	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□
Vaccinium	Ground plant	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□	■	□	□	■	□	□	□	□
Alyxia olivaeformis	Small tree	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□	□	■	□	□	□	□
Alyxia stellata	Small tree	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	■	■	■	■	□	□	□	□	□	□
Alyxia scandens	Small tree	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	■	■	■	■	■	□	□	□	□	□
Alyxia bracteolosa	Small tree	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□	■	■	□	□	□	□	□	□	□
Alyxia sp	Small tree	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□	□	□
Uncinia	Alpine plant	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□
Peperomia	Low herb	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□	■	■	□	■	□	□	□	□	□	□	□
Pimia	Tree	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□
Nototrichium	Small tree	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□
Richella	Tree	□	□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□
Geissois (7-8 species)	Saxifraga	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□	□	■	■	□	□	□	□	□	□	□	□	□	□	□	□	□	□
Oncocarpus	Tree	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□
Begonia	Orchid	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□	□	□	■	□	□	□	□	□	■	□	□	□	□
Eugenia rariflora	Tree	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	■	■	■	■	■	□	□	□	□	□	□	□
Eugenia monticola	Tree	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	■	■
Eugenia sp	Tree	■	□	□	□	□	□	□	■	■	□	□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
Stenogyne	Trailing plant	□	□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	■	■	□	□	□	□
Wikstroemia indica	Tree-shrub	□	□	□	□	□	□	□	□	□	□	□	□	■	□	■	□	□	■	□	□	□	□	■	□	□	□	□	□	□	■	■	□	□	□	■	□	□	□	□
Fragaria chilensis	Chilean strawberry	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□	■	□	□
Isodendron	Shrub	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	■
Nothocestrum	Small tree	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□	■	□	□
Thaucombaula	Shrub	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	■	□	□
Gouldia	Tree-shrub	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	■
Straussia	Tree-shrub	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	■
Deyeuxia	Upland grass	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□	■	□	□
Dammara (Agathis)	Conifer	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	■	■	■	■	□	□	□	■	■	□	□	□	■	□	□	□	□	□	□	□	□	□	□
Podocarpus	Conifer	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	■	□	□	□	■	□	□	□	□	□	□	□	■	□	□
Dacrydium	Conifer	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	■	□	□	□	■	□	□	□	□	□	□	□	■	□	□
Dianella ensfola	Herb	□	□	□	□	□	□	□	□	□	□	□	□	■	□	■	□	□	■	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□
Dianella intermedia	Herb	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	■	■	□	■	□	□	□	□	□	□
Dianella sp	Herb	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	■	■	□
Smythea	Straggling shrub	□	□	□	□	□	□	□	□	□	□	□	□	□	■	■	□	□	□	□	□	■	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□
Graeffea	Tree	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□
Broussaisia	Saxifraga tree	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□
Pterotropia	Tree	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□
Bobea	Small tree	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□

remote, virtually treeless, island of South Trinidad, abound the perished but *unfossilised* remains of a species of the tree *Eugenia*, indicating that the island was formerly well-wooded[41]. The present, much wider geographical distribution of *Eugenia*, shown in table 2A, is revelationary.

Still further south, the flora of the island-group of Tristan da Cunha, Nightingale, and Inaccessible is essentially Fuegian (South American) with an admixture of Cape (South African) genera[42]. Moseley concluded from these details that:

> The close similarity of the flora of the three islands of the group points to a former connection between them.[43]

Such facts point unmistakably to the rather recent existence in what is now the South Atlantic of one or more land routes or archipelagos over which plants had spread both west and east.

4
A SUNKEN SOUTHERN CONTINENT?

Wild plants enjoying even greater discontinuous distribution are known from areas of the southern hemisphere now mostly occupied by southern Africa, Australasia, the southern regions of the Indian Ocean and Pacific Ocean and South America. Collectively, these plants suggest the former occurrence of a now-sunken continental landmass which embraced all these regions, and seemingly connected in the east with another sizable landmass in what is now the Pacific Ocean, and in the east, apparently, with the southern portion of the aforementioned Africo-Brazilian continent in the west.

The previous existence of this great southern continent has long been recognised by geologists and naturalists, who have given it a variety of names – Gondwanaland, Indo-Oceana and Lemuria being the best known. The now submerged Pacific landmass has been variously called Oceana and Pacifica, and is of interest in that, as far as the botanical evidence is concerned, it was apparently joined, either directly or via islands, to western North America.

Table 2A summarises the present distribution of many of these plants, which include such well-loved forms as Begonias and Geraniums. It should be noted that, of the plants listed in table 2A, the seeds of the Kerguelen cabbage, which form the principal food of the local teal, are too soft and perishable to pass unharmed through that bird, and are very unlikely to be transported to more distant regions on the bird's feet or feathers[44]. Other plants on Kerguelen Island also occur in southern New Zealand, about 2,350 miles (3,760km) to the east in the South Pacific, and on South Georgia Island, some 2,700 miles (4,320km) to the west in the South Atlantic[45], the overall impression being that all the Kerguelen plants are actually relict species. Also of relevance is the fact that silicified trunks of large trees occur in late 'Pleistocene' lavas on Kerguelen Island, indicating that a well developed flora thrived there until geologically recently[46].

It must be significant that the great botanist, Joseph Hooker, concluded that the majority of the islands of the Indian Ocean were the upland peaks of a now-submerged southern continent, thus parallelling the conclusions reached by the naturalists who studied the floras of the Atlantic Islands and the Iberian peninsula.

Of particular interest is the fact that the shrub *Pisonia umbellifera* cannot be dispersed by water currents, yet it exists discontinuously from Australia to Tonga, while a closely related species, *P aculeata*, also thrives in the Americas and the Old World[47]. Again, *Peperomia* flourishes in such widely dispersed countries as Australia, various Pacific islands, the West Indies and Bermuda – but while some have suggested that birds may have carried the seeds to the two latter localities from Oceania[48], and despite the surprisingly great powers of flight of some birds, the immense distances involved renders such an explanation decidedly suspect. Moreover, as shown later, innumerable identical or nearly-allied species of insects, crustaceans and molluscs, which birds do not disperse, still inhabit the same broad belt of geographically discontinuous habitats.

Hooker's conclusions respecting a former southern continent foreshadowed those reached by Guppy years later for the Fijian area of the Pacific. Discussing the present distribution of the conifers *Dammara*, *Podocarpus* and *Dacrydium*, Guppy thought that they denoted the:

> ...original continuity of the Fijian land area, not only with the neighbouring islands of the New Hebrides and of New Caledonia, where these genera alike occur, but also with New Zealand, Tasmania and Australia, where they attain a great development.[49]

Interestingly, *Dacrydium* and *Podocarpus* are also known from South America[50], so it may be germane to mention that tree trunks, roots and branches litter the seabed between Panama and the Galapagos Islands[51], and that others occur in late 'Pleistocene' volcanic tuffs on Fiji[52]. Evidently, extensive forests formerly clothed huge land areas in what today are the Indian and Pacific oceans, that these existed until late 'Pleistocene' times, and that widely scattered colonies of *Dammara*, *Podocarpus*, *Dacrydium*, *Eugenia* and other plants on the islands now characterising these oceans represent the last vestiges of a once far more glorious flora.

Finally, the *Eucalyptus* tree of the Indian archipelago and Australia is, like the trees (plane, poplar, sequoia, etc) mentioned in Part One, apparently a survivor from Miocene/Pliocene times. In Australia, it occurs abundantly with the cones of the southern conifer *Banksia* in argillaceous deposits in southern Victoria[53]. These beds have been variously dated as late Pliocene or early Pleistocene. It will be recalled that the broom *Adiantum reniforme*, which still thrives on the Azores and Canaries, lived in Portugal during Pliocene times, and that much of the present circumpolar flora is similarly ancient.

No less than seventy-seven species of living plants, some with notable Pliocene, even Miocene, characteristics, are unique to Tasmania, New Zealand and Central America[54], so it must be of interest that subfossilised fruits discovered in Australian gold-bearing drift-gravels of Pleistocene age also belong to Miocene plants[55]. At some places in Victoria, these Australian gravels overlie the prostrate trunks and branches of large trees, some stumps still in situ, with their roots embedded in the original ancient soil[56].

It appears that various geologically 'old' plants still flourish virtually unchanged at many localities, exhibiting few or no signs of having developed into new forms during the intervening period (millions of years, according to conventional geological chronology). Could it be that the ancient flora they represent persisted right down to so-called late 'Pleistocene' times when, together with contemporary animal life of every kind, it was catastrophically decimated and its surviving elements obliged to inhabit (on a discontinuous basis) the new topography occasioned by the cause of those changes? If, as is widely agreed, the Pleistocene period ended about 11,000 years ago, it follows that essentially Pliocene floras clothed great areas of the world *until* that date. Innumerable botanical remains encountered in 'drift' and other 'Pleistocene' deposits the world over seem to suggest precisely this.

5
THE BURIED FORESTS OF NORTH AMERICA

Vegetable remains entombed in alleged 'Pleistocene' deposits are known from many localities in Europe[57], Africa[58], Asia[59], Australasia and South America[60] – where so-called late Tertiary (Miocene/Pliocene) and early Pleistocene plant fossils now reposing at 13,000ft (4,000m) at Corocoro, and at 14,000ft (4,308m) at Potosi, in Bolivia, include a fern and tropical trees closely allied to those now living in the Amazon lowlands[61]. Such remains, however, are probably most abundant in North America, where several spectacular finds have occurred. We commence with a look at some of the evidence from southern Canada.

Sir William Dawson and Prof D P Penhallow[62] were among the earliest students of Canada's so-called 'Pleistocene' floras – but while their work has inevitably been augmented by more recent discoveries and reports, much of what they recorded is highly relevant to the main theme of this book. For example, at Scarborough Heights and elsewhere near Ontario, clays yielded remains of cedar and pine trees, portions of rushes, leaves, a variety of seeds, specimens of *Chara, Bryum, Fontinalis* and two species of *Hypnum*[63]. Then, near the River Don, Toronto, leaves and wood fragments were discovered in dark hued clays 70ft (22m) below ground level, where, also, a Maple leaf occurred in overlying reddish ferruginous sand, itself overlain by boulder-clay[64]. Boulder-clay also overlies a bed at Rolling River, Manitoba, containing shell and fish debris mixed with a great variety of plant remains[65].

At Cape Breton a hardened peaty bed, subjacent to 'till' or boulder-clay, contains twigs, branches of coniferous trees, and a great variety of fibrous and epidermal tissues, apparently of swamp vegetation indicative of a genial climate. When ignited, these remains burnt with a flame in the manner of lignite[66]. As noted below, lignitised plants are actually quite widespread in 'drift' deposits over much of east-central Canada.

Lignite occurs in or below superficial deposits in the valleys of the Albany, Kenogami, Missinaibi and Abitibi rivers between Hudson Bay and the Great Lakes. On the bed of the Kenogami it appears in association with 'till' and boulder-clay, and contains pieces of canoe birch and coniferous wood. That along the south branch of Coalbrook is 3ft (1m) or more in thickness, is overlain by up to 70ft (22.5m) of pebbly 'till' and gravels, and, retaining a "distinct woody character", contains the flattened trunks of trees some 2ft (0.6m) in diameter.

Two miles above Woodpecker Island in the same valley horizontal beds of lignite, composed chiefly of sticks and half-decayed rushes, occur in the *midst* of 'till' deposits 125ft (38m) thick. Three miles (5km) below Woodpecker Island lignite, as much as 6ft (1.8m) thick, extends for hundreds of yards, and consists of laminae of moss and sticks in prodigious quantities[67]. Indeed, so numerous are lignite seams throughout this general region that lignitous matter is believed to underlie all the clays, sands, gravels and other superficial deposits, blanketing the territory south-west of James Bay for a distance of no less than 200 miles (320km)[68].

The peaty and woody accumulations in the Bow and Belly river valleys of Alberta are comparable examples from western Canada, where pressure has sometimes hardened them to the consistency of lignite[69]. Further north, just below the top soil at certain places in the valley of the Mackenzie River, shales forming the river banks are covered with the largely *undecayed* leaves of very ancient deciduous forest trees such as maple, oak and poplar, none of which can now thrive at that latitude[70]. Various early travellers observed burning seams of lignite at several places in the Mackenzie valley above the Bear River[71].

Faced with such evidence, it is difficult to disagree in general with the following conclusion which, although formulated by Dawson and Penhallow over a century ago, is still essentially correct:

> ...When these plants flourished in Canada, there must have been open water and a land flora in the Arctic basin – conditions, of course, altogether incompatible with the existence of a polar ice-cap, although not inconsistent with their existence in the more elevated districts or those cooled by the cold Arctic currents.[72]

Indeed, modern observations made in Arctic Canada, militating against former extensive ice-sheets there, strongly support Dawson and Penhallow's argument, while the evidence of the 'genial' character of many of the recorded plants merely emphasises what has already been inferred about the vanished Arctic forests. The half-decayed condition of much of the known material clearly indicates that its destruction, accumulation, and burial was a geologically recent event. As a whole, this Canadian evidence compares favourably with the European lignite discoveries and with the apparently coeval testimony of the lignites at Geiseltal in Germany.

As noted previously, many ancient valleys and gorges in the American Midwest lie buried under immense accumulations of 'drift' and associated materials originating in more northerly latitudes, where "Logs and fragments of wood are often got at great depths in the buried gorges"[73].

At Bloomington, Illinois, pieces of wood, some of it yew, were found 123ft (38m) below the surface during the sinking of a shaft[74]; a huge log was discovered 40ft (12m) below ground-level, resting directly upon 'till' or hard-pan, during the digging of a well at Columbia, Ohio[75]; while elsewhere in Ohio, and also in Michigan, similar finds have

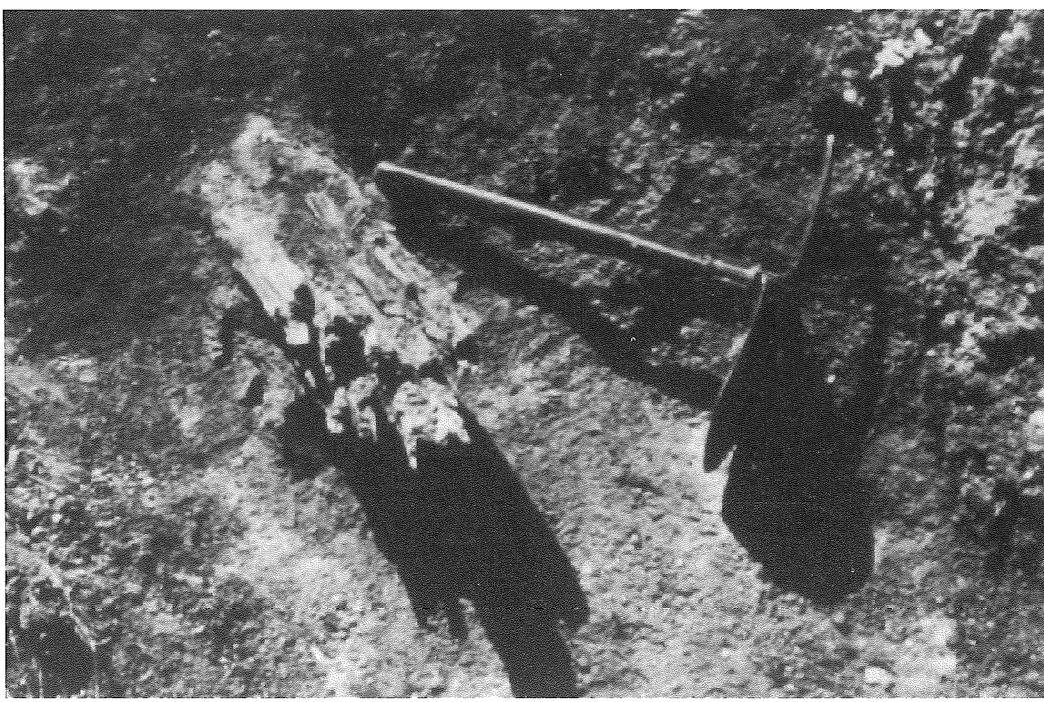


Fig 2.1. Buried log in soil section, Shelby County, Ohio. *Courtesy of Dr R P Goldthwait.*

occurred. Overall, the finds have been very numerous:

> Buried tree-trunks are often exhumed from the glacial drift at a depth of from 20–60ft from the surface. Dr Locke has published an account of a mass of buried driftwood at Salem, Ohio, 43ft below the surface, embedded in ancient mud. The museum of the University of Michigan contains several fragments of well-preserved tree-trunks exhumed from wells in the vicinity of Ann Arbor. Such occurrences are by no means uncommon. The encroachments of the waves upon the shores of the Great Lakes reveal whole forests of the buried trunks of the white cedar[76].

Buried timber resembling that of the osage-orange has been found at a depth of 42ft (13m) at Coventry, Summit City, near Lake Erie, Ohio, and mineralised black and brittle wood apparently of a cedar tree at a depth of 30ft (9m) in a similar excavation at Ross City, also in Ohio. A 20ft (6.2m) long trunk of a white cedar, complete with roots and portions of the upper boughs, came to light in 'muck' beds 18ft (5.5m) below ground-level in Cleveland, Ohio, a district where a layer containing abundant partly-decayed pine, spruce and cranberry leaves has been repeatedly penetrated – the result being that untreated water from many wells formerly sunk there was unfit to drink. Together with twigs, leaves and dead shells, the partially rotted but *unmineralised* remnants of another large cedar tree were found 12ft (3.6m) below the surface at Dover, Cuyahoga County, Ohio, and 3 miles (4.8km) north of New Burlington a "dense layer of logs" was encountered 30ft (9m) below the surface.

Of 59 wells sunk by the early 1860's in Hamilton County, Ohio, six had penetrated 'muck' beds, leaves, timber or carbonaceous silt. These accumulations were occasionally of enormous thickness. Leaves, sticks and vegetable mould exposed in a well shaft at or near Carey's Academy, Cleveland district, comprised a layer no less than 9′2″ (2.8m) thick. In another well nearby, a great bed of leaves and logs, this time under blue clay, was passed at a depth of 40ft (12m). This blue clay occurred in at least 35 wells sunk in Hamilton County by 1864, and invariably contained logs, twigs, and leaves.

An upright tree stump, complete with roots, was discovered in this same blue clay at a depth of 30ft (9m) below ground-level 8 miles (13km) east of Oxford in Butler County, Ohio, while at Athens, also in Ohio, several large logs were found 10ft (3m) lower down. Great beds of timber occur at several places in Mercer County, Ohio, between 40 and 50ft (12m and 15m) from the surface, and half-decayed logs were quite commonly found while sinking wells on the upland farms in nearby Sciota County. Closely similar finds were made at varying depths in Madison, Franklin, and Stark counties, showing that: "...muck beds and trees are universal beneath the soil throughout Ohio"[77].

The extent of these buried forests clearly outstretches even that of the sizable state of Ohio. For instance, well-preserved willow remains came to light in red clay 50ft (15m) below the present surface of Lake Michigan, in a well sunk at Green Bay, Wisconsin[78], while further north abundant decayed vegetation has been found under similar circumstances on Oak Island at the western extremity of Lake Superior[79].

Several years ago, at the site of Two Creeks, Wisconsin, abundant remains of large forest trees were discovered buried under deposits attributed to the Mankato glacier, allegedly a feature of the supposed Wisconsinian ice advance about 25,000 years ago. Accordingly, these trees were initially believed to date from that time, but later laboratory Carbon-14 tests on spruce wood and associated peat from the site reduced their antiquity to, significantly, only 11,000 years BP[80].

Elsewhere in Wisconsin, decayed and unmineralised white cedar wood has been found 18ft (5.5m) down in a well shaft in Walworth County, while at Appleton township unrotted red cedar (*Juniperus virginiana*) occurred at the same depth. A second, more decayed, specimen occurred nearby at a depth of 30ft (9m). In adjacent Minnesota, white cedar wood was discovered at the base of sandy clay 10ft (3m) below ground-level near the Mesabi Range on the banks of the Embarras River, and two large logs of resinous timber at a depth of 60ft (18m) in a well sunk at Iowa City, in Iowa. At Burlington, also in Iowa, extensive beds of sticks and leaves have been encountered 12ft (3.6m) below the surface – similar occurrences being recorded at various other localities west and south of that town[81]. Still more numerous finds of subterranean timber have been made all across Illinois, especially in the counties of Jersey, Marion, St Clair, Woodford, Grundy, McLean, Morgan, Tazewell, Menard and McHenry, and sometimes at depths of up to 110ft (34m) below ground-level[82].

Yet other finds could be listed from neighbouring Mississippi and Indiana, although the many examples just cited adequately convey the immense, and probably more or less continuous, extent of this buried vegetation. Together with the stupendous volumes of plant debris forming the previously-mentioned Canadian lignite deposits north of the Great Lakes, these discoveries west and south of the Great Lakes in effect constitute one gigantic raft of subterranean botanical rubbish – the remnants of once vast forests of mixed conifers and deciduous timber, overwhelmed and deeply buried by whatever deposited the even more gargantuan volumes of 'drift' all over midwestern America and southern Canada. Before their destruction, however, these forests extended much further north than is possible today.

Interestingly, modern botanical research has shown that, even during alleged glacial times, the commonest tree genera in, for example, Illinois were "present there during the entire Wisconsinian (Pleistocene)"[83], that deciduous forests south of the Sangamon River in Illinois, Indiana and Ohio, were dense and flourished in a "climate more humid than the present one"[84], and that *northern* plants have been identified in these buried floras of the American Midwest[85]. One authority, Grüger, has even concluded:

> One must assume for this region for the entire Wisconsinian, a temperate climate, which may have permitted the survival of many plant types relatively close to the ice edge.[86]

Other botanists, concerned more with floral distribution than with geological hypotheses, have arrived at rather similar conclusions. Braun, for example, has postulated ideas very similar to those advocated by Grüger on the basis of present plant geography[87], a line also adopted by Iltis still more recently[88]. Yet others could be quoted.

If, as previously advocated, the ice-sheets of glacial theory never existed in so-called 'Pleistocene' times, then the difficulties confronting botanists studying evidence like the above largely evaporate. Moreover, the fragile nature of much of this botanical debris – leaves, rushes, twigs, nuts, cones, berries, moss etc. – strongly militates against ice having overwhelmed and buried such material, even though the deposits enveloping it are conventionally regarded as 'glacial'. The fact that equally large buried forests and delicate plants occur in Alaska and all over northern Siberia, but not in deposits usually thought to have been laid down by ice-sheets, is highly relevant, and suggests that all these flora, whether in America or elsewhere, perished from the same general cause and at the same time.

Collectively, the foregoing testimony of numerous living and lately-extinct plants shows not only that many flora were once far more extensive than at present, but also that they were so until surprisingly recently – they inhabited latitudes in which they can no longer flourish, and clothed a world topographically very unlike our own. This testimony also indicates a former prevalence of climatic conditions considerably more genial than today. The botanical evidence as a whole, therefore, harmonises extremely well with the unrelated disciplines of Pleistocene geology and early tradition (see Part One). As we shall now see, the record of zoology is practically a duplicate of that just examined.

6
Dislocated Faunas: the Atlantic Basin

Like the botanists, many zoologists studying the geographical dispersal of land and freshwater animals have concluded that various land-routes or close-knit archipelagos must have formerly occurred in many regions now below sea level, to satisfactorily account for existing faunal distributions. Prof H Simroth, for example, investigating the slugs of the Iberian peninsula, North Africa and the Canary Islands, deduced that a direct land connection between the three areas must have existed until comparatively very recently[89].

Well known malacologists (studying molluscs) have reached similar conclusions. Thus, on the Azores, out of 69 species of land-shells (which have a natural aversion to sea-water) 37 are common to Europe or the other Atlantic Isles. Most, if not all of them, are thought to have probably originated at those localities in 'pre-glacial' days, during or even before 'Pleistocene' times[90]. They are, therefore, relict species of a fauna now drastically reduced numerically and territorially. Both Dr W Kobelt and Dr von Ihering have shown that European, West Indian and Central American land-shells certainly implied the former existence of some transatlantic land-route, severed only towards the close of the 'Pleistocene' period[91].

That such land connections really did exist seems irrevocably established by the following data:

> The present fauna of the four archipelagos – the Azores, the Madeiras, the Canaries and Cape Verde – is not an island but a continental fauna: in particular, the mollusc fauna is indigenous to the Mediterranean and distinct from the equatorial-African. At the same time, there is a resemblance in the fauna of the Canaries and Mauritania, both showing the same kind of molluscs. The earth-worms, *Oligochetes*, in the Canaries, are akin to the same creature in Southern Europe.
>
> It is to be concluded from these observations that in an epoch close to ours – say, at the end of the glacial period – the islands of the four archipelagos were joined to the African continent.[92]

Again, Prof.Scharff noted that operculate (lidded) land-shells of the West Indies comprise:

> ...so large a proportion of the Antillean land-snail fauna, that a majority of the genera are found on two or more of the islands and the mainland, while nearly every species is absolutely restricted to a single island, appears to me to be very strong testimony in favour of a former general land connection.[93]

Evidence from Jamaica and the Lesser Antilles indicates that the disappearance of this land connection was accompanied by the near-extinction in late 'Pleistocene' times of a very diverse earlier ('glacial') land-snail fauna[94] – a factor accounting for the remarkable distributional pattern of the present snails as noted by Scharff and, as seen below, why many of them, though now insular forms, are so closely related to one another. It would, moreover, not be unreasonable to conclude that the loss or subsidence of this former land connection occurred coevally with that of the transatlantic land route called for above by Kobelt and von Ihering, on the basis of other molluscan evidence.

Ewing, it will be recalled, indicated the awesome vertical scale, and Termier the huge linear extent of such subsidence when, at the close of the 'Pleistocene' epoch, large portions of the Atlantic floor – which must *a priori* have included the land routes of the naturalists – sank some 2–3 miles (see Part One).

Elsewhere, as between Greenland and Norway, the greater part of the North Atlantic subsided as much as 9,000ft. That freshwater shells inhabiting a bog at Killough in Co Down, N Ireland, are stunted forms allied not merely to some still living in Arctic Europe, Greenland and America, but to others, almost identical, dredged as dead shells from the Atlantic floor near Rockall off the Norwegian and Scottish coasts, the Shetland islands, Iceland and Jan Mayen island, at depths of up to 9,000 fathoms, and generally from all areas between Davis Strait and Gibraltar[95], confirms not only the enormity of this crustal subsidence, but supports those claims which date the collapse as having occurred "since the Ice Age"[96].

Elaborating upon the American and African relationships of the Atlantic isles fauna, Merezhkovsky added:

> ...the geographical distribution of the molluscs *Oleacinidae*, existing only in Central America, in the Antilles, the Canaries, the Azores, on the island of Madeira and in the Mediterranean basin, presupposes the existence... of a continent embracing all these regions. Fifteen varieties of molluscs live only in the Antilles and on the Senegal coast of Africa, and it is impossible to explain their presence by the transportation of the embryos; while the coral fauna of the islands of St Thomas includes six varieties, of which one, apart from this island, breeds on the submarine rocks of Florida; while four are on the Bermuda isles, which again can scarcely be explained by the transportation of the embryos, as their watery life is too short to allow for their being transported by oceans currents.[97]

All the land-shells of the Bahamas, Puerto Rico, Haiti, Cuba and Jamaica are generally related to each other and to those of Florida and Yucatan (Mexico), whereas those from the Windward Isles are closely allied only to South American forms[98]. This suggests the occurrence of a natural barrier separating the two areas represented by these distinct land-shell groups even before 'Pleistocene' times – a detail seemingly confirmed by the fact that:

> The fishes, shells, sea-urchins and other organisms of the West Indian basins belong to *modern* types, which to a large extent seem to have migrated from the Atlantic Ocean. Their recent appearance suggests *great changes in the physical history of the West Indian seas...*[99] (our italics)

and by the recent discovery of fossils of the *same* species of *foraminifera* (uni-celled marine creatures) in sea-bed cores obtained from both sides of the Panamanian isthmus[100]. Today, these creatures are specifically distinct either side of the isthmus.

Like many other naturalists, Spencer concluded that the submergence of the Antillean landmass and elevation of the Panamanian isthmus were geologically recent events, and that much marine zoological data from the Caribbean generally loudly echoes the implications of the land-shells of the Atlantic isles, north-western Africa and the Iberian peninsula[101].

Among annelids, the occurrence of similar earthworms in the Canaries and southern Europe represents further powerful evidence for an uninterrupted land connection between those regions at no very remote date, for, like the slugs and most land-shells, earthworms soon perish if consigned to seawater. The same fate befalls similarly immersed frogs, toads and newts, yet the presence of several identical or related species of these amphibians in water-sundered Sardinia, Corsica and the British Isles suggests that these islands, too, were recently united to the European mainland[102].

The French writer, L Germain, has highlighted the fact that certain insects – such as the familiar Canary Butterfly *Setomorpha discipunctella* – also occur in West Africa and tropical America[103]. Enlarging upon this subject, Spence noted that:

> Sixty per cent of the butterflies and moths found in the Canaries are of Mediterranean

> origin, and twenty per cent of these are to be found in America... The (crustacean) *Platyarthus* is represented by three species in Western Europe and North Africa, one in the Canaries, and one in Venezuela.[104].

And Wallace said of the insects of the Azores:

> The butterflies, moths and *Hymenoptera* are few in number... Beetles are more numerous... The total number of species is 212, of which 175 are European... 23 of these are not found in any of the other Atlantic islands... Besides these are 36 species not found in Europe, of which 19 are natives of Madeira or the Canaries, 3 are American, and 14 are altogether peculiar to the Azores. These latter are mostly allied to species found in Europe, or in the other Atlantic islands, while one is allied to an American species... Many of these small insects have, no doubt, survived the glacial epoch, and may, in that case, represent very ancient forms which have become extinct in their native country.[105].

Analogous details are traceable between the European and North American ants and beetles. Among the *Lepidoptera*, for example, 243 species are common to these continents, while:

> A great number of North American ants are identical with European ones... Northern Europe possesses one peculiar genus of Ant – *Anergetes*. This is closely allied to *Epoccus*, another genus confined to North America... 487 species of *Coleoptera* are common to North America, Northern Asia and Europe.[106].

The restriction of the water-mite *Hydrachna geographica* – a creature with limited powers of flight – to Europe and eastern North America[107] is still another example, which also parallels the distribution of the freshwater sponge *Hetermeyenia ryderi*, thriving today only along the North American Atlantic coast (between Florida, Newfoundland, and Sable Island) and western Scotland and Ireland[108]. Such distribution is inexplicable unless continuous land with freshwater lakes and ponds once existed between Europe and North America.

The distribution of the pearl mussel (*Margaritana margaritifer*) suggests it is another relict species, since:

> The European freshwater pearl mussel is found in the United States, where other allied species exist. In Eastern Europe and Western Asia the genus is unknown. It is widely spread in Western Europe from Northern Scandinavia to Spain – without, however, entering a single river communicating directly with the Mediterranean or crossing the coastline of that ancient Central European ocean which extended along the northern border of the European Alps eastward to Asia in Miocene times. Its very discontinuous range, coupled with its peculiar European distribution, and its absence from Western Asia, seem to imply that the freshwater pearl mussel found its way across the Atlantic with the sponges just referred to, at a very remote time.[109]

The freshwater molluscs of Iceland and the present distribution of woodlice tell a similar story:

> Twenty-one different kinds of land and freshwater mollusca are known from Iceland, including such well-known species as *Arianta arbustorum*. This is not likely to have been accidentally introduced, and its presence in Iceland strongly supports the idea of a former land-connection between that island and Europe. Such common European woodlice as *Porcellio scaber* and *Oniscus asellus* are liable to be unintentionally carried by man. Yet the fact that these two species are widely spread and apparently indigenous to both Europe and America, and are found not only in Iceland, but also in the Faeroes, is significant.
>
> Among the Iceland freshwater molluscs there is one which has probably been derived from a former land-connection with Greenland, *viz Succinea groenlandica*. It

is common to both countries, yet quite unknown in Europe proper.[110]

As remarked earlier, abundant molluscan and other evidence obtained from the floor of the North Atlantic indicates the geologically very late existence of a land connection between North America and western and north-western Europe, via Greenland and Iceland. *Succinea groenlandica* is an excellent example of that former reality.

This sunken North Atlantic territory which, in its time, formed much of the now-submerged lands of Appalachia and Fennoscandia (see map 1B) was also the domain, as shown below, of many 'old' (Pliocene) molluscan biota – zoological parallels of the similarly 'ancient' plant species noted previously among the scarcely-fossilised botanical evidence recorded from now-inhospitable Arctic latitudes. The freshwater character of most of these molluscs and, as noted with regard to much of the lost Euro-American flora, many of the aquatic plants, indicates that these sunken lands were well watered and enjoyed pleasant climatic conditions – conditions vastly different from those now typical of the same latitudes today, yet able to support comparatively delicate creatures like water-mites and freshwater sponges.

Near Billefjorden on Spitzbergen five north-dipping ancient shorelines contain numerous shells of the cold-water Pliocene mollusc *Astarte borealis*[111], a mollusc which also occurs profusely in the 'drift' deposits on Moel Tryfaen and at Gloppa near Oswestry, Wales[112], while a contemporary thick-shelled mollusc, *Cyrtodaria siliqua*, although known from so-called 'glacial' clays in Co Durham and Caithness, no longer thrives in Britain[113], yet still does so in Nova Scotia and several eastern states of North America.

Here, then, are instances of formerly widespread Pliocene molluscs now extinct at many of their previous European habitats but still surviving in limited areas of the New World. The significance of the survival to present times of various typical Pliocene and Miocene plants has already been noted. This, we now see, is duplicated in the zoological record.

The aforementioned Mediterranean element reappears among the 'higher' animals of the Atlantic islands. The lizards, for example, include a North African form and a South American (Chilean) form, but virtually all the burrowing (Amphisbaenid) lizards exhibit Mediterranean or African affinities, with a few also apparently having New World relationships[114]. The lizard *Thysanodactylus bilineatus* is also of interest as being common to Brazil and the island of Fernando de Noronha[115], these two localities also sharing the cricket genus *Gryllus*[116].

The present distribution of the Sirenian genus *Manatus* and of the Monk Seal *Monachus*, is also peculiar. Neither of these marine mammals frequent the open sea, yet today several known species inhabit opposite shores of the Atlantic – the West Indies, western Mediterranean and the seaboards of West Africa and eastern South America. This suggests the almost inescapable conclusion that the ancestors of these mammals spread along some ancient coastline uniting the Old and New Worlds until comparatively recent times[117].

7

Dislocated Faunas: Eurasia, Oceania and the Southern Hemisphere

Remaining with the Mediterranean element, but this time in the Mediterranean itself, we find that the land-shell *Buliminus pupa* occurs only in Algeria, Sicily, southern Italy, Greece and Asia Minor, and that a related species, *B fasciolatus,* is confined to Greece, Syria and the islands of Crete, Cyprus and Rhodes. These and practically all other species of *Buliminus* are geographically very restricted and do not survive prolonged immersion in salt-water.

Conchological researches have shown that Morocco and southern Spain were also physically united in the recent past and that land-shells typical of those on Sicily also thrive in the Tetuan Mountains just south of the Strait of Gibraltar[118]. Further east, a whole assemblage of plants and animals was found by the French savant Blanchard to be common to Tunisia and Sicily[119].

Among the near-endless ranks of beetles, no less than 12 species of *Hopatroides* flourish in Greece and Asia Minor, and one *H thoracicus* in Andalusia, Spain. Similarly, the related form *Amphicoma* is represented by 15 species in western Asia and the Balkans, and by three others peculiar to north-west Africa and southern Spain[120].

Lepidopterists will know that Asia Minor hosts two of the three European species of the butterfly *Thais,* and that *T cerisyi* inhabits some of the Greek islands as well as the Greek mainland and Turkey. In Europe, Greece and southern Italy are the only habitats of the magnificent butterfly *Danais chrysippus* which, however, is well known from Syria, Persia and the whole of southern Asia. Interestingly three species also occur in North America.

Although at least 32 species of *Bacillus,* a genus to which the stick-insects belong, are scattered across southern Asia, Africa, Australasia and the Sandwich Islands, four additional species known from southern Europe also range into northern Africa[121]. This distributional pattern closely resembles that of *Rhax* and *Galeodus,* two spider-like genera occupying southern Europe, North Africa and western Asia[122].

Crustaceans also furnish analogous details, the freshwater crab *Thelphusa fluviatilis* being a case in point. Although other species of it occur as far south as Madagascar and the Cape of Good Hope and as far east as Australia, *T fluviatilis* thrives in southern Spain, North Africa, Sicily, southern Italy, Greece, Cyprus, Turkey, Syria, and Persia[123].

Another freshwater crustacean, the crayfish *Hemicaridina desmaresti,* inhabits Spain, Corsica, Sardinia, Sicily and Asia Minor, while the subterranean shrimp *Typhlocaris* "is represented by three isolated species around the Mediterranean". Certain other shrimp genera typical of tropical *land-locked* salt-water pools enjoy even more exotic geographical distribution. *Antecaridina lauensis,* for example, is known only from the Dahlak archipelago in the southern Red Sea, the island of Europa and the Fiji islands. Similarly *Ligur uvae* occurs only on Aldabra Island north-west of Madagascar, Halmahera Island in Indonesia and Fiji; while one *Hippolytid* genus has been recorded only from Cape Ras Muhammad in southernmost Sinai, Funafuti in Micronesia and Hawaii[124].

Volumes could be filled with additional 'Mediterranean' examples of similarly dispersed insects, molluscs and crustaceans, but we must pass on to consider various higher animals exhibiting similarly discontinuous distribution.

The toad *Discoglossus pictus*, for instance, lives in Spain, north-west Africa, Malta, Sicily, Sardinia and Corsica[125]. The ubiquitous tree-frog *Hyla arborea* ranges from Japan, through China, Persia, Asia Minor, southern Europe, France, Spain to North Africa and is present on Corsica, Sardinia, Sicily and on most of the larger Greek islands as well as on the Madeira and Canary islands and the Salvages. Regarding its Mediterranean distribution, Scharff remarked:

> The occurrence of the tree-frog on so many of the Mediterranean islands is of particular interest, especially as... the more minute features of the various forms can be traced from island to island, adding one more proof – if proof were needed – of their former continuity.[126].

Amphibians, of course, are as adversely affected by salt-water as land and freshwater shells, so these varieties of *Hyla arborea* must have reached their present habitats before the disruption of the landmass of which the present Mediterranean and Atlantic islands are remnants.

An impressive number of reptiles enjoy a generally comparable distribution. The worm-like lizard *Blanus cinerus*, for instance, lives in Spain, North Africa and on some of the Greek islands. Another lizard, belonging to the family *Scincidae*, thrives today on several Greek isles, as well as on Sicily, Sardinia, Spain and the Canary Islands, while the European chameleon *Chamaeleon vulgaris* occurs in southern Spain, North Africa and Sicily. Among the snakes, *Periops hippocrepis* is found only in Spain, Sardinia and Greece; the burrowing *Typhlops lumbricalis* on mainland Greece and some of its islands and in Asia Minor as far as the Caucasus Mountains; and *Eryx jaculus* on the Greek islands of Naxos and Tinos, in Turkey and across south-western Russia[127].

Eight species of amphibians and reptiles occur east and west of the Italian peninsula, and south of it in North Africa, but are absent from Italy itself. Forsyth-Major demonstrated the close affinities of the North African, Sardinian and Corsican forms. Out of a total of 21 species, 12 inhabit Italy, at least 16 North Africa and 17 Spain. From such evidence he argued that Corsica, Sardinia, Sicily and north-west Africa constitute a zoogeographical province from which Italy, except for a few west coast localities, is excluded, and that:

> The close relationship shown in the fauna of Corsica and Sardinia to Africa, permits the supposition that the connection with these islands had persisted to a *much more recent date* than with Europe (our italics).[128]

The botanical record from the same general region is strikingly similar[129].

With their great powers of flight and their seasonal migrations, particular species of birds are less easy to identify positively as truly indigenous to given geographical regions and are discussed but briefly here. Just two examples only need be considered. Of these, the fire-crested wren *Regulus ignicapillus* which very occasionally visits southern Britain, is common in Asia Minor and resident throughout the year in southern Europe. More importantly, it occurs in Sardinia, Malta and along the shores of northern Africa. Very interestingly, two related species, *R teneriffae* and *R maderensis*, inhabit the Canary and Madeira islands respectively.

Our second example, the common Goldfinch, *Carduelis elegans*, though breeding throughout Europe, except in the extreme north, is unusually abundant in southern Europe and north-west Africa and has a range extending eastwards to Persia and westwards to Madeira and the Canaries[130].

Among the mammals, it may be mentioned that scattered communities of a small race of red deer are to be found in Corsica, Sardinia and north-west Africa[131]. Fossil remains of the same deer have also been discovered in 'Pleistocene' cave-breccias – of which more shortly – on Malta[132] and Crete[133].

Natural dwarfing, apparently in response to insular conditions can, however, be achieved by some animals remarkably swiftly. Recent research[134] has demonstrated that the red deer of Jersey, Channel islands, for example, attained their present small size in just approximately 6,000 years. Several other analogous instances of rapid dwarfing among other animals have been recorded from other parts of the world[135].

The wild sheep of Asia Minor, Cyprus, Sardinia, Corsica and Tunisia, and the European Porcupine which occurs in Asia Minor, Greece and the island of Rhodes, southern Italy, Sicily, North Africa and Spain are analogous examples. Likewise, the small shrew-like *Crocidura etrusca* is found in southern France, Italy, Sicily and North Africa (and the Cretan cave-breccias); while the Black-mouthed Weasel, *Mustela boccamela*, inhabits Persia, Asia Minor, Greece, southern Italy, Sicily, and Sardinia. A closely related species, *M africanus*, flourishes in Malta and Algeria[136].

Additional instances abound of discontinuously distributed living biota in and around the Mediterranean basin, although those already cited adequately indicate the formerly very different arrangement of land and sea there.

What then was the general extent and shape of the ancient landmass which covered the present Mediterranean prior to its disruption and submergence?

During the Pliocene period – and probably in so-called early 'Pleistocene ' times too – continuous land united the present Balkan peninsula to Tunisia via southernmost Italy and Sicily[137]. Sicily itself was joined to Sardinia and Corsica and all three islands formed part of an apparently unbroken land tract stretching westward to embrace all north-west Africa, the Iberian peninsula and, perhaps, southwestern France. The Strait of Gibraltar did not exist at that time. Professor Suess christened all this land the Aegean continent[138], and Forsyth-Major referred to it as Tyrrhenia[139].

Uninterrupted land, dotted over with freshwater lakes, also united Crete and southern and eastern Greece with Asia Minor and all the land as far east, perhaps, as Afghanistan. Forests covered the Anatolian district of Turkey for at least a part of this period[140], and one or more large lakes occupied the Seistan basin of Afghanistan down to about 9,000 years BP[141]. Others also existed then in the northern portion of the Balkan peninsula. Numerous 'Pleistocene' animal remains found throughout this huge region belong to or are closely allied to forms still inhabiting South Africa. This detail implies that a land route occurred then between southwest Asia and South Africa.

The southern limits of Tyrrhenia are more conjectural although an extensive body of water, remembered traditionally as Lake Tritonis, allegedly divided the eastern and northwestern regions of Africa by occupying much of present western and central-southern Sahara; but whether any direct communication existed between it and the shallow sea due east of Tunisia, called the Pelasgian Sea[142], is unclear. Certainly there is every indication that innumerable animal and plant species freely migrated across this ancient landmass for untold ages. Extant biological evidence admits no other sensible explanation.

Like several other prehistorians and naturalists, Suess believed that Tyrrhenia foundered geologically recently – probably during early Holocene (*ie* post-glacial) times – and that ancient people witnessed it[143]. A goodly number of geologists, however, have urged that it must have been an earlier (Pliocene) event largely because many of the associated fossils represent supposedly typical Pliocene organisms. Although plausible, we have also noted that many existing plants and animals are essentially Pliocene survivors and that many 'Pleistocene' forms were too. The actual 'age' of many Tyrrhenian species, however, may be considerably younger than commonly realised. The determination of the Pliocene/Pleistocene boundary in the Mediterranean region (the site of this former vanished continent) is still uncertain and has lately been much discussed[144].

Shifting attention once more to the aforementioned sunken landmasses of Oceania and the southern hemisphere we find that:

> The presence of the wingless fly in both Kerguelen and Heard seems to show that the islands were formerly connected, which is also confirmed by the occurrence of freshwater fishes identical with species occurring in New Zealand, Tasmania and the Falklands and South America.[145]

Clearly insufficient time has elapsed for these creatures to have evolved into separate species since the break-up of the great landmass of which their present habitats were apparently once a part. It will be recalled that Ball made very similar observations about the geographically isolated Alpine flora in the northern hemisphere.

The small land-shell shaped like a pointed round tower, *Clausilia*, apparently first arose in earliest Tertiary times, yet still persists today in Ireland (two species), southern England (four species), Spain (one species), and in south-west Europe (where hundreds of different kinds thrive). Professor Boettger, who spent a lifetime studying this mollusc, recorded some 700 species of the genus and sub-divided it into several sub-genera. Many of these apparently had *no fossil ancestors*. Furthermore, almost 100 species of the sub-genus *Phaedusa* still live in India, Sri Lanka (Ceylon), the Malayan peninsula, China and Japan[146]. Today, some occupy China (*Garmieria*), East Africa (*Macroptychia*), Madeira (*Boettgeria*) and South America (*Nenia*), and are spread the length and breadth of Termier's Africo-Brazilian continent, mainland Asia and various offshore islands.

The land-shells of the Pacific islands paint a similar picture. Their close relationships indicate that in comparatively very recent times the islands they now inhabit were united as a large landmass occupying much of central Oceania[147], and which, via the Galapagos Islands, connected with north-western South America. The earthworms of these two last named regions are identical[148]. Innumerable other analogues abound in Oceania.

Niah cave in Sarawak, Kalimantan (Indonesian Borneo), contains the fossil remains of a large mammalian fauna which for the most part closely resembles that of tropical forest habitats in present-day south-east Asia. The fauna includes the Malay tapir (*Tapir indicus*) which, occurring only as a fossil in Kalimantan, Java and China, still lives in Sumatra, the Malay peninsula and Thailand. Also present is the giant pangolin (*Manis palaeojavanica*), known previously only from the supposed 'middle Pleistocene' deposits on Java, and a species of the 'ancient straight-tusked elephant' *Palaeoloxodon namadicus*, which had earlier been recorded only from similarly dated deposits in eastern Kalimantan[149]. Other fossils represent highland mammals like the lesser gymnure (*Hylomys suillus*) and the ferret-badger (*Helictis orientalis*), now living only at altitudes exceeding 2,000ft (615m).

Here, then, in Niah cave, is a 'late Pleistocene' fauna composed of forms still flourishing in the same general region or in neighbouring countries; or known elsewhere solely from allegedly 'older' deposits; or which in some cases are extinct everywhere. Animals like *Tapirus*, *Helictis* and *Hylomys*, therefore, are essentially relict genera.

The same label attaches to the Tasmanian 'wolf' (*Thylacinus*) and the Tasmanian 'devil' (*Sarcophilus*), two particularly savage marsupial carnivores that still survive on Tasmania but which, as fossils from Australia show, enjoyed a much wider distribution during the Pleistocene. Similarly, the sooty-opossum (*Phalangista*) and the brush-kangaroo (*Halmaturus*) are now found alive only on Tasmania, whereas they were formerly contemporaries of *Thylacinus* and *Sarcophilus* on mainland Australia[150]. Neither the primitive duckbilled platypus (*Ornithorhynchus*) nor the spiny anteater or Echidna (*Tachyglossus*) like salt-water, yet both are presently denizens of Tasmania and Australia[151], and the latter, with the related genus *Zaglossus*, of New Guinea also[152].

That dry land – which would have permitted unhindered colonisation by these animals – united New Guinea and northern Australia in the *very* recent past is now well-established. The evidence for it includes geologically young upraised coral terraces on the

Huon peninsula of New Guinea[153], submerged channels on the bed of the Arafura Sea cut by bygone rivers associated with now-vanished Lake Carpentaria further west on the floor of Torres Strait[154] and various hydrological changes embracing the entire Gulf of Carpentaria[155].

It can be no coincidence that, more or less synchronously with these changes, others, which among other things affected vegetation in upland New Guinea[156] and the Javan and Sumatran highlands[157], occurred across the Moluccan Sea region between Celebes, the Philippines and New Guinea itself. There, approximately 11,000–10,000 years ago, there was a sudden increase in general humidity which, among a variety of botanical changes, promoted an abrupt expansion of hitherto seemingly rare mangrove forests[158]. Such changes cast much light on the still discernible extent of the dislocation suffered then by the once-continuous faunas and floras of formerly larger Indonesian and Australian land-masses.

The experience was apparently that previously noted with regard to the break-up of the inferred dry land inhabited by the surviving molluscs of the modern West Indies.

Numerous large flightless birds in the southern hemisphere are other noteworthy relict forms. The emu (*Dromaeus*) and the cassowary (*Casuarius*) which now live in Australia, New Guinea and various Indonesian islands are unknown as fossils before so-called Pleistocene times[159], as also is the case with the flightless kiwi (*Apteryx*) of New Zealand. Conversely, enormous now extinct populations of moas and other flightless birds, including the dangerous *Harpagornis*, abounded then in New Zealand; while on Madagascar the huge *Aepyornis* or 'Elephant-bird' was similarly common. The celebrated ostrich of Africa not only formerly ranged into Eurasia but was present in Pliocene faunas[160] and, with the flightless birds of the Pacific island of Guam, is one of the few flightless birds now living north of the equator. Interestingly, the flightless rhea of the pampas is also known from South American Pliocene[161] and Pleistocene deposits.

Irrespective of the animal classes to which they belong, all the foregoing organisms represent surviving fragments of immensely more varied faunas which existed until late Pleistocene times. They are the last vestiges of faunas which have been geographically dislocated. The distribution of these creatures is discontinuous in both hemispheres and highly suggestive of the former existence of large continental land-masses across much of what are now the southern Atlantic, Indian and Pacific oceans, and central Oceania. The geologically recent disappearance of these tracts, moreover, is seemingly confirmed by the significant absence of specific differentiation among any of the survivors.

8

A VANISHED PREHISTORIC OCEAN

Northwards of ancient Tyrrhenia and south-east of Fennoscandia, during times which geologists have called Pliocene and Pleistocene, was an immense sea or ocean of great zoogeographical significance. Formed aeons before in Miocene times or earlier, its waters covered areas which today are the Rhone and Rhine valleys, northern

Germany, most of central and Arctic Europe as far as the Urals, and huge tracts of Russia at least as far east as Lake Baikal and as far south as the Black and Caspian seas. This great body of water is known as the Miocene Ocean. The draining of this ocean was a calamitous event which apparently attended extensive land elevations and the demise of the Siberian mammoths and their contemporaries. As long ago as 1866 Raphael Pumpelly discussed this vanished sea and the Russian steppe deposits as follows:

> The sea in which the great steppe deposit was precipitated was studded with islands now represented by the ridges and peaks which rise above the plains. The surface of the plains rises everywhere toward the former islands, partly because the deposit in its formation adapted itself partially to the original surfaces of the valleys it fills, and partly from its thickness being increased by the tributary detritus of the islands...
>
> The age of this extensive deposit is a question of much interest. If it is contemporaneous with the steppes and terraces of the valley system of the Orkhon and Angara, it seems probable that the sea which left this deposit over nearly all of what is now the plateau, was also contemporaneous, within certain limits, with that great body of water which, extending from the polar ocean to the Caspian, occupied all Western Siberia.
>
> The fact... that seals, identical in species, inhabit the fresh waters of the lakes Baikal and Oron... and the Caspian Sea, seems to refer to that period. The Oron lake is a tributary of the Vitim, and through this of the Lena, in which no seals occur. This circumstance points very clearly to a former water communication between these far separated localities, and to the time at which the seals of the Oron became isolated from those of the Baikal and the Caspian falls – perhaps in the same period with the emergence of the great plains of northern and western Siberia, the deposits of which are characterised by abundant remains of the mammoth as well as of *Bos urus* and *Rhinoceros tichorhinus*.
>
> The closing event in the history of the great sea that in comparatively recent times covered so large a part of Asia, extended from the pole to the Caspian and Black Seas, and from the Ural mountains to near the Great Wall of China, was the disappearance of its waters from the long trough that reaches from the shores of the Arctic sea, through the Barabinsky steppe to the Aralo-Caspian depression.
>
> It appears to me that the ancient physical geography of this vast region, and the effects of its elevation, present one of the most interesting and important fields of exploration. Whether we consider the meteorological changes that must have been brought about by the upheaval of so large an area, or the influence of this great water communication and its currents on the *distribution of existing genera*, the geological phenomena that have affected this broad belt of the great continent have, beyond doubt, had an important influence on the *recent* history of our planet.[162] (Our italics).

A similarly recent draining of this great sea has been advocated by, among others, Sjögren[163], while the Arctic affinities of some of the denizens of its remaining portions – for example the Caspian and Aral Seas – also apparently confirm this opinion[164]. The fauna still occupying the Caspian Sea includes crustaceans belonging to an otherwise exclusively marine order, the *Cumacea*. Ten species peculiar to this body of water have been enumerated, and of others that thrive there the minute pelagic copepod *Limnocalanus grimaldi* (which also occurs in the Baltic Sea and Arctic Ocean), and the marine isopod related to the common wood-louse, *Idotea entomon* (which has a similar northern distribution), deserve special mention. Two species of the shrimp-like schizpod crustacean *Mysis* – *M microphthalma* and *M caspia* – which are closely allied to the Arctic species *M oculata*, also inhabit the Caspian[165].

Scharff has noted that several kinds of Caspian fish appear to be descended from typical *marine* forms, and that the presence there of seals of the species *Phoca caspica*: "...indicate that at no very distant date – at any rate since

Pliocene times – a closer connection with the Arctic Ocean existed than at present"[166].

Broadly speaking, therefore, the present Caspian fauna is a relict marine one, very much like those of lakes Onega and Ladoga in European Russia, and like others in Finland and Sweden.

Recent Russian studies have not only confirmed but amplified these details and the climatic conditions under which they developed[167].

That the Caspian Sea once extended to the Aral and Black seas, and that all three are vestiges of that ancient Miocene Ocean which bathed the northern shore of the old Tyrrhenian continent has long been established. Certainly the sediments deposited by this huge body of water are traceable for immense distances. They reach at least as far north as the River Kama in Central Russia, where Karpinski[168] and others have studied them, and they have been explored in the Yenisei valley where they contain sub-fossil *marine* shells[169].

Closely similar shells have been recorded from the same sediments approximately 1,500 miles (1,920km) to the west[170], a matter of considerable palaeogeographic importance, as many earlier authorities favoured a water channel between the Miocene Ocean and the polar sea east of the Urals. These discoveries, however, indicated that, during the period in question, a great bay or gulf existed west of the Urals and penetrated at least as far north as the White Sea. From such details, Dawkins correctly deduced that before 'glacial' times: "...the sea had already rolled through the low country of Russia, from the Caspian to the White Sea and the Baltic, and formed a barrier to western migration to the Arctic mammals of Asia"[171]. Map 2A shows the probable disposition of land and sea in Eurasia at that time.

9
MEDITERRANEAN GRAVEYARDS

Attending as it did the break-up of much of Tyrrhenia and the elevation to their present heights of all the major European and Asiatic ranges, the draining of the old Miocene Ocean was sudden, violent and catastrophic. The displacement of its waters, in fact, constituted a disaster of the first magnitude. In few regions are the effects of this displacement more riveting than at various places around the present Mediterranean basin. Especially remarkable are the caves and fissures.

After exploring the Sicilian cave of Maccagnone, Dr Hugh Falconer reported:

> ...the cavern had been filled right to the roof, the uppermost layer consisting of a concrete of shells, bone-splinters, with burnt clay, flint-chips, bits of charcoal and hyaena coprolites, which was cemented to the roof by stalagmatic infiltration... of contemporaneous origin... A great physical alteration... occurred to the conditions previously existing, emptying out the whole of the loose, incoherent contents, and leaving only... portions agglutinated to the roof. The wreck of these ejecta being visible in the patches of *ceneri impastati*, containing fossil bones, below the mouth of the cavern.[172]

Elsewhere in Sicily, in the hills around Palermo, veritable hecatombs of hippopotamus bones have been found. As much as:

> Twenty tons of these bones were shipped from around the... cave of San Ciro, near

> Palermo, within the first six months of exploiting them, and they were so fresh that they were sent to Marseilles to furnish animal charcoal for use in sugar factories... The bones were those of animals of all ages down to the foetus, nor do they show traces of weathering or exposure.[173]

The freshness of these bones and the presence of very young individuals shows that some sudden and geologically recent cataclysm was responsible for their accumulation. In Prestwich's opinion the causative agent was an immense flood which, at its nadir, submerged the British Isles, the whole of Central Europe and the Mediterranean islands of Corsica, Sardinia, Sicily and Malta. Reconstructing the event, Prestwich wrote:

> The animals in the plains of Palermo naturally retreated, as the waters advanced, deeper into the amphitheatre of hills until they found themselves embayed... the animals must have thronged together in vast multitudes, crushing into more accessible caves and swarming over the ground at their entrance, until overtaken by the waters and destroyed... Rocky debris and large blocks from the sides of the hills were hurled down by the current of water, crushing and smashing the bones.[174]

Prestwich also added that it was: "...impossible to account for the... phenomena ...by any agency of which our time has offered us experience... The agency, whatever it was, must have acted with sufficient violence to smash the bones"[175].

Among the animals found at Maccagnone were hyaena, lion, a large bear and the ancient straight-tusked elephant (*Palaeoloxodon antiquus*). These flourished alongside the aforementioned hippopotami, one of which (*Hippopotamus pentlandi*) was a dwarf form also known from coeval deposits on Malta, Crete, mainland Greece, Cyprus and in the cave of Santa Teresa near Spezzia in northern Italy[176].

Abundant remains of full-sized hippopotami have also been discovered in other Sicilian caves and rock-fissures[177], habitats hippopotami now seldom frequent. Their occurrence in caves and fissures, frequently too small to accommodate even one individual, is mystifying until it is realised that these animals did not live where their bones now repose but were transported *en masse* to these sites from more distant localities.

Also of much interest was the discovery in a cavern at Luparello, near Palermo, of the bones of a dwarf species of *Palaeoloxodon, P mnaidriensis*[178], a form better known from specimens found on Malta[179].

The old torrent bed of Benghisa on Malta abounds in breccia-filled fissures. Excavated last century these produced irrefrangible evidence that the breccias and the innumerable bones they contained had been deposited under exceptionally violent conditions.

> Among the large blocks of fresstone, either impacted or strewn in a heterogeneous manner, were lying seemingly entire skeletons of elephants, some of the skulls and jaws furnishing good evidence of the rough usage they had sustained by being broken and crushed flat by blocks which, with the force of impact, had cracked the others on which they impinged. These conditions were beautifully illustrated in the cases of thigh and pelvis bones, which had been smashed to pieces by blocks falling on them... Entire skeletons of the dormice (of a gigantic extinct genus) were found between blocks as if their bodies had sunk into the hollows as they floated past, whilst fragments of large birds' bones and traces of a huge fresh-water turtle, and several vertebrae and skulls of lizards, as large as a chamaelon, were found in conjunction with... land-shells... the appearance presented by this remarkable collection of organic remains seems... to indicate that water at one time flowed down the gap, and was subject to occasional extraordinary deluges which bore down the large blocks and whatever exuviae came within reach[180].

Dolomieu, an early observer, concluded that a great wave had passed over Malta, overwhelmed its animal denizens and washed off all its superficial soil (which accounted for the island's bare aspect)[181]. Admiral Spratt later reached similar conclusions[182]. Like the Sicilian bones, the tortoise and turtle remains found in these fissures appear to have been conveyed thence from some other unidentified locality by a large body of water which: "...at one time overflowed the greater portion of the eastern half of the island"[183].

Dr Leith Adams concluded that this deluge proceeded from a northern direction[184], that it had cast whole carcasses into the fissure at Mnaidra, and that, due to the exceptional freshness of their bones, many animals had been entombed in the flesh, albeit in dismembered condition[185]. This applied particularly to the remains of pygmy elephants which, as with the Sicilian hippopotami, represented individuals of every age from infant to adult[186]:

> In a little crevice in the eastern wall of the Mnaidra Gap in Malta not three feet either way, among enormous quantities of fossil land-shells, lay the two detached lower jaw bones of possibly the smallest of the two pygmy elephants, and under them portions of the spinal column with *ribs in situ*... The finding of fragments of pubic bones, and of vertebrae in their *natural order of succession*, and in a *linear direction*, shows clearly that there must have been several of the elephants introduced in the flesh.[187] [Our italics].

As previously seen, similar dismemberment characterised many of the coeval faunas now occupying the Alaskan 'muck' beds and we shall encounter them again sporadically over huge areas of Eurasia, North and South America and Australasia. These animals were not dismembered by natural predators, but by something acting just before or during their burial on quite literally a hemispheric scale.

Significantly, pygmy elephants, which appear to have been so prominent in the land fauna of the Tyrrhenian landmass, today only exist in the Congo basin. Similarly, the only living pygmy hippopotamus, *Hippopotamus liberiensis*, is now confined to West Africa.

The aforementioned gigantic dormice of Malta tell a parallel story. Adams observed that:

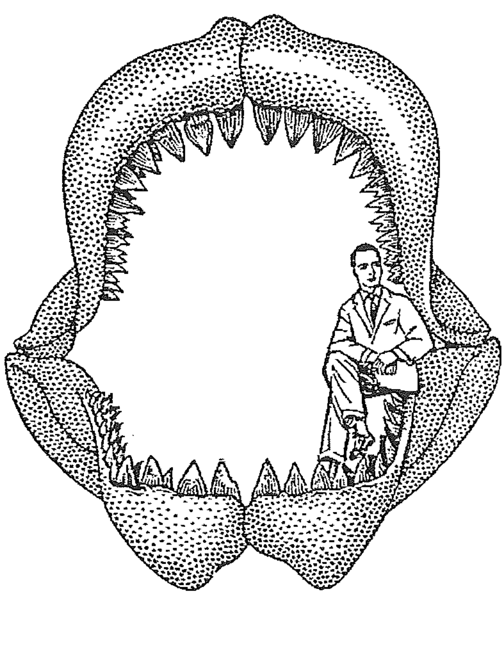
> ...their wholesale destruction at all ages of their existence, from the new-born to the aged (was clearly synchronous with) the wholesale destruction of the pachyderms... The rationale of finding such vast quantities of dormice and bird's bones, either... in fragmentary states or... entire, along with uninjured bones of elephants, or below or between blocks of stone in the old torrent-bed of Benghisa, together with their presence in almost every similar ossiferous deposit in the islands, seems to me conclusive that they cannot be accepted as representing the usual casuals from natural decay, but when taken in conjunction with what has been previously stated, they afford very strong circumstantial evidence that the extinction of the land fauna of the period was brought about by changes in the physical geography of the area...[188].

Excavations conducted a few years later by A A Caruana in the Maltese fissure of Is-Shantün revealed similar indiscriminate exterminations. Many 'Pleistocene' elephant bones and molars, including one of a pygmy species, were found mixed up with numerous bird bones *and* sharks' teeth. Caruana offered the standard explanation that the shark teeth had been derived from an earlier (Miocene) deposit scoured away by massive water action[189] – marine deposits abounding at some localities with teeth like those from Is-Shantün.

Miocene sharks were the largest which ever lived, and included the monstrous *Carcharodon*, one species of which, possessing distinctive triangular teeth up to 8" long, may have had a 6–7ft wide jaw gape, and probably attained a length of 80ft[190]. Significantly, several smaller species of *Carcharodon* persisted down to late 'Pleistocene' times, and one, in effect still a 'Miocene' form, continues to do so off the eastern coast of Asia[191]. Very interestingly therefore, *non-fossilised* teeth, 5" long and larger than in any known living shark, and essentially identical to those of the Miocene species, have been dredged up from the sea-floor off Australia. They represent a shark which, according to Dr David Stead, must have been "80–90ft long"[192].

Now, while Caruana's suggested origin of the Is-Shantün shark teeth is conceivably correct, there is – because 'Miocene' sharks have survived down to our era – no longer any valid reason to regard the Is-Shantün cave specimens as necessarily older than the 'Pleistocene' deposits which yielded them – deposits accumulated at a time when, as shown above, species of *Carcharodon* certainly existed. Might it not be, therefore, that the absence of other Miocene fossils at Is-Shantün signifies that these sharks had, as living Miocene 'survivors', been swept out of the concomitantly emptying Miocene Ocean located north of Tyrrhenia and buried alongside contemporary land animals destroyed with them? In that connection it must surely be relevant that remains of great fish lie on and in the permanently-frozen Siberian deposits enclosing the debris of countless

Fig 2.2. Carcharodon shark-jaws.
Original in the Amer. Mus. Nat. Hist.



'Pleistocene' land animals, including the aforementioned refrigerated mammoth and rhinoceros carcasses, and that various rock fissures in the Jura mountains and along the north coastline of the *present* Mediterranean are filled with fossils of *Pliocene* and 'Pleistocene' *marine* organisms[193].

We have already noted that Tyrrhenia, apparently submerged at the end of 'Pleistocene' times – or even in earliest Holocene times[194]: the equivalent of Forrest's "since the Ice Age" dating for the disappearance of ancient Atlantic landmasses – was well populated by a great variety of 'Pleistocene' *and* Pliocene animals. The repeated parallelling of so many disparate details on a near-hemispheric basis within the *same* segment of time is surely not fortuitous.

Fissures in the side of a *barren*, truncated mountain, having a base a mile in circumference, situated near the village of Cérigo, on the Adriatic island of that name, contain a veritable graveyard of bones. Known locally as the 'mountain of bones', this eminence is covered from its base to its summit, both within and without, by the remains of a wide range of 'Pleistocene' animals[195]. Exactly as for the aforementioned Sicilian and Maltese evidence only aqueous action on a gigantic scale can account for such colossal bone accumulations.

Crete is another Mediterranean island in places honeycombed with limestone caves and fissures, yielding the bony remains of a large and interesting 'Pleistocene' fauna. This included rodents and pygmy elephants, from a cave near Cape Maleka, bones, horns, and teeth of antelopes and deer from a cavern on the promontory of Kutni[196], numerous rodent bones from a cave at Sphinari, and fragments of pygmy hippopotami in a hillside cave near Melato. Remains of similar animals, together with those of ruminants and a species of elephant occurred in another in the Bay of Kharoumis[197]. Widespread water action has been advocated for the extinction and burial of all these animals[198].

A very similar story unfolds in the western Mediterranean. Late 'Pleistocene' bone-breccia in caves and fissures on Corsica, Sardinia and the Balearic islands contain the fossil remains of a wide variety of animals that, in many instances, are actually typical late Tertiary (Miocene and Pliocene) forms. Indeed, when these fossils were first studied it was supposed that the breccias were likewise of Tertiary date[199], but subsequent studies of some of the rodents and molluscs disclosed their undoubted 'Pleistocene' age[200]. Once again, therefore, we find – on these islands – an ancient (Tertiary) fauna persisting down to the close of 'Pleistocene' times.

The event which submerged Tyrrhenia and choked caves and fissures on the aforenamed Mediterranean islands with animal remains also visited North Africa and the Iberian peninsula, similarly overwhelming the contemporary ('Pleistocene') fauna and flora there. Thus, remains of *Palaeoloxodon* have been found in Algeria[201], and at Tangier[202], and those of the enormous 'southern mammoth' (*Archidiskodon meridionalis*) at Mansoura[203]. Bones and teeth of hippopotami have been unearthed near Constantine and elsewhere in Algeria[204], others of the woolly rhinoceros (*Coelodonta tichorhinus*) at Chetma near Biskra[205], and those of its constant companion the hairy mammoth (*Mammuthus primigenius*) near Oran[206]. Among other Algerian fossil proboscidean remains, are some apparently of the living African elephant, *Loxodonta africanus*[207], an unexpected occurrence also parallelled in South African 'Pleistocene' deposits[208].

This Algerian 'Pleistocene' fauna also included various gazelles[209], several cervids like those known from the Corsican fissures[210], a series of bovids – including *Bos* (*Bubalus*) *antiquus* from Djelfa and Sétif[211] – and a number of horses[212]. Of the latter, one, although occurring in 'Pleistocene' deposits, strongly resembles the defunct Pliocene horse *Equus stenonis*[213], and another possesses teeth reminiscent of those of the earlier Miocene horse *Hipparion*[214]. Interestingly, *Hipparion* has been found elsewhere in undoubted late 'Pleistocene' deposits[215]. Once again, therefore, the evidence suggests the survival in north-west Africa during late 'Pleistocene' times of very ancient animal forms which had died out elsewhere, but which were there living alongside a rich variety of animals of more modern character.

North of Morocco, the 1,370ft (422m) Rock of Gibraltar is extensively fissured and displays old beach lines now some 600ft (185m) above present sea level. As Prestwich once observed, the Rock was:

> ...in Quaternary times, an island not more than 800ft, or less, high, which rose by successive stages to its present height. It is more than probable, however, that at some time before it settled at that level, the whole of the area was upheaved to such an extent that a land passage was formed to the African coast.[216]

Bones or portions thereof fill these fissures and represent:

> ...panther, lynx, caffir-cat, hyaena, wolf, bear, rhinoceros, horse, wild boar, red deer, fallow deer, ibex, ox, hare, rabbit... The bones are most likely broken into thousands of fragments – none are worn or rolled, nor any of them gnawed, though many carnivores then lived on the rock... A great and common danger, such as a great flood, alone could have driven together the animals of the plains and of the crags and caves.[217]

Captain Frederick Brome, the principal collector of these remains (which also included many species of birds) reached similar conclusions:

> The scattered, broken state of everything found, together with the fact that the objects were almost invariably discovered near and under the sides of the cavern and passages, appears to me to indicate that these appearances would only have been caused by some convulsion accompanied by flood[218].

Nor were the bones rolled or water-worn, and very few showed signs of having been gnawed. They looked, in fact, singularly fresh despite their splintered condition with-

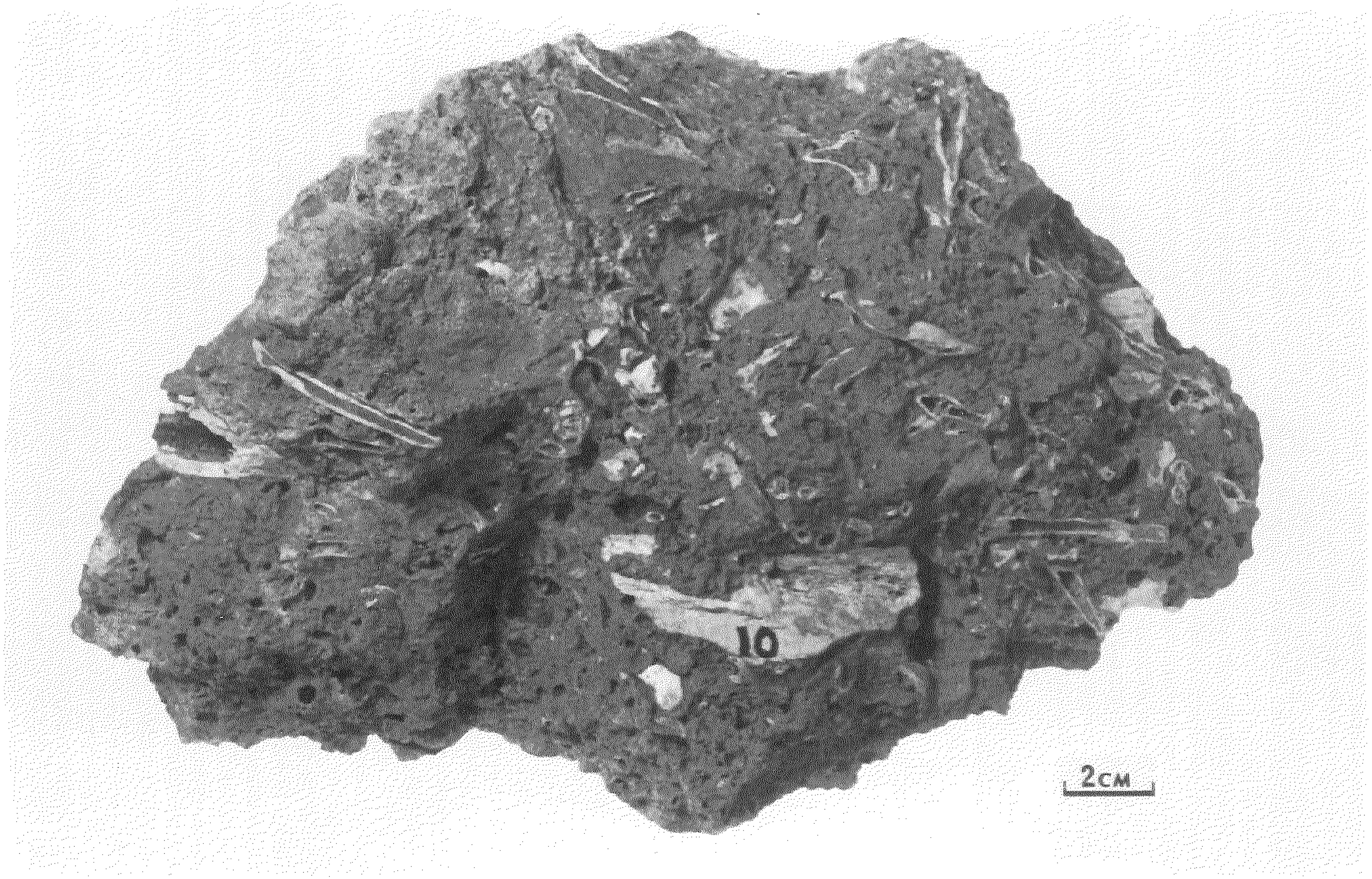


Fig 2.3. A rare photograph of bone breccia from Genista Cave, Gibraltar. Scattered fragments of bone can easily be seen embedded in the reddish-grey breccia. Although numerous descriptions have been published of various 'Pleistocene' animals from bone-breccias in-filling caves and rock-fissures, exceedingly few illustrations of the actual breccias have ever appeared. *Courtesy of Salisbury and South Wiltshire Museum.*

in the breccia[219]. Significantly, land and *marine* shells occurred at all depths down to 290ft (89m) below the surface in one of the fissures (Genista no:1), which also yielded pieces of *coral*[220]. Tons of bones were retrieved from these fissures, but were afterwards largely dispersed and lost to science[221].

Although a few of the originally excavated pieces of bone breccia from Gibraltar have survived, a handful of examples may yet be examined in the Natural History Museum in London and the geological collections at Salisbury, England, and confirm the reported freshness of the remains embedded in them. Later excavations of other Gibraltar caves by, amongst others, D A E Garrod, A Craven Greenwood, R Wilson and J Waechter testify to the consistently unrolled and fresh appearance of the bones from all the caves explored, and the general accuracy of the above-cited observations of Prof Prestwich and Captain Brome – that is, diluvial not glacial action produced these accumulations.

10
SUBTERRRANEAN CHARNELHOUSES

Approximately 11,500 years ago the shattered remains of countless 'Pleistocene' (Ice Age) animals (*sensu lato*) and plants were deposited both north and south of the equator, in limestone caves and rock-fissures like those just reviewed. Usually featuring several chambers, these caves, via narrow fissure-like tortuous passages, often penetrate solid rock for horizontal and vertical distances sometimes exceeding several hundred feet, are intersected by separate fissure systems (fig 2.4), and are globally very numerous.

Most of the remains retrieved from these apertures have been deposited in great confusion, with normally incompatible kinds of animals lying in unnaturally close juxtaposition. Often accompanying these organic masses are both rounded and angular stones of dissimilar composition and, less frequently, sizable boulders. All these objects are usually enveloped and united by consolidated muds, earths or hard breccias, although at Mont de la Molière near Estavayer in Switzerland, at Kropp in Carniola and elsewhere, they are directly associated with iron-ore deposits[222]. In another case a nearly-complete rhinoceros skeleton has been found lying *in a vein of lead* at Dreamy Hole, Derbyshire, England[223].

In effect, these sites amount to underground charnelhouses, and, as previously noted around the Mediterranean basin, their testimony is important.

As present space limitations prevent reference to more than a tiny fraction of the total number of known sites, a small selection of typical Old and New World examples must accordingly suffice.

Bone-caves have been explored for well over 200 years, among the earliest British examples being a series of three at Oreston near Plymouth. The first of these, opened in 1812, contained numerous much broken but unabraded rhinoceros bones. The second, a smaller affair discovered in 1820, yielded mixed rhinoceros, bear and deer bones, while the third, excavated in 1822, was considerably larger and contained, in addition to still more rhinoceros remains, huge numbers of bones representing a wide range of other coeval mammals[224].

Table 2B compares the Oreston animals with those found a few years later in similar deposits in Ash Hole cave at Berry Head, in Brixham Cave and in Kent's Cavern, Torquay,

Table 2B
Animals found in cave-deposits, Devon, England

Scientific name	Common name	Oreston	Ash Hole Berry Head	Brixham Cave	Kent's Cave Torquay
Mammuthus primigenius	Hairy mammoth	X		X	X
Coelodonta tichorhinus	Wooly rhinoceros	X			X
'Rhinoceros' sp.				X	
Machairodus latidens	Saber-toothed tiger				X
Panthera spelaea	Cave lion	X		X	X
Ursus priscus	Brown bear	X	X		
Ursus cultridens	Bear				X
Ursus spelaeus	Cave bear	X		X	X
Hyaena spelaea	Cave hyaena	X		X	X
Canis lupus	Wolf	X			X
Vulpes vulpes	Fox	X			X
Felis catus	Wild cat				X
Putorius vulgaris	Polecat		X		
Putorius ermineus	Stoat	?X	X		X
Lagomys spelaea	Cave pika				X
Sorex vulgaris	Shrew				X
Meles taxus	Badger		X		X
Arvicola amphibia	Water vole	?X	X	X	X
Arvicola agrestris	Field vole				X
Arvicola pratensis	Bank vole				X
Mus musculus	Mouse	?X		X	
Rhinolophus ferrum-equinum	Great horseshoe bat				X
Sus scrofa	Hog	X			
Capra sp. or Ovis sp.	Goat or sheep	X			
Rangifer tarandus	Reindeer	?X	X	X	X
Cervus elaphus	Red deer				X
Megaceros hibernicus	Giant Irish deer	X			X
Strongyloceros spelaeus	Round-antlered cave deer				X
Cervids (various indeterminate species)	Deer (various forms)	X		X	X
Lepus variabilis	Norway Hare				X
Lepus cuniculus	Rabbit		X		X
Hippopotamus major	African hippopotamus				X
Bos primigenius	Auroch	X		X	
Bison minor	Small bison	X			
Equus fossilis	} Horses	X		X	X
Equus plicidens		X			
Asinus fossilis	Large ass or Zebra	X			

(after Buckland, Busk, Pengelly, Hodge, Boyd-Dawkins, and others)

England. The lists provide a good basis for comparison with analogous cave discoveries elsewhere.

Like those from the aforementioned Sicilian and Maltese sites, these South Devon remains, and especially those from Kent's Cavern, had:

> ...suffered considerably from pressure, after having first undergone violence from the force which impelled and congregated them in this narrow creek. They were found driven into the interstices of the opposite wall, or piled in the greatest confusion against its side[225].

As in the Mediterranean region, these British sites revealed young and old animals of many normally incompatible species entombed together, no single individual being preserved entire and the majority in an exceedingly fragmented condition. Many bones have also been found jammed into the *furthest* recesses of these caves, which sometimes occur several hundred feet from the cave's entrance.

Other British bone-caves and fissures of note occur on the Isle of Portland in Dorset[226]; Durdham Down near Bristol; in the Mendip Hills, Somerset[227]; at Cresswell Crags[228] and Windy Knoll[229], both in Derbyshire; at the south end of Kirkdale, Yorkshire[230]; on the Gower peninsula[231], Caldy Island and around Tenby in south Wales[232]; and the Vale of Clwyd, north Wales, where great accumulations of red clay invaded the cave at Cefn so forcefully that it ploughed up its original floor[233]. The bones in this cave belonged to mixed 'northern' and 'southern' animals – the 'northern' forms being represented by the bison, reindeer, and woolly rhinoceros and the 'southern' species by the ancient straight-tusked elephant (*Palaeoloxodon antiquus*), the round-nosed rhinoceros (*Dicerorhinus hemitoechus*), and *Hippopotamus major*[234].

It is unquestionably significant that one of the foremost investigators of the Cefn caves concluded that, during the 'drift' epoch, they had been *submerged*[235]. A *marine* invasion has been postulated to explain a similarly disturbed cave floor at Cae Gwyn near Denbigh[236]. Even in Eire analogous discoveries have occurred, the relevant phenomena again being attributed to water action[237].

Virtually indistinguishable from their British counterparts, numerous bone-caves, fissures and ossiferous breccias occur in continental Europe, being especially well developed in the limestone districts of France and Germany. Some, like the cave at Gailenreuth near Bayreuth (fig 2.4), have become internationally famous. Indeed, first explored in the late eighteenth century, Gailenreuth cavern was the earliest to be studied scientifically[238] and it became the standard by which all later similar cave discoveries were compared. Buckland's splendidly graphic description of this cave and its contents[239] clearly indicates that water, operating violently and tempestuously, had carried all the remains into the cavern and deposited them irregularly. Buckland's reference to the congeries of 'agglutinated' bones is especially noteworthy, as duplicated effects have sometimes been encountered in bone-caves elsewhere.

Other important German bone-caves occur at Köstritz[240], Kühloch[241], and in the Hartz Mountains (Biels' Höhle and Bauman's Höhle)[242], where the results of former powerful water action are again evident.

Of the many known French bone-caves and fissures, the 1430 foot (440m) high 'Montagne de Genay', located north-west of Semur in Burgundy, is a particularly striking example, the deposition of its bone-breccia capping being, in Prestwich's opinion, "an act of short duration"[243]. Other noteworthy French bone-fissures occur at Pédémar and Santenay. From the latter, various remains of lion, bear, wolf, fox, giant ox or bison, horse, lynx, *Rhinoceros merckii* and *'Cervus' elaphus var canadensis* have been recorded lying in the wildest disorder[244]. In this assemblage of mixed 'northern' and 'southern' animals, the horses were exceptionally large and the wolves unusually abundant[245]. The presence of the Canadian species of deer, known too from several other west European sites, is also interesting.

Bone-caves and fissures in the French maritime departments of Aude and Gard[246] have yielded analogous evidence, as have those located in the escarpments bordering the Rhone valley from Doubs in the north[247] to Montpellier in the south[248]. The animals found at these sites include species present in the cave-breccias of Gibraltar and the railway cuttings at Mentone, Baoussé-Roussé, and near Antibes, dug in 1870[249].

At Nice, fissure deposits contained remains of yet extant land-shell, lizard, snake and tortoise species, and the bones of hairy mammoths, woolly rhinoceroses and extinct bears[250]. Other caves and fissures on the famed Côte d'Azur have yielded mixed terrestrial and marine organic debris. One such was Vallonet cave at Roquebrune-Cap-Martin, between Monaco and the Italian border, where bones of lions, rhinoceroses, hyaenas, macaco monkeys, elephants and, most significantly, whales came to light[251]. Whales and remains of marine creatures do not get into caves and fissures unless washed into them by masses of water.

Italy continues the story, for bone-fissures and caverns in the hills of Piedmont, Liguria[252] and Tuscany, have disgorged a fauna: "...not distinguishable from that of Gibraltar"[253], while generally similar occurrences of land-shells and animal bones abound in breccias at Verona, Vicenza, and other places in the southern foothills of the Italian dolomites[254].

In neighbouring Croatia, bone-caves in the Julian Alps[255], around Trieste[256], in the Pivka basin (Slovenia)[257], and along the Dalmatian coast[258], have yielded a variety of 'late Pleistocene' mammals of considerable interest. Thus, in a cave near Crni Kal, remains of the comparatively rare *Dicerorhinus kirchergensis* have been found[259], while Vjetrenica cave has produced bones of the leopard[260]. Eastwards in Croatia, the mountain of Ischuber features a breccia containing numerous bones of bears[261], contemporaries of other 'Pleistocene' cave-bears and lions found in the cave earths of inland Bosnia and Herzegovina[262].

Cave-bear remains also abound in several ossiferous caverns at Peggau, near Graz, in Austrian Styria[263]. The faunas from these and other Austrian bone-breccias[264] compare well with those from fissures penetrating limestone strata to depths of 720ft (221.5m) or more *below* ground level in Carniola, where bones of cave-bears and other mammalian carnivores were found to predominate[265].

The celebrated Dragon's Caves near Mixnitz, Austria[266], various Bohemian (Czech) bone-caves[267], and others in the Tatra Mountains near the Polish border[268], have yielded many coeval animal bones, while in Poland itself, a notable assemblage of 'late Pleistocene' rodents has been found in a cave at Nietoperzowa[269].

Completing our brief survey of this remarkably abundant European evidence, we should mention that in the Zakarpat district of Belarus, close to the Slovakian border, remains of a hairy mammoth, cave-bear, hyaena and other 'late Pleistocene' animals have been discovered in the bone-caves of Charitch, and that the cave-breccias in the Zhiguli Mountains near Kybyshev contain a profusion of comparably-aged bird and mammal bones[270]. Yet other breccia- and bone-filled caverns occur in the western foothills of the Ural Mountains resemble the examples just mentioned.

In continental Asia, shells and bones of elk, bison, and other 'northern' animals occur profusely in breccias occupying caves and fissures near Beirut, Lebanon[271], while remains of late 'Pleistocene' elephants, the woolly rhinoceros and *Bubalus* (the Indian water-buffalo), mixed with those of 'southern' animals, have been found in the cave of Ksar'Akil, Syria[272]. What these supposed 'northern' species were doing so far south has never been properly explained. The fact that allegedly 'northern' forms – bison, bear and a very large feline – have been found even further south in Israel[273], merely emphasises the error of the usual interpretation that these mammals were Arctic animals.

Immense quantities of 'Pleistocene' animal bones closely resembling those from aforementioned European caverns and fissures have been excavated from numerous bone-caves in the Altai mountains of central Asia. They include such interesting forms as mastodon, giant camel, gazelle, saiga antelope, giant beaver and ostrich[274], and are reminiscent of others from parts of inland China and Korea, which are riddled with fissures and caverns closely packed with shell and animal remains analogous to those we have just discussed.

Close to the village of Choukoutien, near Peking, a series of interrelated bone-caves and fissures discovered earlier this century has yielded information of great scientific importance. They contained some surprising anomalies, whereby typically 'late Pleistocene' animals occurred in the *lower* beds alongside representatives of 'old' faunas, while the reverse situation was sometimes met with in the upper beds. Moreover, in almost all instances and irrespective of whether they belong to 'old' or 'newer' types of animals, the bones were unabraded and looked amazingly fresh.

Among the animals found were a great variety of rodents, a porcupine, at least two species of hyaena, the wolf, fox and *Cyon*, a very large sabre-toothed cat, tiger, leopard, and other felines, brown bear, cave-bear, two-horned rhinoceros, woolly rhinoceros, big-horned sheep, an animal allied to the musk-ox (*Boopsis sinensis*), the pig, hare, deer, a horse, a camel, several kinds of bovids (including *Bubalus*), *Cynailurus*, a large elephant like *Palaeoloxodon antiquus*, the baboon, the ostrich, and a species of tortoise[275].

Viewed collectively, these animals reflect an extraordinary range of habitats and climatic conditions, and resemble the mixed faunal assemblages noted all over Europe. Thus, there were animals typical of jungles or warm-moist climates, of tundras or cold-wet climates, of prairies and steppes or dry-temperate climates, and of semi-desert or hot-dry climates.

At least one cave at Choukoutien contained a puzzlingly high number of *complete* skeletons of normally incompatible animals – hyaena, horse, tiger, *Cynailurus*, red deer, *Viverra*, and so on[276]. These suggested that, like some of their European contemporaries, these particular individuals were interred in the flesh.

One of the most unexpected discoveries at Choukoutien concerned the fractured remains of seven human beings squeezed into a fissure or narrow cave. Representing European, Melanesian and Eskimo racial types these aroused immediate interest[277]. Initially, it was assumed that these individuals had been murdered aeons before, as their skulls were badly smashed. This, however, begged the question of how or why such diverse racial types congregated simultaneously (demonstrated by the close juxtaposition of their skeletons) at a locality now far removed from their respective habitats, or came to lie in deposits enveloping similarly diverse animals.

If, however, tumultuous water-action was the entombing agent, then these faunally and climatically incompatible animals and humans, and the suspected complete carcasses, amount to oriental analogues of those ascribed to an identical cause in Europe and the Mediterranean basin.

Finds in a limestone cave near Reijo, Korea have included late 'Pleistocene' rhinoceros and horse remains of exceptional size[278], like those previously noted in the Santenay cave breccia. Interestingly, similar *very* large horse bones have been discovered in North American 'drift' deposits too.

> Evidence clearly echoing all this has come to light in various Australian caves. Ice-sheets like those advocated by orthodox glaciologists were, of course, conspicuously absent from Australia, so this evidence is especially significant. It occurs, for example: ...in caverns... at Wellington; at Boree; near the head of the Colo river; at Yesseba, on the Macleay river; at the head of the Coodradigbee; not far from the head of the Bogan, and in other places.[279]

Commenting on the Wellington valley bones, Lang observed:

> Frequently these occur so fixed between large rocks that it is quite impossible to get them out; and indeed, in general, none can be got in an entire state from the matrix, being in their embedded state full of fractures; ...the bones were in... abundance, and generally upright... the animals that owned these bones could not have died a natural death, for most of them have evidently been subjected to great violence, and exhibit fractures in every direction.[280]

A contemporary authority stressed the singular mode of burial of these remains thus:

> They are not found in any regular position, such as would be imagined had their owners lived and died where their remains now lie. Heads, jaw-bones, teeth, ribs, and femurs are all jumbled and concreted together without reference to parts. The quantity of small animals it must have taken to form a deep deposit of their bones, perhaps two feet deep, ten wide, and of indeterminate length, must have been something prodigious, for they are compressed into the smallest possible space and must have decomposed from exposure... No entire skeleton has been discovered, and very rarely were any two bones of the same animal found together. On the other hand... from the nearly natural position of the smaller bones in the foot of a *Dasyurus*, it can scarcely be doubted that this part of the skeleton was embedded in the cement when the ligaments still bound the bones together. The united radius and ulna of a kangaroo are additional evidence of the same kind; and yet, if the bones had been so separated and dispersed and broken into minute fragments, as they now appear in this breccia, while they were still bound together by ligaments, it is *difficult to imagine how that could take place under any natural process with which we are acquainted...* the best specimens of single bones have been found wedged between huge rocks, where the breccia is found like mortar between them, in situations eight or ten fathoms underground.[281] [Our italics].

Here, then, in these Australian caves we find precisely the same scenario as exists in the Eurasian equivalents – namely, that countless assorted animals (including some apparently dismembered while still in the flesh) were entombed chaotically and violently and crowded unnaturally into small rock cavities and crevices; the principal difference being that the Australian animals are not envisaged as 'northern' or Arctic species, whereas their European counterparts commonly are, and their burial attributed to ice-action.

Also noteworthy are the great depths at which some Australian finds have occurred. These rival many recorded from Europe. Thus, in bone-caves at Coodradigbee, emu remains were discovered over 200ft (61.5m) below ground level[282]. In Australia the burial of remains at such depths is surely consistent only with tumultuous water-action on a huge scale. The 'agglutinated' condition of numerous bones in rock-crevices and bone-caves around Chudleigh, Tasmania[283], suggests a similar causal agent, as in fact do the enormous accumulations of extraordinarily fresh-looking moa remains in various New Zealand caves, at several of which (*eg* Earnsclough, Otago and Manuhirikia), moreover, specimens have been found with sinews, muscles and dried flesh still attached[284].

Essentially identical evidence has been reported from South America. Numerous limestone caverns scattered across the Brazilian states of Sao Paulo, Minas Geraes, Goyaz and Bahia have yielded rich harvests of organic remains comparable to those mentioned on preceding pages. Of these, the extensive series of caves and deep fissures between the Rio das Velhas and the Rio Paraopeba in Minas Geraes state have yielded evidence of much importance. Staggering quantities of bones filled these apertures, but usually in such broken condition and so promiscuously that complete skeletons were extreme rarities. Near Caxoeira do Campo, for instance, is a cave some 120ft (36.9m) long, 6–9ft (1.8–2.7m) wide and 30–40ft (9–12m) high. From this the excavator Lund procured half a cubic foot of red earth packed with minute bones. Of all the half under-jaws detectable in it, 400 belonged to small opossums and the remainder to no less than 2,000 different kinds of mice, bats, porcupines and small birds. It should be stressed that Lund counted *only* under-jaws; numberless other small bones in the sample remained uncounted. Elsewhere, Lund excavated the whole of the clay floor of a 24ft (7.3m) long cavern at the Fazenda do Escravimia. The clay filled 6,552 firkins[285]. Lund again counted all the half under-jaws in a measured sample of this clay and, on the assumption that similar jaws were spread fairly uniformly throughout the remainder of it, concluded that the remains of *not less* than 6,881,500 individuals of opossums, mice, cavias and porcupines lay entombed within it. Even if this calculated total was exaggerated by as much as six times reality, a prodigious total of approximately 1,000,000 still results! In *addition to these* were immense numbers of uncounted bones of small birds, lizards, frogs and other diminutive creatures.

Among the more interesting larger animals found by Lund were the *Megatherium, Mylodon, Toxodon, Macrauchenia*, the giant armadillo *Hopolophorus*, an enormous rodent related to the modern *Capybara*, the extinct jaguar *Smilodon neogaeus, Chlamydotherium*, the defunct monkey *Protopithecus*, a mastodon and the flightless emu and rhea. It should be noted that mastodon remains seldom occur in caverns, being more usually discovered in fissures or natural hollows or pits underlying superficial deposits.

Several caves explored by Lund around the margin of Lagoa do Sumidouro, near Santa Lucia, contained human bones mingled with those of the extinct cave jaguar, a huge *Capybara*, and others belonging to horses and llamas[286]. One cave was especially noteworthy for yielding the bones of over fifty human beings of both sexes and every age from infant to decrepit old man. Their skeletons lay buried in hard clay and were discovered mixed together in such confusion – not only with each other but with *Megatherium* bones and those of other late 'Pleistocene' animals – as to preclude the idea that they had been buried by human agency. All the remains, both animal and human, possessed the same chemical composition, thereby indicating the contemporaneity of all the individuals represented[287]. Interestingly, the skulls of these ancient humans were *dolichocephalic* (or long-headed), a character which, according to Prof Scott-Elliott[288] and many other anthropologists, was distinctive of the 'old' European Neanderthal race, formerly thought to have been ancestral to modern humans (*Homo Sapiens*) and to have become extinct about 25,000 years ago.

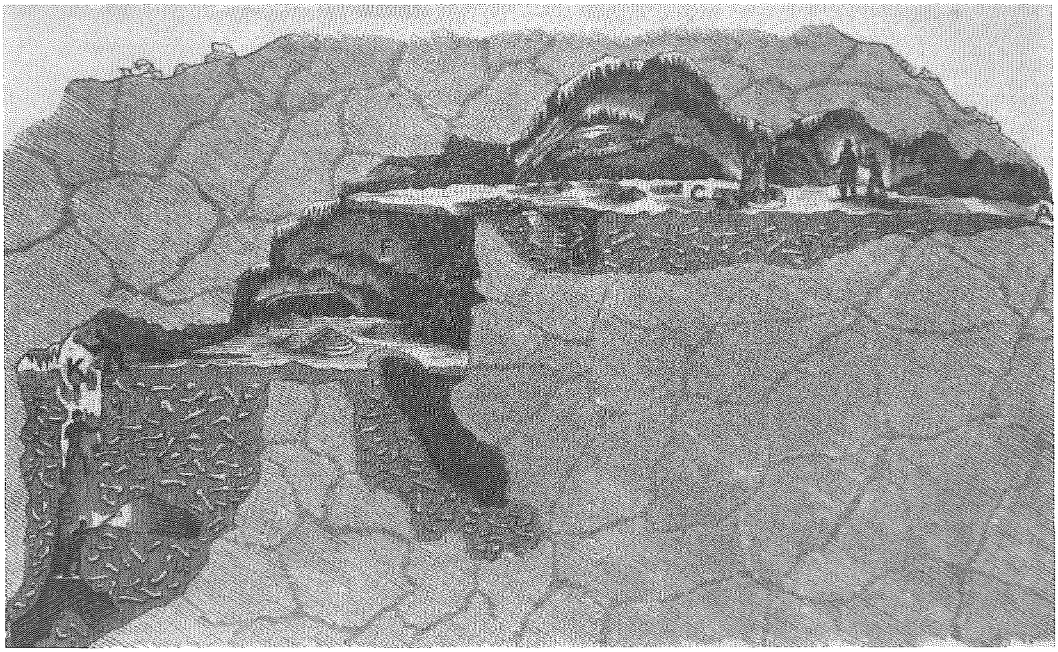
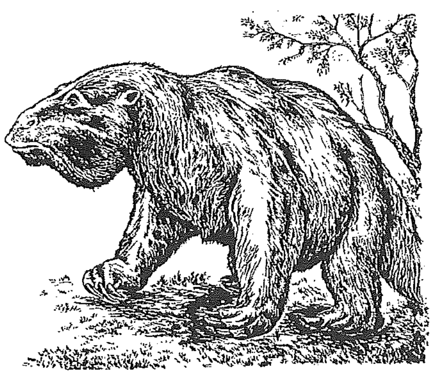
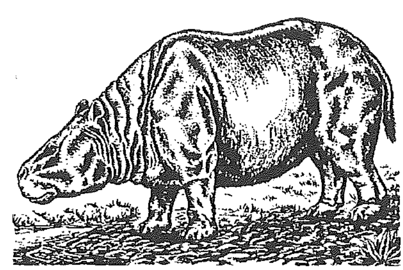


Fig 2.4. Vertical section of the cave at Gailenreuth, near Bayreuth, Franconia.



Left: Fig 2.5a. Megatherium. The largest of the ground-sloths, about 20ft (6m) long. Common in both North and South America. A smaller North American contemporary was the Mylodon.



Above: Fig 2.5b. Toxodon, a regular companion of Megatherium in South America, stood over 4ft (1.3m) high at the shoulders.

Left: Fig 2.5c. Glyptodon. A giant armadillo, some 9ft (2.7m) long. Known from both North and South America.

Fig 2.5abc. Some prominent 'late Pleistocene' animals of North America. *Illustrations from "The Fossil Book" by Carroll Lane Fenton and Mildred Adams Fenton, reprinted by permission of Doubleday & Co, Inc.*

Both these premises have proved to be fallacious. The lineage of Neanderthal Man is now known to have differed from that of *Homo Sapiens* – not being ancestral to modern humans[289], and that this race is now known to have survived in at least the Levant until Middle Palaeolithic times, or approximately 10,000 year ago[290]. The Neanderthals lived in organised communities, which would account for so many differently-aged individuals in the Lagoa Santa cave remains, although they also are suspected of being cannibalistic[291]

Although comparatively rare, human remains have also been found in certain North American caves. Conkling or Bishop's Cap Cave in the Organ Mountains, New Mexico, for instance, contained scattered human bones chaotically deposited with those of a ground-sloth (*Nothrotherium*), a coyote, a very large wolf (*Aenocyon*), numerous rodents, a horse, bison, an antelope, a camel (*Tanupolama*) and other 'Pleistocene' animals[292]. Several of these animals have turned up again in various other caves in the United States. In Gypsum Cave, near Las Vegas, Nevada, for example, unusually well-preserved fresh-looking remains of *Nothrotherium*, the camel, horse, and the mountain-sheep, have been discovered[293], while bone-breccias at Bootlegger Sink, Pennsylvania, have yielded a rich harvest of late 'Pleistocene' animals in every way analogous to those from equivalent European breccias[294].

But by far the most intriguing North American cave evidence was that found in a closed cave near Cumberland, Maryland. Among the animals discovered were the tapir, crocodile, wolverine, lemming, mink, porcupine, hare, red-squirrel, long-tailed shrew, badger, elk, coyote and a puma-like feline. Though mostly broken or fractured, all the remains were notably fresh-looking[295]. Dr J W Gidley and Dr C L Gazin, who conducted the first scientific investigation of these remains, observed:

> Many of the species are comparable to forms now living in the vicinity of the cave; but others are distinctly northern or Boreal in their affinities, and some are related to species peculiar to the southern, or Lower Austral, region.[296]

Initially these faunal differences were interpreted as meaning that the northern animals were deposited during a cool glacial episode and the southern forms during a warmer interglacial episode. This explanation subsequently crumbled, however, when continuing researches showed all the animals to have been coeval.

Indeed, it was reluctantly admitted that: "This strange assemblage of fossil remains occurs hopelessly intermingled...[297].

Confronted by all the foregoing evidence, its internal consistency and global distribution, it is difficult to withhold agreement from the following remarks by a former president of the Edinburgh Geological Society, which, though applied at the time to European bone-caves, relate equally to the equivalent sites on other continents:

> ...It is certain that these caves and fissures, so packed with carcasses, are now almost universally dissociated and broken off from the old lines of drainage in which they discharged the function of river channels... the old surfaces of country in which they occupied this position have been *totally destroyed*; and this destruction can only have been due to great fractures and great bendings of the underlying rocks... in *very recent* times *great* changes in the moulding of the earth's surface over a great part of Europe occurred with sufficient rapidity to cause a great destruction of animal life...[298]. [Our italics].

11
ILLUSORY FAUNAS

Before leaving the remarkable evidence of the bone-caves, some further aspects of the extraordinary story they tell require highlighting.

The tremendous, if disorderly, concentrations in certain caves and fissures of the bones of just one animal type, or very few types, is replicated on nearly all continents. Such distribution indicates that the cause of this phenomenon cannot, as is often postulated, have resulted, however indirectly, from even the most widespread ice action that it is possible to image – action which, as we have seen, in any case almost certainly never occurred.

During the formative decades of geological science, when certain caves confronted pioneer investigators with an unnatural abundance of remains of particular animal types, special names reflecting their speleological occurrence were invented to distinguish them. Among these were *Ursus spelaeus* (cave bear), *Hyaena (Crocuta) spelaea* (cave hyaena) and *Panthera (Leo/Felis) spelaea* (cave lion). Although the actual remains showed no special adaptation to regular cave-dwelling habits, it was *assumed* that the animals concerned had been cave-dwellers because they were found where they were.

Significantly, most of the animals awarded 'speleological' names were carnivores apparently related to living species which do sometimes favour caves as dens or lairs. It was not long before scholars were postulating certain caves as former bear or hyaena dens.

The first such explanation appears to have been proposed as early as 1795 by Rosenmüller[299] regarding the preponderance of bear remains met with in certain German caves[300], but did not achieve general popularity until 1821 when Buckland championed it to account for the unusually large number of hyaena bones found at Kirkdale Cave in Yorkshire[301], and others wrote about such lairs in verse[302]. Buckland's theory was also especially notable for involving climatic changes – for were not hyaenas, which no longer inhabit Britain, tropical animals? For a while, Buckland's notion of a 'hyaena den' became 'front page news'[303].

Quick to appreciate that point – duplicated by much other botanical and faunal evidence from temperate, even Arctic, latitudes across vast tracts of the northern hemisphere – Buckland's contemporaries, as well as many later writers[304], concluded that much warmer conditions than now had formerly prevailed at Kirkdale when hyaenas had frequented it and other now cool-temperate localities yielding such remains. Indeed, Buckland himself remarked that the presence of tropical hyaenas at Kirkdale indicated "...a probable change of climate in the northern hemisphere"[305].

It is hardly necessary to remind ourselves that all these conclusions and speculations appeared a full seven years before the publication of Lyell's 'uniformitarian' principles, and almost seventeen years before the announcement of Agassiz's glacial (ice age) hypothesis – both of which we discussed in Part One.

But the early palaeontologists operated a kind of 'double standard', for, where abundant herbivore remains predominated in cave breccias, as for example at Maccacogne in Sicily or Lagoa Santa in Brazil, they coined no 'speleological' names for them because their living, or nearest living, counterparts were natural denizens of grassland, woodland or aquatic environments, and a cave-dwelling existence could not be envisaged for such animals in any numbers, particularly as their skeletal remains showed absolutely no adaptations to the regular habitation of caves.

When, also, it is remembered that the bones of innumerable carnivores and herbivores identical to those entombed in the cave and fissure deposits have been found in coeval ('Pleistocene') gravels, sands and other strata elsewhere, often scores, even hundreds of miles distant from caves, it is apparent that they enjoyed a non-cave-dwelling existence. In this context, 'speleological' species names are incongruous. Nor is it convincing that the prodigious numbers of herbivore remains encountered in some caves can all have been the remnants of individuals dragged inside them by cave-dwelling bears, hyaenas, wolves or lions – even if extended over a period of many years. The curiously complete skeletons at Choukoutien, the sheer size of mastodon, mammoth and rhinoceros skeletons found in other caves, and the extraordinary number of hippopotamus individuals in the Sicilian caves around Palermo, are all details militating against interpretations requiring the herbivores to have been the remains of carcasses dragged into caves by carnivores.

The latter's failure to even commence dismembering some of the still-complete herbivore cadavers, supposedly dragged with immense effort inside the caves from without, or cornered and killed within it, is also inconsistent behaviour among carnivores *habitually* occupying caves, since they could hardly have failed to dispose of the carcasses over the immediately ensuing period.

The fact that certain caves contain virtually uncountable numbers of bones or, equally abnormally, are choked with the remains of a single animal type, deserves some explanation as to precisely what set of circumstances could have produced such effects.

If steadily worsening conditions preceding the outbreak of whatever slaughtered these animals signalled impending great danger even to the animals themselves, their actions will almost certainly have conformed to the behaviour patterns peculiar to different animal groups. Herbivores will have reacted with typical mass herd reactions; carnivores, canines excepted, as individuals or as limited family groups; and canines, especially wolves and other wild dogs, probably as packs. All creatures, irrespective of the categories to which they naturally belonged, would have instinctively sought shelter, and in many cases caves clearly offered ideal sanctuaries.

Unless the herbivores were large or very numerous, the carnivores would inevitably oust herbivores from caves to usurp their refugia. Herbivores seeking sanctuary would naturally avoid caves already occupied by carnivores and seek alternative shelter. It is not difficult therefore to appreciate how some caves came to be occupied solely by either carnivores or herbivores, and sometimes by just one species of animal.

But examples have been cited where both carnivores and herbivores co-mingled in a single cave, perhaps the only refuge available for miles – the panic-stricken recipients of a common threat among whom natural hostilities were mutually suspended.

The evidence everywhere strongly suggests that all these cave occupants were drowned *en masse* by violent water action, and in many cases never lived where they were entombed. It is also patently obvious, and will become ever more so as this saga unfolds, that those animals caught outside sanctuaries were also overwhelmed and then swept into and buried within caves and fissures alongside the original occupants, by the same massively destructive agent. This explains the mixture of faunal elements in many caves and fissures, the reason why young and old were slaughtered indiscriminately, and why the bone-cave phenomenon is generally of such worldwide extent. The underlying cause operated as thoroughly in supposedly glaciated areas as it did in those postulated to have laid outside them – and generally similarly in all hemispheres.

Enormous numbers of these animals, though now found in Arctic Siberia, Alaska and other lands now unable to support them, were moved vast distances from their original homelands by swiftly-moving water which transported them tumultuously in as immense moving masses of twisting, churning, water-borne organic debris, mud, silt and boulders. Only such a scenario explains the aforementioned evidence from Alaska, and the astoundingly fissured and shattered bones in the caves of Australasia and elsewhere – invariably buried in the utmost confusion, rammed into the furthest crevices of caves or buried astonishing depths down deeply-tortuous rock fissures.

Collectively, all the foregoing indicates that the pioneer students of these extraordinary remains committed an unfortunate error in inventing cave faunas that never actually existed, even though, as today, certain carnivores do sometimes inhabit caves for indefinite periods. Few, of course, will doubt that occasional lucky carnivore survivors of this traumatic episode (and a handful of these *did* exist) will, following the general cessation of this suggested stupendous water action, have located carcass-filled caves and fissures, and subsequently used them as ready-made larders. Carnivore tooth-marks on herbivore bones in cave breccias, as at Kirkdale and other caverns, strongly suggest that such occasions did indeed arise here and there in post-diluvial times, with some sites accordingly becoming bear and hyaena dens for unknown periods of time. But overall assessment of the known evidence indicates that such places were not common, even though, as seen later, other more terrible interpretations of the same evidence are possible.

Removal of the Ice Age of orthodoxy, as previously advocated, together with the realisation that most of the animals found in the cave and fissure deposits were never natural denizens of such sites, immediately eliminates the necessity to envisage cave faunas of the kind postulated by conventional treatment of the subject. The absence of such an Ice Age also invalidates those concepts which call for alternating glacial and interglacial interludes and the differing animal assemblages associated with them. In short, such faunas, especially the cave faunas, are illusory.

12
ABNORMAL BURIALS

The mammoths and mastodons mentioned throughout this book belonged to that group of trunk-bearing mammals known as *Proboscidea*. Unlike the mammoths, mastodons were not true elephants but a separate and generally more primitive proboscidean branch which parallelled them. Very numerous during late Pliocene and 'Pleistocene' times, the dominant form at the time of the great disaster we are alluding to was *Mammut* (formerly *Mastodon*).

Originally common in Europe and southern Asia during late Pliocene and early 'Pleistocene' times, *Mammut* seems to have largely withdrawn from those regions by the close of the 'Pleistocene' period, when, however, it abounded throughout the Americas. *Mammut americanum*, sometimes referred to as *Mastodon giganteus*, was the commonest North American species, whereas in South America *M andium* and *M humboldti* predominated. The main differences between these species was in their dentition.

Mature individuals of *M americanum* stood about 9½ft (3m) tall at the shoulders, although occasionally higher stature was attained. The feet had five toes, the great weight of these animals being carried by a large springy pad on the underside of the foot, a feature present even in juveniles. In life, the body was covered with rusty or dun coloured hair, and the tusks, which were large, tended to curve gently

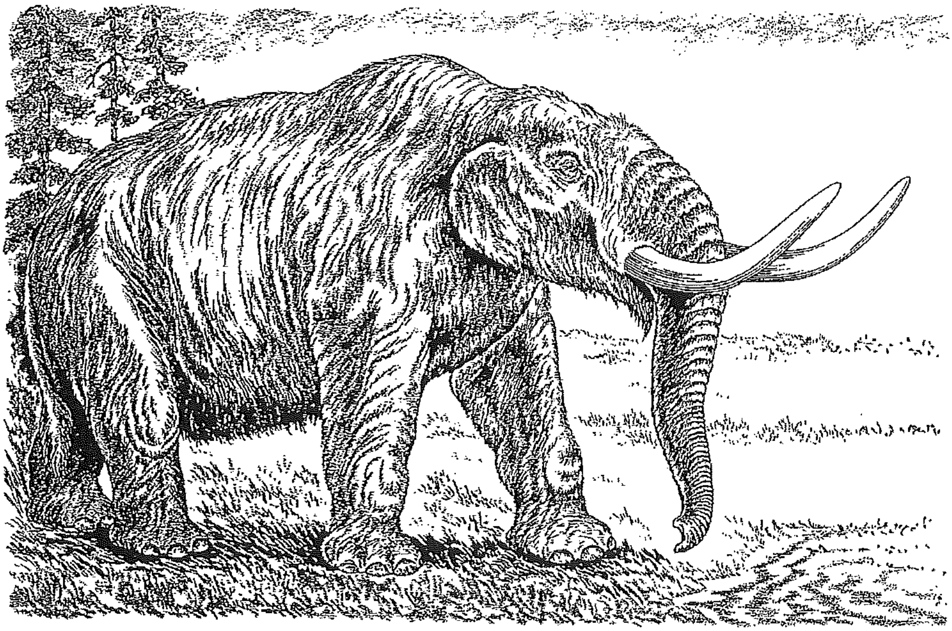


Fig 2.6. *Mammut Americanum:* the life appearance of the American mastodon, based on buried specimens found in the United States. *Illustration from "The Fossil Book" by Carroll Lane Fenton and Mildred Adams Fenton, copyright 1958. Reprinted with permission of Doubleday & Co, Inc.*

upwards. These details are well known because several more or less complete carcasses of these great creatures have been discovered in salt marshes and bogs.

The youthful appearance of many American mastodon remains is most striking, and has induced the observation that: "Some mastodon skeletons show every evidence that the animals lasted down to very late periods well within 'historic times', as that phrase is construed in Europe..."[306].

There is now no doubt that many mastodons survived in the New World well into Holocene times, when they were seen and hunted by palaeo-Indians. They survived an event that indiscriminately destroyed enormous herds of them, which dismembered and buried countless individuals of all ages and both sexes in great alkaline mud-banks and similar deposits, and which at many localities preserved their battered carcasses nearly as effectively as ice and frost did the Alaskan and Siberian mammoths.

While the northern animals were frozen solid in ground almost instantly reduced to permafrost conditions, the mastodons were entombed in great avalanches of mud and salts that, upon consolidating, often preserved many of their soft parts and sometimes even their stomach contents. Interestingly, while the Siberian and Alaskan mammoth remains often lie near or at the bottom of the 'muck' formation, so these mastodon carcasses frequently occur at or near the base of the North American bogs and marshes, which themselves often occupy hollows in the 'drift'[307]. The two sets of deposits thus appear to be essentially complimentary, and their origin probably a more or less simultaneous result of a common paroxysmal event, as mastodon and mammoth remains have been found at some localities lying alongside each other. Thus:

> In America the mastodon deposits are diluvial, and agree in position with those containing *Elephas primigenius* (in Eurasia)[308].

Among the first recorded discoveries of mastodons with preserved soft parts were five individuals found some 3 miles (4.8km) from the Ohio River by the Shawany Indians in 1762. Dr Warren, a diligent recorder of many early finds, mentions that: "...In digging a well near the entrance of the Wabash into the Ohio, there were found some bones of a mastodon... in company with skin and hair"[309].

Accompanying another skeleton found elsewhere were large pieces of skin resembling "fresh-tanned leather"[310]. The freshness of these mastodon soft parts is not unique, nor indeed peculiar to mastodons, but applies equally to the vegetable remains often found with them. Thus, occurring with a mastodon skeleton discovered in Orange County, New York state, in 1845, was a:

> ...mass of broken twigs, *etc*, lying beneath the pelvic bones... in quantity about five or six bushels; towards the posterior portion, it presented three traces of convolutions, passing in a straight column of four inches diameter through the pelvic orifice, and behind the ischium terminating in a homogeneous mass, evidently of a foecal character.[311]

A year earlier, several mastodon skeletons came to light in a natural basin at Hackett's Town, New Jersey, affording evidence of stomach contents[312], and a further instance occurred somewhat later at Newburgh on the Hudson River, when a mass of crushed twigs was observed between the ribs of a mastodon found there[313]. Yet another discovery of the same ilk occurred near Jamestown, New York state, in August 1871. The find was examined *in situ* by, among others, Prof S G Love, whose report, cited in Hartnagel and Bishop's valuable survey of New York mastodon discoveries[314], is well worth reading.

Microscopical examination of samples of these stomach contents revealed that the Newburgh mastodon apparently fed on hemlock-spruce[315] and that the Hackett's Town mastodons had evidently eaten young shoots of the white cedar[316]. It must be relevant, therefore, that white cedar wood is prominent in the previously noted subterranean forests of mid-western North America, which perished suddenly and were buried deep under 'drift' deposits.

The calamitously abrupt character of this event is underscored by the unexpected positions in which several virtually complete mastodon skeletons have been discovered. For example, nearly all the skeletons found in the deposits in the valley of the Great Osage river were in a nearly *vertical* position[317]; and James Southall says that, since early colonial days, many others have been met with standing *erect* just below the surface of swamps or bogs[318]. Again in the Newburgh mastodon: "The anterior extremities were extended under and in front of the head... The posterior extremities were extended forward under the body"[319].

And of another discovered in Monmouth County, New Jersey, in 1823, we read that:

> ...its vertebral column, with all its joints and ribs attached to them in their natural position, lay about eight or ten inches below the surface. The scapula rested upon the heads of the humeri, and these in a *vertical* position upon the bones of the fore-arm, as in life. The fore-arm was still buried. It inclined a little backwards, and the foot which was immediately below it was placed in advance of the other, as it would be if the animal *had been walking*. The four feet rested on the sandy stratum underlying the black earth in which the animal was embedded.[320] [Our italics].

Likewise, Van Rensselaer, discussing a mastodon skeleton found in 1823 near Long Branch, New Jersey, reported that: "Its position... was vertical, the feet resting on a stratum of sand and gravel, and the head to the west-south-west[321].

Elsewhere, mastodons have been discovered in other strange positions. Warren says the remains of the Hackett's Town specimens were:

> ...found covered from four to six feet deep, except the largest, which lay near the south-east side of the basin, and were but slightly covered. A few feet to the north of

> this lay the next in size on its back, and a little to the north and west of this the other two, both as if in a *standing* position; and the calf was found in a similar position near the north side of the basin... The question very naturally occurs, 'How and when did so many of these large animals become embedded in this narrow space?' – questions more easily asked than answered. My first conjecture, before seeing the place, was, that they had been mired in attempting to reach a spring or lick; but the small extent and shallowness of the basin, and the gradual descent and character of its bottom (which... is perfectly solid... closely paved with rolled stones...) all forbid such a supposition.[322] [Our italics].

Even if these animals were mired – which, contrary to evidence, is still the most popular explanation – it is exceedingly difficult to conceive how, once stuck fast in thick mud, even a powerful animal like a mastodon could manage to turn itself upside-down and become buried 'on its back'. Certainly it might fall to one side and remain there for evermore, but not *upside-down*. The solid nature of the underlying strata is also interesting and repeated at many sites. That these animals may have sensed the catastrophe about to engulf them is possibly indicated by the curiously repeated south-west to north-east alignment of many of their remains[323]. Were they turning to face or to avoid a threat so enormous and sudden that in many instances there was not even time for them to be knocked over by it? Certainly we agree with Warren's observation that:

> The cause of the disappearance of the mastodon seems to be mysterious. We are... disposed to believe that an animal of so large a size, of so great a strength and such extensive distribution... must have required some great and general catastrophe to overwhelm and annihilate it.[324]

That water was a major element in that catastrophe has been traced at other North American mastodon sites. Thus, around a salt-marsh at Saltville in Virginia containing the remains of mastodon, *Mammuthus primigenius* and numerous other coeval animals and freshwater clams, many large angular blocks of jasperoid lying on the lower slopes of the hills rimming the marsh are "distinctly water-worn". Significantly, many of the clams still retain their iridescent nacreous shell layer as well as the periostracum[325], so geologically recent was their demise.

As well as mastodons, other contemporary animals retaining portions of their soft parts have been found in these North American bogs and marshes. Articular cartilage and tendinous attachments occurred on bones of a giant feline (*Megalonyx*) described by Dr Leidy in 1859[326], and soft parts adhered to the remains of a peccary found in a saltpetre deposit in Kentucky. But it is in the frozen ground of Siberia and Alaska that the most famous discoveries of this kind have been made.

The millions of animals that perished during the terrible convulsions which terminated the so-called 'Pleistocene' times were nowhere more dramatically preserved than in Siberia. There, the picture is everywhere one of appalling disorder, carnage and wholesale destruction, with countless animals and plants frozen in positions of death ever since the day they perished. As a result, their remains are amazingly fresh-looking and are frequently indistinguishable from those of animals and plants that have died mere weeks ago. Here and there amid the chaotic masses of organic debris occur whole or partial carcasses of a wide array of late 'Pleistocene' animals – the Arctic equivalents of the mastodon cadavers just mentioned, and just as informative. These Siberian examples, however, have been deposited in particularly noteworthy fashion.

In the Lyakhov Islands, for instance, there exists an extensive lower layer of granular ice, 70ft (21m) thick, not formed from compacted snow, and directly *overlying* this is a layer of clayey freshwater material enclosing numberless tusks and skins of mammoths together with the refrigerated corpses of musk-ox, horse, rhinoceros, American stag, antelope, reindeer, tiger and other mammoths[327]. One of the mammoth carcasses found here was of special interest in that its remains had been smashed before coming to rest, for pieces of it were distributed around the main body of the specimen and much of its hair had been removed and its skin badly cut and excoriated[328]. Its mode of burial had obviously been exceedingly violent.

This singular depositional sequence is evidently extraordinarily widespread, for it is encountered many hundreds of miles distant in the valley of the Berezovka river. There, a mammoth carcass excavated in the middle Kolyma region in 1901, at a place by riverside cliffs, lay in a depression in fossil ice into which it had apparently been partially thrust. Great quantities of blood had flowed from the acute wounds it had suffered at the time of death, and this had congealed and frozen solid along with the dismembered tail of a bovine animal which was found immediately below the mammoth's right forefoot[329]. Not very far distant in the same district, the perfectly preserved upper part of a horse's skull, complete with muscle fibres, was found buried between the trunks of larch trees protruding from the river banks[330], while further east, in the valley of the Indigirka River, similar mangled animal remains have come to light.

Still further east, in the Yana valley, an allegedly complete carcass of a horse or pony was found during the late 1890's in frozen soil on the banks of a tundra lake north of Verkhoyansk. The specimen, which was never collected, is said to have possessed long greyish-white hair[331].

Very interestingly, Sir Roderick Murchison, reporting on the results of a then-recent expedition down the Yenisei River, recorded that:

> During the progress of this expedition the important discovery has been made of entire skeletons of mammoths, whose skin and hair has been preserved in frozen mud... the heads of these extinct elephants were, for the most part turned towards the south, as if the animals had been retreating southwards when caught either by inundation proceeding from the North Polar region... for when we travel southwards, we find mammoth remains becoming much scarcer, and instead of whole animals, we meet with their broken and disjointed bones only, as if they had been transported from the north.[332]

This closely parallels the previously-noted observations about the disposition of the upright mastodon carcasses and skeletons.

That water moving on a gigantic scale was indeed involved with these widespread extinctions is suggested by the head of a woolly rhinoceros, *Coelodonta tichorhinus*, discovered in 1771 near the Vilyui (Wiliui) River north of Yakutsk. Prof A F Brandt of Berlin wrote:

> On a careful examination of the head... it was... remarkable that the blood-vessels and even the fine capillaries were... filled with brown coagulated blood which in many places still preserved its red colour[333].

Asphyxia, either by drowning or suffocation, invariably induces gorging of the capillaries with blood. Brandt's analysis of the matrix adhering to this particular rhinoceros established drowning as the cause of death, and showed that it was buried with fragments of freshwater Pleistocene plants[334]. It must be relevant that buried masses of ancient ice occur, encasing the carcasses of mammoths and their contemporaries as at Berezovka, elsewhere along the Vilyui valley.

During the late 1700s, Pallas visited large areas of Siberia. In the Irtish River valley, he found sub-fossilised shells of living species no longer thriving at such latitudes. Many still preserved their horny pelicles and some *retained traces of the molluscs themselves.* Bones of mammoths and other extinct animals occurred in the same formation, and nearby the heads of great fishes and pieces of cellular bone of unidentifiable origin[335]. Elsewhere he saw a petrified jaw-bone coated with mus-

Fig 2.7. Frozen Mammoth of the Berezovka.
Photo by J Kirchner. By permission of the American Museum of Natural History.

sels[336]. He regarded these as having "...come from a great inundation"[337].

If yet further evidence is needed, we can mention the discovery of a whale skeleton far inland on the Chukchee peninsula in north-eastern Siberia, still partially covered by skin, with deep red, almost fresh flesh adhering to many of its bones[338]. River floods had partly eroded the frozen sand enveloping this individual the preceding winter, and as exposure of the carcass to even one summer's sun would have induced putrefaction long ago, there could be no doubt of the specimen's very great antiquity. It was found at the same level as the bones of mammoths and other 'Pleistocene' mammals.

An almost identical picture emerges in neighbouring Alaska, where, in the 'muck' beds:

> The excellent state of preservation of many of the bones, the recent decay of animal matter shown by the existing odour, quantities of hair found in contact with a mammoth's skull, the occurrence of the outer sheath of bison's horns, and the finding of vertebrae of bovine animals lying in their proper order of sequence, render it probable that *entire carcasses* were deposited, and that congelation followed close upon their entombment.[339] (Our italics).

Furthermore:

> Most of the bodies of the animals had been torn and twisted by some violent cataclysm before being frozen in the enveloping muck... The archaeologists also found mammoth's meat which was still in an edible state.[340]

Richardson and Hibben, who made these observations, wrote before the more recent discovery of a partial carcass of a frozen baby mammoth in the Alaskan 'muck' beds[341], a find fully justifying Richardson's speculations over a century ago. This discovery is not unique, however, for in the summer of 1977 the refrigerated carcass of another baby mammoth, believed to be geologically older than its American counterpart, was exhumed near Madagan in eastern Siberia[342].

Among other Alaskan evidence may be mentioned the frozen carcass of a young musk-ox[343], and the partially complete frozen cadavers of bison, several felines, various deer and a wide range of other contemporaries of the mammoth found at localities scattered across the state's western terrain[344]

Similar burials occur even in Europe. A complete rhinoceros carcass preserved in an oil-saturated deposit has been found in Poland, and several mammoth skeletons or partial carcasses have been found in European Russia standing upright in consolidated silty mud. Of the latter, the best known examples were discovered at Swijatosski near St Petersburg in 1775[345], another near the same city about 1826[346], and one at Troitzkoe near Moscow in 1846, associated with plant fragments, *fish scales and bones* and pieces of coal[347]. All were reminiscent of the finds of erect mastodons in North America.

Unquestionably the Siberian and Alaskan animals and plants were the common victims of a catastrophe which afflicted both countries with equal force and produced similar results – results remarkably similar to those already noted at many Asiatic, European, North American and Australasian bone-caves and fissures, where entire or partially whole animals were also tumultuously entombed in the flesh. This aspect of the fossil evidence, whether encountered at allegedly glaciated localities or not, is impressively consistent worldwide.

On the basis of present mollusc distribution, the testimony of the now-vanished northern forests, the evidence of the lost Miocene Ocean and the central Siberian pollen record, northern latitudes were much warmer than today[348]. Quite clearly, therefore, *the mammoth and its companions did not live during an Ice Age*. They were the victims of an event which produced one, and which, in Siberia and Alaska, either transported their remains into arctic latitudes, or invested those latitudes with glacial conditions.

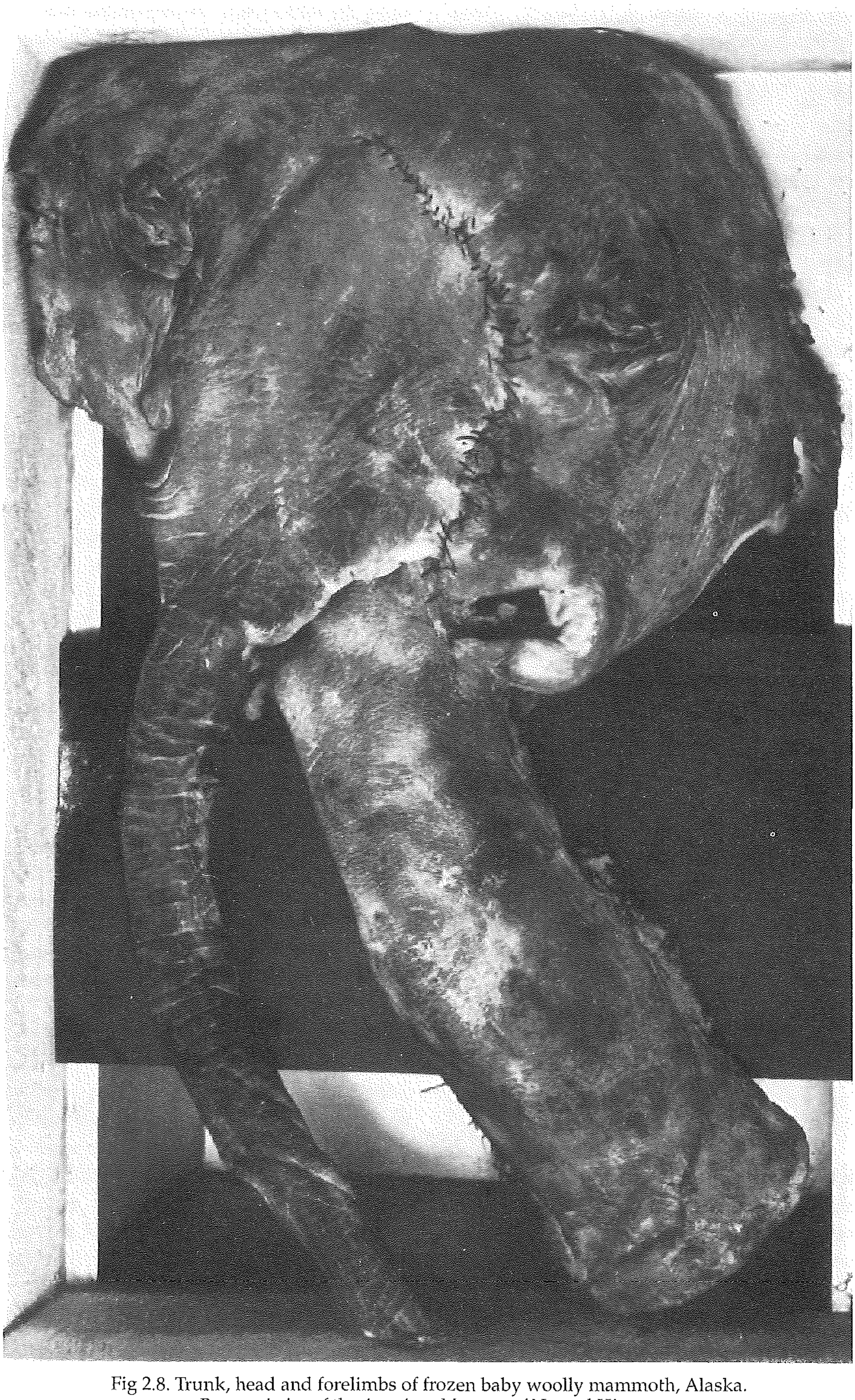


Fig 2.8. Trunk, head and forelimbs of frozen baby woolly mammoth, Alaska.
By permission of the American Museum of Natural History.

Fig 2.9. Part of a mammoth tusk, Alaska, found in 1868. *Courtesy of the Univ of Southampton.*

13
Incompatible Bedfellows

If upright skeletons and amazingly preserved frozen animals are prominent facets of the 'Pleistocene' biological record, so too is the following remarkable evidence from California, South America and Africa.

The previously-mentioned asphalt and tar-seeps in California, which contain such a varied assortment of birds, are also the cemeteries for a rich assemblage of late 'Pleistocene' faunal and floral life. The most spectacular discoveries have occurred at Rancho La Brea. There, the remains are packed tightly together into an almost unbelievable conglomeration: "...a bed of bones... in which the number of sabre-tooth and wolf skulls together averaged twenty per cubic yard"[349].

So abundant were the remains that between 1906, when systematic excavations first began, and 1931, no fewer than 700 skulls had been retrieved of the sabre-toothed tiger (*Smilodon*) alone[350]. Accompanying these was a quite staggering profusion of bones and teeth belonging to horses, camels, bison, mastodons, mammoths, rodents, coyotes, wolves, sloths and numerous other mammals and birds[351]. Initially accorded a late Pliocene antiquity, later studies showed these remains to be coeval with late 'Pleistocene' plants collected from the Carpinteria asphalts. Very significantly, these plants proved to be typical of a Recent flora now only thriving 200 miles (320km) further north[352].

The exceptional number of animals at Rancho La Brea is usually explained thus: some animal stuck fast in the tar, crying out, attracted mammalian and avian carnivores anxious to secure an easy meal, but these in turn, also becoming ensnared in the sticky trap, joined their hoped for meals, the grim cycle being repeated innumerable times. This interpretation, however, is badly at odds with the facts, for, as Prof Merriam has observed:

> As the greater number of the animals... have been entrapped in the tar, it is to be presumed that in a large percentage of cases the major portion of the skeleton has been preserved. *Contrary to expectations, connected skeletons are not common.*[353] (Our italics).

Admittedly the bones are splendidly preserved as far as their often fragmentary state allows[354], but are, like their counterparts in the Alaskan 'muck' beds: "...broken, mashed, contorted, and mixed in a most heterogeneous mass, such as could never have resulted from the chance trapping and burial of a few stragglers"[355].

These animals were apparently buried violently in an already dismembered condition. Interestingly, a human skull, found among these animals, was assigned to 'Ice Age' times as the associated animal remains were of supposedly similar antiquity. The skull, however, is typical of normal crania in living Amerindians, a point of particular significance when we come to consider our next Californian discovery.

Shortly after the mid-nineteenth century discovery of gold in California, a succession of noteworthy finds occurred at several places where auriferous gravels, underlying lava-capped mountain ridges, were mined or tunnelled into for the precious metal. Of these finds Dr G F Wright has left us the following interesting account:

> As early as 1863 Dr Snell of Sonora began a systematic collection of animal and human

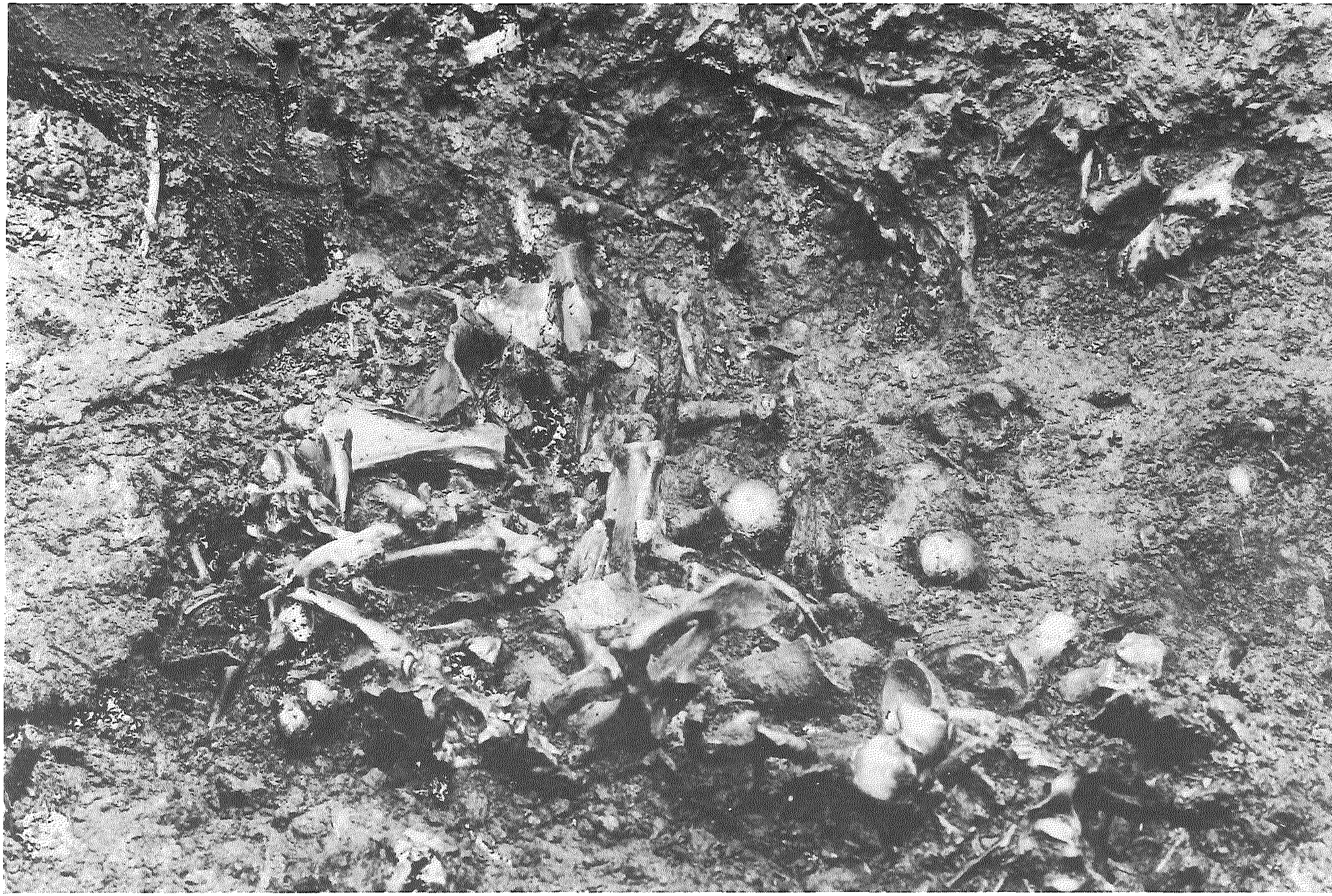


Fig 2.10. Part of the great accumulation of bones at the Rancho La Brea tar-pits, near Los Angeles, California. Note the disarticulated condition of the remains and their confused disposition within the tar. *Photo by R S Lull. By permission of the Museum Archives, Los Angeles County Museum of Natural History, California.*

remains from the mines in his vicinity. In his collection were several objects marked as 'from under Table Mountain', among which was a human jaw...

In 1857 Hon Paul Hubbs, of Vallejo... picked a portion of a human skull out of the dirt as it was brought from the Valentine Shaft, under Table Mountain, near Shaw's Flat...

Ten years after, Mr Hubbs more fully detailed the circumstances of the discovery, and Professor Whitney and Gorham Blake Esq, made special examination of the locality and careful enquiries of the owners of the mine, and satisfied themselves that the bone really came from under the basaltic covering of Table Mountain... All this is preliminary to the famous Calaveras skull...[356]

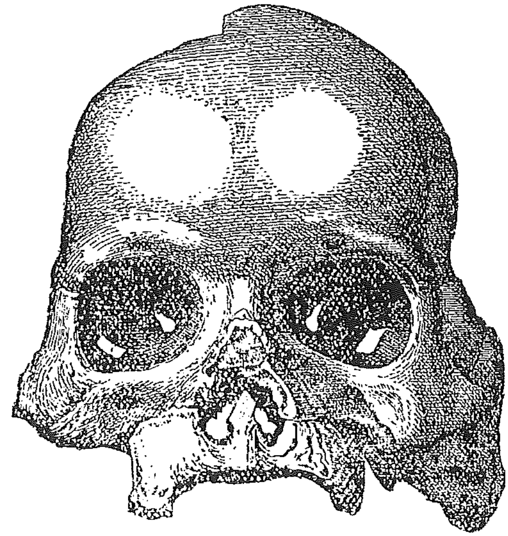


Fig 2.11. The Calaveras skull (after Whitney).

The Calaveras skull was found by a certain Mr Mattison during February 1866 next to a petrified conifer 60–80ft (18–25m) long within gravel in a mine tunnel underlying 40ft (12m) of basalt capping Table Mountain near Altaville. It was originally mistaken for a petrified tree-stump as it was so encrusted with earth and stony matter[357]. However:

> ...the appearance of the skull in every way corroborated his (Mattison's) statement. The original incrustation shows that it was not taken from a cave... Fragments of bones and gravel and shells, were so wedged into the cavities of the skull... that there could be no mistake as to the character of the situation in which it was found. Chemical analysis showed that organic matter was nearly absent, and... (that the skull) was in a fossilised condition[358].

Wright also observed:

> ...the Calaveras skull, which, if genuine, far antedates anything human which has been discovered in Europe, is not of a particularly inferior order...[359].

Earlier scholars dated the skull as Pliocene because among other finds made under Table Mountain were the remnants of the typical Pliocene horse *Hipparion*[360], not recognised as having survived into late Pleistocene times until much later[361]. Today, the Table Mountain gravels are usually regarded as Pleistocene, while in some quarters the Calaveras skull has, despite much evidence to the contrary, been interpreted as that of a modern rather than a fossil man[362]. Other human remains, reportedly found in another mine tunnelled under Table Mountain[363], were certainly fossil, being associated with late 'Pleistocene' plants and the bones of mastodons and its contemporaries believedly deposited by "tumultuous waters"[364].

Great natural convulsions must also have been responsible for the disposition of whales and other marine creatures on the *crests* of mountains in various other parts of California. Thus Hay quotes Dr Steven Bowers as stating:

> Bones of whales and other cetaceans are met with in various portions of the county [Ventura county], especially along the sides and crests of the Santa Paula mountains.

> On the summit of this range, at an altitude of 2,000ft, the remains of a large seal, probably *Eumetopias stelleri* (*E jubata*), were obtained...[365].

Bowers assigned a Pliocene age to the deposits containing these remains, but Hay and others have shown that they date from later 'Pleistocene' times – in which case the deposition of cetaceans at such altitudes during times so geologically recent can only have proceeded under conditions that, elsewhere, would be termed catastrophic.

Animal fossils from the San Pedro Valley, California, present apparently anomalous faunal mixtures of much interest. Included are Miocene sharks, seals and porpoises, allegedly early Pleistocene sea-lions *and* land vertebrates, species of molluscs, sea-urchins, bryozoans and foraminifera which are still flourishing but unknown as fossils before Pleistocene times, and numerous late Pleistocene mammals and birds[366]. These are classic examples of 'old' and 'new' organisms coexisting in incompatible habitats or being assembled tumultuously and consigned to a common grave.

Last century, Prof P M Duncan, studying the Lake Titicaca basin of Andean Peru/ Bolivia, noted the existence of siluroid, cyprinoid and other marine fishes in the lake, and that corals attached to rocks underlying the extensive nitrate deposits along the presently waterless Peruvian coast west of the lake represent *existing* species[367]. Today these corals lie 2,500–3,000ft (769–923m) above sea level. This region, however, which must once have lain much lower, is believed to have been well-wooded in the recent past and to have supported a rich and varied fauna. Numerous skeletons of forest-dwelling ant-eaters strewn across what is now the desert of Tarapaca eloquently testify to this[368].

Some unexpected 'late' occurrences of geologically 'old' animals have been reported from equatorial Africa. For example, in 1931, a portion of an articulated skeleton of the Miocene elephant *Deinotherium* was found in 'Pleistocene' deposits at Olduvai (Oldoway), Kenya, associated with shells of species still thriving in those latitudes. The skeleton occurred: "...in conditions which preclude the possibility that it is derivative"[369].

Other *Deinotherium* bones and teeth had previously been observed near Ngeti close to the Ugandan border with the then Congo territories (Zaire) by the Belgian geologist Delpierre, in beds which: "...on other evidence, he was convinced are of Pleistocene date. He affirmed, too, that these most unexpected fossils were not derived"[370].

More recently, further *Deinotherium* remains were retrieved from supposedly 'early Pleistocene' beds near Teleki volcano, Kenya, along with bones of a Machairodont lion, a large mustelid, *Hyaena cf namaquensis*, a hare, *Tatera*, *Hystrix*, a mastodon, a primitive elephant, several pigs, an extinct rhinoceros, a horse (*Stylohipparion*), a hippopotamus, a large giraffe, an okapi, various bovines, two kinds of crocodile, three species of tortoise (one of great size) and numerous fishes[371].

Recent reports and photographic records from an enclosed valley in the Nepalese Himalayas of a herd of living elephants apparently allied on the one hand to the *Stegodon*, a Pliocene and early 'Pleistocene' Asiatic ancestor of the modern elephants[372], and on the other, to *Stegomaston*, a mastodont genus as yet certainly known only from the early Pleistocene of the Americas[373], suggest an even more interesting instance of late survival of an animal extinct elsewhere, and that 'out-of-place' fossils like the Is-Shantün cave Miocene shark teeth and the *Deinotherium* remains just noted are indeed highly germane to the subject of this book.

Although little is presently known about them or their significance to general proboscidean evolution[374], these elephants almost certainly represent relict animals isolated in their present remote domain through the huge topographical changes wrought in the Himalayan region about 11,000 years ago by the great catastrophe here being unveiled – as we have seen in Part One.

Naturalists offer *different* explanations for these finds of antiquated species lying alongside those of geologically more modern aspect, frequently interpreting them as much on supposed geophysical grounds as on their anomalous biological character. Such assemblages,

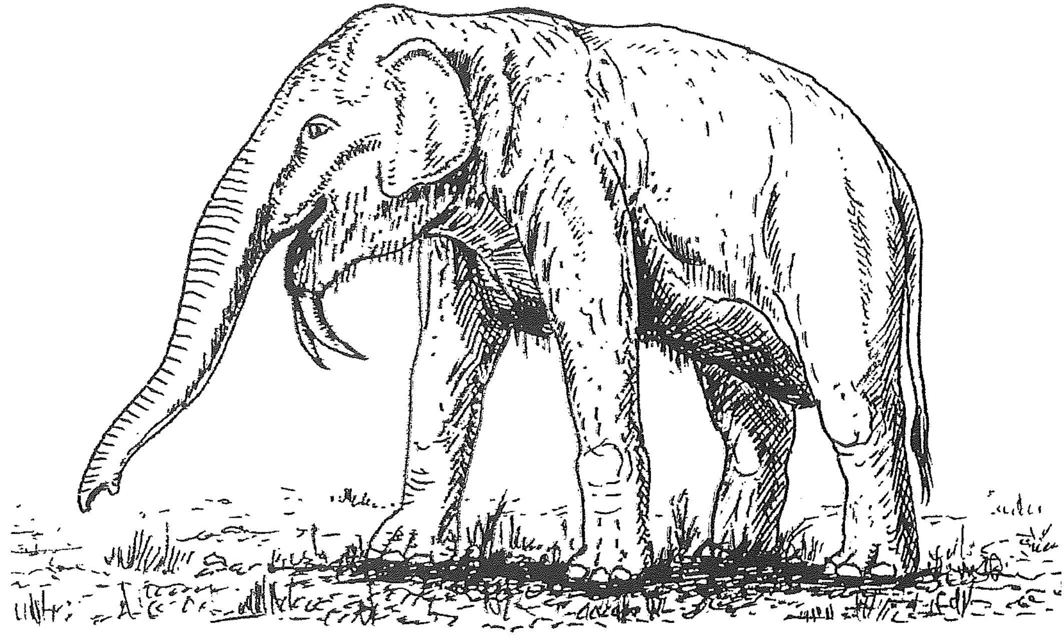


Fig 2.12. Deinotherium, which reached a height of 10ft (3m) at the shoulders. It possessed no upper tusks, but large lower tusks curved downwards and backwards. It probably had a long trunk. *Original drawing by J B Delair.*

both plant and animal, recur in nearly all latitudes, and were apparently produced more or less synchronously everywhere. Thus attributing the evidence from higher, colder latitudes to 'glacial' conditions is as questionable as ascribing evidence from lower, warmer latitudes to non-'glacial' causes. Non-'glacial' causes are advocated solely because of the assumed existence of extensive and chimerical northern ice-sheets. Neither non-existent northern 'glacial' conditions nor southern non-'glacial' causes are valid scenarios, and some alternative agency responsible for creating the recorded effects must be brought to light.

The evidence itself is perfectly unambiguous. Along with the removal of an 'Ice Age' like that which has been hitherto commonly envisaged, the evidence strongly suggests that there is something seriously amiss with the last phases of standard geological chronology. Whatever is amiss is intimately associated with the appalling extinctions, abnormal burials and the apparently endless instances worldwide of so-called 'contradictory' (or incompatible) field evidence. A deeper, but brief review of these chronological factors unquestionably reinforces this impression.

14
A Revised Geological Chronology?

The diverse geological and biological evidence (fossil and extant) we have examined thus far converges on the fact that stupendous worldwide geophysical changes have occurred geologically very recently. It also highlights the fact that an impressive range of plant and animal forms (each identical or nearly so) now distributed discontinuously in different regions of the world represent floras and faunas so lately dislocated that insufficient time has elapsed for new species to have developed within their ranks. These changes were evidentially sudden and violent, the present topographical conditions in the world being their principal visible legacy – and all living things the descendants of the animals and plants which survived them.

The testimony of the fossils, moreover, reveals that biological decimations were wholesale and without regard to the biological classes, numbers, sizes, ages, sexes, or health of the victims. Many organisms perished literally where they stood, being suddenly buried erect or even in walking positions – or were permanently frozen with *singular rapidity* following their demise.

Thus, not only these annihilations but also the deposition of many enveloping deposits ('drift') were catastrophically sudden. These deposits, usually attributed to prolonged and massive ice-action, often overspread extensive tracts of land, ignoring pre-existing topography – and they are sometimes immensely thick. Their accumulation, therefore, occurred on a colossal scale, both in terms of volume and linear extent.

Extraordinary speed, huge scale, great violence and indiscriminate action are therefore equally prominent factors in *both* the geological and the biological records of the period under review.

Typical 'drift' deposits occur far outside allegedly glaciated regions, or, conversely, are absent from many others believed to have been heavily glaciated. Abnormally buried organic remains in otherwise typical 'drift' deposits often occur in latitudes inimicable to large-scale ice-action. These are inescapable facts strongly militating against the popular explanation of the origin of these great deposits.

As noted previously, a special geological 'period', the Pleistocene, was erected by geologists expressly to embrace these formations, on the basis of the real existence of these former glaciations. Since, however, ice-action is by nature very slow, the time allocated for these glaciations and the resultant 'drift' accumulations has been correspondingly long. Accordingly, it has been common to reserve a span of two or more million years for the duration of the Pleistocene 'period'. Such concepts are seriously at variance with the field evidence, for if the glaciations of orthodoxy (the 'Ice Age') never really existed, and if the singular 'drift' deposits accredited to them were accumulated at comparatively great speed, then the duration of the Pleistocene epoch must actually have been unexpectedly brief.

Repeated discoveries in 'drift' deposits of mixed floras and faunas, simultaneously involve climatically-incompatible 'northern' and 'southern' species, modern *and* ancient biota, or forms which no longer flourish at the latitudes where their remains now occur. These loudly proclaim a sudden and violent extinction. The disposition of land and sea must also have differed markedly before the onset of these changes, and equally different meteorological conditions formerly existed, profoundly affecting the geographical distribution and general abundance of faunas and floras.

With the elimination of an Ice Age of conventional conception, and observing that many supposedly typical 'Ice Age' animals (*eg*, mammoth, woolly rhinoceros, *etc*) were *not* actually well adapted to glacial conditions, the faunas and floras found in Pleistocene 'drift' deposits must in reality have flourished during the preceding Pliocene period (see Appendix A).

The generally equable conditions characteristic of Pliocene times were highly favourable to the development and proliferation of life-forms of all kinds, and in that respect did not materially differ from the equally genial Miocene period which preceded it. A mixture of ancient (Miocene) and less ancient (Pliocene) organisms – including allegedly Arctic species – thrived side by side, therefore, throughout Pliocene times, persisting until its brief, sudden and cataclysmic close about 11,500 years ago – when, concomitantly with the deposition of the 'drift', they were slaughtered wholesale.

For these reasons, typical Miocene and Pliocene species occur with surprising frequency alongside those of supposedly younger 'Pleistocene' age, or figure alongside various specially adapted organisms now enjoying geographically discontinuous distribution. The occurrence of Miocene and Pliocene plants and animals, such as *Deinotherium*, *Hipparion*, *Eumetopias*, and *Carcharodon*, in late 'Pleistocene' deposits, or the survival of various living animals and plants having comparably ancient origins, thus ceases to surprise. We know of no other scheme which satisfactorily or comprehensively accounts for such otherwise anomalous biological occurrences.

Instead of being a distinct geological epoch of appreciable duration, the Pleistocene (as epitomised by the 'drift' formations and attendant phenomena) appears therefore to have been little more than a rather brief 'stage'. The time allegedly occupied by the glacial and interglacial episodes of conventional Pleistocene chronology was actually non-existent. Conversely, the

Table 2C

Revised chronology for the Tertiary and Quaternary periods in the light of the Phaeton disaster

ERAS	PERIODS	EPOCHS	STAGES	GENERAL CONDITIONS	Approx DATES (in years BP)
CAENO-ZOIC	QUATERNARY	HOLOCENE (Later)	HISTORIC	As at present	2,300-today
			SUB-ATLANTIC	Dry mild	2,700-2,300
			ATLANTIC	Wet mild	3,450-2,700
			BOREAL	Dry cold winters Warm summers	5,500-4,900
				GLACIERS MELT	
		HOLOCENE (Earlier)	PRE-BOREAL	Dry cold	8,000-7,500
			SUB-ARCTIC	Wet cold	11,400
			PLEISTOCENE	Severe. Rapid development of glaciers	11,500
	Pheaton Disaster				
	TERTIARY	PLIOCENE		Equable	14,000,000
		MIOCENE		Equable	29,000,000

Dates based on the latest available evidence

Pliocene period persisted to very much more recent times than has hitherto been commonly supposed.

The unique character of the 'drift' deposits, the 'erratics', *'roches moutonnées'*, and supposed glacial striations, however, is such that they merit a distinctive chronological 'compartment'. The term 'Pleistocene' is therefore retained as a 'stage' rather than an 'epoch' appellation, and is given that stature in the chronological revision summarised above in table 2C.

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Part Three

THE ENDURING MEMORY

1
TRADITIONS AND LEGENDS

In Part One we mentioned that numerous peoples all over the world have preserved ancient accounts apparently describing some of the tremendous catastrophic events which terminated the Pleistocene epoch. The study of such material, however, is fraught with difficulties, especially as it is basically unsusceptible to scientific tests or duplication, and the problem of attaching universally acceptable meanings to it a vexatious one. That alternative avenues of approach exist merely compounds the problem.

Probably the easiest and most naive method is to treat every account as a children's tale or an ingenious fabrication designed simply to instruct or entertain. Another method views all traditions as symbolical, in which case the identification of the symbols will vary from solar deities, nature spirits and guardian entities to rather vague concepts of good and evil reflective of fashions prevailing at different times. Yet another is to evaluate traditions as incredible profane or religious explanations of otherwise normal events inexplicable to early man. Still another approach categorises such material as fragmented memories of once-real people and events, and therefore as genuine echoes of primeval history. It would, of course, be wrong to presume that every tradition falls into just one of these categories. The strongest probability is that all the various approaches just outlined are valid for different groups of traditions.

At this juncture a particularly relevant factor, pinpointed as long ago as 1894 by Ignatius Donnelly, claims attention. Donnelly noted:

> ...we find the legends of the primitive American Indians adhering quite closely to the events of the past, while the myths that survive at all among the civilised nations of Europe are found in garbled forms, and only among the peasantry of remote districts[1].

This distinction between traditions preserved by primitive and cultured peoples is of considerable importance, particularly as many readers will appreciate that:

> Legend has one great foe to its perpetuation – civilisation. Civilisation brings with it a contempt for everything which it cannot understand; skepticism becomes the synonym for intelligence; men no longer repeat – they doubt, they dissect, they sneer, they reject, they invent. If the myth survives this treatment, the poets take it up and make it their stock-in-trade – they decorate it in a masquerade of frippery and finery, feathers and furbelows, like a clown dressed for a fancy ball; and the poor barbarian legend survives at last, if it survives at all, like the Conflagration in Ovid, or King Arthur in Tennyson – a hippopotamus smothered in flowers, jewels and laces...[2].

A further point concerns the superficial simplicity, even naivete, of many traditions. For the initial compilers and purveyors of traditions to convey in clear and unambiguous terms often quite elaborate original concepts and sagas to essentially illiterate mass audiences, it was necessary for these traditions to be presented in simplified or general form. The resultant statements were therefore frequently abrupt or terse, and tended to emphasise the more easily comprehended effects rather than technically complex causes – even assuming that those too were ever understood. Conversely, complicated

Table 3A

Geographical distribution of traditions of the Deluge and Great Catastrophe

A selection of the 500 or more known examples, compiled from numerous sources. The survivors of the Flood in all the legends range from a single individual to a small group. All seemed to have been forewarned of the impending disaster. They escaped by seeking high ground, trees, caves or by means of various objects which would float.

OLD WORLD

EUROPE

Britain: *Druidic*
Finland: *Finns*
Germany
Greece: *Ancient Greeks*
Iceland: *Norse sagas*
Italy: *Romans*
Lapland: *Lapps*
Lithuania
Russa: *Voguls*
Savoy
Scandinavia: *Norse traditions*
Sicily
Slavonia: *Slavs*
Spain
Transylvania
Wales: *Druidic Triads*

Asia
Afghanistan: *Afghans*
Andaman Islands
Arabia
Armenia
Assyria
Babylonia: *(Hasisadra or Xisuthrus), (Ut-Napishtim)*
Burma: *Chingpaws, Karens*
Cambodia & Lagos: *Bahnars, Bannavs*
Chaldea: *(Hasisadra)*
China: Yunnan: *Lolos*
India: Assam: *Ahoms, Anals, Lushais, Singpos;* Bengal: *Hos (Larka Kols), Kamars, Mumdas (Mundaris), Santahs;* Central India: *Bhilos, Kamars;* Kashmir: *Kashmiris*
Indonesia: Borneo (Kalimantan): *Ot-Danoms, Dusan, Dyaks;* Ceram: *Alfoors;* Sumatra: *Bataks, Engano, Nias;* Timor: *Roth;* W. Irian: *Mamberano*
Japan
Malaysia: *Benna Jakim, Kelantan*
Mergui Archipelago: *Selungs*
Mongolia
Palestine: *Phoenicians, Hebrews (scriptural sources: Genesis, Exodus, Job, Josua & Revelations)*
Persia
Philippines
Phrygia (Anatolia)
Siberia: *Buriats, Tatars, Kalmaks*
Sikkim
Sri Lanka: *Kalyani*
Sumer
Syria
Taiwan (Formosa): *Ami, Bunun and aboriginal tribes*
Tibet: *Lepcha*
Turkestan: *Bokharas, Tatars*

AFRICA

Bantu
Basutto (probably borrowed)
Bermagai
Carthaginians
Egyptians (several versions)
Hottentots
Kangas
Loangas
Massai (probably borrowed)
Ovahereros
Somalis
Sudanese
Wanyoros

AUSTRALASIA & OCEANIA

Australia: Queensland|: *Aborigines;* Victoria: *Kurnai, L. Tyres tribe*
New Zealand: *Maori*
Papua
Ociania: Micronesia, Melanesia, Polynesia
Fiji: *Fijians*
Hawaii: *Hawaiians*
Hudson Islands: *Nanumanghan*
Leeward Islands (incl. Tahiti)
Mangaia (Hervey) Islands
Marquesas Islands
New Hebrides
Pelew Islands
Samoa
Sandwich Islands
Society Islands

NEW WORLD

NORTH AMERICA

Aleuts (Aleutians)
Algonguins (incl. Foxes & Sacs)
Apaches (Arizona)
Arapaho
Ashochimi (California)
Athabascans (Canada)
Bella Coola (Canada)
Caddoque
Cayus
Cegiha
Cherokee
Chewkee
Chickasaws (Dakotas)
Chimakums (Washington)
Chippewa
Chocktaw (Oklahoma)
Cree (Canada)
Delaware
Dogrids (Canada)
Eskimo (Canada, Alaska, Greenland)
Gros-Ventres (Montana)
Haida (NW Pacific Coast)
Hareskin Indians (Canada)
Hopi (SW states USA)
Iroquois (North-east)
Kaska (Brit. Columbia)
Kathlamet
Kato (California)
Klamath (Oregon)
Kolush (Alaska)
Kinsteneax (Missouri)
Kootenay
Kwakiutls (NW Pacific Coast)
Lenni-Lenapes
Lilluets
Luisenos (California)
Loucheux (Dinjieh) (Brit. Columbia)
Maidu (California)
Maitaquais (Canada)
Makah (Washington)
Mandan
Muskwaki (Canada)
Natchez (Mississippi)
Nez-Perces
Ojidway (Canada)
Oraibi
Papagos (Arizona)
Pawnee
Pima (Arizona)
Quilentes (Washington)
Salishan (Okinagan) (Washington)
Shoshona (Colorado-Utah)
Slave Indians (Canada)
Snolionish (Puget Sound)
Snoqualmi (California)
South River Indians (California)
Southern Ute (California)
Taculli (Takahli) (Canada)
Tahoe Indians (Nevada)
Tchiglit (Tingit) (Alaska)
Thompson Indians (Canada)
Tinneh (several versions)
Tolowa (Oregon)
Tsimshian
Tuleyome Indians (California)
Ute (Colorado)
Washo (California)
Wichita (Oklahoma)
Wintun (California)
Wyandot
Yana (California)
Zuni (New Mexico)

CENTRAL AMERICA

Guatemala: *Maya*
Mexico: *Aztec, Maya, Mixtec, Toltec, Cora, Huichol, Michoacans, Tarahumare, Texpis, Zuni*
Nicaragua
Panama: *Cunas*
Salvador
Caribbean: *Caribs, Haitians*

SOUTH AMERICA

Argentina: *Araucanians, Tierra del Fuegans*
Brazil: *Aberderys, Bororo, Cabo Frio Indians, Caraga, Cashinaua, Caura, Chincha, Coroado (kainganag) Indians, Guarani, Ipuriana, Kataushy Indians, Maypures, Parray, Timanacs, Tupi*
Bolivia: *Yurucares*
Chile: *Araucas*
Colombia: *Chibcha or Muyscaya, Cuna*
Equador: *Carari, Jivaro*
Peru: *Chiriguana, Incas (several versions)*
Paraguay: *Mbocobi*
Venezuela: *Tamanaki*

VANISHED REGIONS

Atlantic: Atlantis
Central Asia: Gobi Sea
Indian Ocean: Lemuria
Arctic: Hyperborea
Pacific: Mu
North Africa: Tritonis

traditions (usually oriental) apparently developed to satisfy the more sophisticated tastes of court, temple and scholarly audiences – virtually the only educated elements in early societies – and mentioned causes (if at all) usually in allegorical or more specific terms.

Bearing these factors in mind we may now consider the general abundance, distribution and character of these ancient recollections of a huge world disaster. These, we shall find, mention numerous aspects and local details such as could be hardly imagined or invented had they not actually been witnessed or experienced. This feature of the traditions will become particularly prominent in Part Five of this book.

It is uncertain how many separate catastrophe traditions exist, although the total certainly amounts to many hundreds. They are broadly divisible into those which describe a terrible conflagration, and those which record an all-embracing flood, usually identified with Noah's Deluge. In almost every case, the conflagration is said to have preceded the flood, which then extinguished it.

With the exception of Antarctica, catastrophe traditions are known from every continent, the Americas furnishing the largest number and Africa the fewest (table 3A). Their geographical distribution reveals the absurdity of the efforts made in some quarters to show that the Deluge traditions were entirely derived from the scriptural story of Noah as disseminated by Christian missionaries. As a general explanation it fails miserably. Yet the notion of a vast flood was evidently so ingrained in human memory that it could not be forgotten[3]. It must, therefore, have been an event either of the most recent past or of exceptional proportions and severity.

An important feature in many of these traditions is that the cause of these calamities was one or more cosmic bodies, which in simple terms engaged in a 'war in heaven'. That such a seemingly preposterous idea is common in so many different legends raises the question as to why numerous often-unrelated peoples should even share such a remembrance when no such celestial 'war' has been observed in historical times. The only conclusion that can be arrived at is that the disaster described in these traditions did actually occur, and made such an indelible impression upon the few survivors of the event that accounts of it were carefully preserved down to our own times as the most enduring of memories.

In reviewing the cataclysmic saga represented by these legends, we shall briefly examine each of the main themes individually, as exemplified below.

2
CONFLAGRATION

The effects produced by a great world conflagration accompanying huge tectonic upheavals are graphically described in many traditions and written accounts, such as that bequeathed to us by Ovid. Ovid tells how a celestial body, called *Phaeton*, approaches Earth so that:

The earth bursts into flame, the highest parts first, and splits into deep cracks, and its moisture is all dried up. The meadows are burned to white ashes; the trees are consumed, green leaves and all, and the ripe grain furnishes fuel for its own destruction... great cities perish with their

> walls and vast conflagration reduces whole nations to ashes[4].

In his work *Theogony*, the classical Greek writer Hesiod clearly described the effects of this great conflagration which, preceding the Flood, was attributed to a celestial body called *Typhon* (another name for Phaeton). Another writer, Apollodorus, furnished further details stating that Typhon:

> ...out-topped all the mountains, and his head often brushed the stars... Such and so great was Typhon when, hurling kindled rocks, he made for the very heaven with hissing and shouts, spouting a great jet of fire from his mouth... at Mount Haemus he heaved whole mountains... a stream of blood gushed out of the mountain[5].

The Typhon legend was especially connected with pre-dynastic Egypt, where Typhon was also called *Set*[6], another name for the biblical *Satan*. The Roman writer, Pliny, described Typhon:

> A terrible comet was seen by the people of Ethiopia and Egypt, to which Typhon, the king of that period, gave his name; it had a fiery appearance and was twisted like a coil, and it was very grim to behold; it was not really a star so much as what might be called a ball of fire[7].

Strabo records that the Egyptian shore of the Red Sea was once called Typhonia[8]. Interestingly, an old Arab tradition asserts that: "...the Red Sea is simply water that did not dry up after Noah's Deluge"[9].

Other effects produced by the great heat associated with this conflagration are common to many flood traditions. For example, from Persia, we have the statement that: "The sea boiled, and all the shores of the ocean boiled, and all of the middle of it boiled"[10]. The cause of this heating was ascribed to the 'star' *Tistrya*, "the leader of the stars against the planets"[11] – note that more than one 'star' is indicated; and it was accompanied by an incredibly violent hurricane[12]. In another tradition, Tistrya: "...let a stream of fire flow toward the earth... (and) filled our world with its devouring heat"[13].

Several North American traditions refer specifically to the phenomenon of superheated water: "Great clouds appeared... such a great heat came, that finally the water boiled. People jumped into the streams and lakes to cool themselves, and died"[14]. Further south, on the Pacific coast, other Amerindian legends state that: "It grew very hot... many animals jumped into the water to save themselves, but the water began to boil"[15]. Although initially somewhat fanciful, these assertions will later be found to be entirely consistent with the chain of physical effects that such an appalling calamity must inevitably have engendered.

3
FLOOD

According to several traditions, there were two floods – the Flood of Deucalion and the Flood of Ogyges[16] – and many writers, both ancient and modern, confused by this, have tried to determine when these floods actually occurred. Was Noah's Deluge the Deucalion or the Ogygian Flood? Did the latter occur in the 5th millennium BC, and was the Flood of Deucalion an earlier event? Commyns Beaumont (Appian Way) is emphatic on this point:

> ...The story of Phaeton is undoubtedly the account of a very remarkable celestial event, which left behind it certain terrestrial effects. Tatian, Clement and Eusebius all agreed that the Phaeton event was identical with the Deucalion flood.[17]

The *Genesis* account of Noah's Deluge is, perhaps, the most familiar of all known Flood traditions, although when compared with other versions of the event it is obviously incomplete. It also gives no inkling as to its real cause, merely stating that it was divinely ordained. The *Book of Revelation*, however, associates the catastrophe with Satan as the cause of this[18], adding that, after a 'war in heaven', Satan was "cast out of heaven onto Earth", whereupon a great flood issued from his mouth and drowned the whole world.

The great Babylonian epic of Gilgamesh, from which the Biblical account of Noah's Flood is derived, or shared a common origin[19], contains details not included in the *Genesis* version. It refers to a great "hail from heaven" and a tremendous whirlwind or cyclone which "swept up to heaven" accompanying a flood that "swiftly mounted up... to the mountains"[20]. Sanskrit versions allude to the same effects[21].

Other flood traditions, examined more fully later, describe the Deluge as a veritable water-mountain, as a stupendous wall of water, or as an irresistible foaming watery avalanche. Few, if any, liken it to an ordinary, steadily rising, riverine flood. It was something special.

4
CELESTIAL DISORDER

In Ovid's account of this catastrophe, we learn that the Chariot of the Sun, driven by Phaeton, moved "no longer in the same course as before", that the horses pulling it broke "loose from their course" and "rushed aimlessly, knocking against the stars set deep in the sky and snatching the chariot through uncharted ways", and that the constellations of the Cold Bears tried to plunge into the ocean[22].

This description of stellar movement is exactly what an observer on Earth would see if the geographical poles were moving or, put another way, if an axial tilt was in progress. That this is what Ovid implied, is borne out later in his account when he wrote how Phaeton complained:

> ...the heavens are carried round with a constant rotation, carrying with them the lofty stars, and whirl them with rapid motion. Against this I have to contend; and that force which overcomes all other things does not overcome me, and I am carried in a contrary direction to the rapid world.[23]

Ancient Chinese texts also apparently confirm an axial derangement:

> ...the pillars supporting the sky crumbled and the chains from which the earth was suspended shivered to pieces. Sun, moon and stars poured down into the north-west, where the sky became low; rivers, seas and oceans rushed down to the south-east, where the earth sank. A great conflagration burst out. Flood raged. Wild beasts and terrible birds made men their prey...[24]

On the other side of the world, the Pawnee Indians of America preserved essentially similar memories of a remote time when the North Polar star and the South Polar star "changed places" or "went to visit each other"[25]; while, further north, the Greenland Eskimos informed early missionaries that ages ago the Earth "turned over"[26].

The consequence of a tilting of the terrestrial axis, as suggested in these traditions, would mean the displacement of the world's oceans. Several traditions actually refer to such dreadful effects:

> The ocean, too, is contracted, and that which lately was sea is a surface of parched sand, and the mountains which the deep sea has covered start up and increase the number of scattered Cyclades [islands]; the fishes sink to the bottom, and the crooked dolphins do not care to raise themselves on the surface for air as usual. The bodies of the sea-calves float lifeless on their backs on the top of the water.[27]

And:

> Why do the seas delivered to him by lot decrease, and why do they recede still farther from the sky? ...look around on either side, see how each pole is smoking; and if the fire shall injure them, thy palace will fall in ruins. See! Atlas himself is struggling, and hardly can he bear the glowing heavens on his shoulders.[28]

Another interesting account of world devastation is found in the ancient Norse texts, the *Elder Edda* and the *Prose Edda*, in the saga known as *Ragnarok*. The name itself is significant for, according to Anderson[29], it means 'the darkness of the gods'. However, Donnelly suggested that it could also mean *regn* = rain, and *rok* = smoke or dust, hence 'rain of dust' – the rain of dust, ashes, sand and stones mentioned in numerous legends from other countries[30].

This Norse saga implies, like Ovid's account, that at least two bodies were involved in the catastrophe, and passed close to Earth 'devouring' the sun and the moon:

> ***Then happens that which will seem a great miracle;***
> ***That the wolf devours the sun, and this will seem a great loss.***
> ***The other wolf devours the moon,***
> ***And this, too, will cause great mischief.***
> ***The stars shall be hurled from heaven.***

The effect of this 'mischief' was:

> ***Then it shall come to pass that the earth will shake so violently***
> ***That the trees will be torn up by the roots,***
> ***The mountains will topple down,***
> ***And all bonds and fetters will be broken and snapped.***
> ***The Fenris-wolf*** (the name given to one of the assailants) ***gets loose.***
> ***The sea rushes over the earth,***
> ***For the Midgård-serpent*** (the name of the other assailant) ***writhes in giant rage,***
> ***And seeks to gain the land.***

and: ***"As they ride over Bifrost it breaks to pieces..."*** (*Elder Edda*).

The location of *Bifrost* is uncertain, but later we will suggest its possible former geographical site.

Another important point in Ovid's account concerns Phaeton's direction of flight when nearest Earth:

> The moon, too, wonders that her brother's horses run lower than her own, and the scorched clouds send forth smoke.[31]

With the result that Phaeton's 'chariot' (apparently a cosmic companion) disintegrates:

> ...But the omnipotent father, having called the gods to witness, and him, too, who had given the chariot to Phaeton, that unless he gives assistance all things will perish in direful ruin, mounts aloft to the highest eminence... from which he moves his thunders, and hurls the brandished lightnings.
>
> He thundered aloud, and darted the poised lightning from his right ear, against the charioteer, and at the same moment deprived him both of life and his seat, and by his ruthless fires restrained the flames. The horses are afrighted, and, making a bound in the opposite direction, they shake the yoke from their necks, and disengage

themselves from the torn harness. In one place lie the reins, in another the axle-tree wrenched from the pole, in another part are the spokes of the broken wheels, and the fragments of the chariot torn in pieces are scattered far and wide. But Phaeton, the flames consuming his yellow hair, is hurled headlong, and is borne on a track through the air, as sometimes a star is seen to fall from the serene sky, although it really has not fallen[32].

This disintegration is remembered in many traditions. The Ute Indians of California state that it was the result of a conflict between two brilliant celestial bodies named *Ta-vi* and *Ta-wats*. Ta-vi, like Phaeton, is alleged to have roamed the heavens on an erratic course, but when it approached too close to Ta-wats a fight ensued and:

> ...the sun was shivered into a thousand fragments, which fell to earth causing a general conflagration. Then Ta-wats fled before the destruction he had wrought, and as he fled the burning earth consumed his feet, consumed his legs, consumed his body, consumed his hands and arms – all were consumed but the head alone, which bowled across valleys and over mountains, fleeing destruction from the burning earth, until at last, swollen with heat, the eyes of the god burst and the tears gushed forth in a flood which spread over the earth and extinguished the fire.[33]

That portions of objects engaged in celestial conflict fell to Earth is contained in many early traditions and writings. Herodotus states that the final struggle between Typhon and Zeus occurred over the coastal route from Egypt to Palestine[34]. Referring to Syrian memories of this drama, Strabo wrote that Typhon: "...when struck by the bolts of lightning fled in search of a descent underground"[35]. However, Apollonius Rhodius states that: "...smitten by the bolt of Zeus, [Typhon] lies whelmed beneath the waters of the Serbonian lake"[36].

Another facet recorded in some traditions concerns the fearful noise that accompanied this disintegration. A very early Arabian tradition mentions how the legendary 'Irem of the Columns' was, in one fateful day, destroyed by a thunderous noise and fiery blast from heaven[37]. Hindu texts contain another reference to these aerial explosions: "...the 'boar-form' (Phaeton) suddenly uttered a sound like the loudest thunder, and the echo reverberated and shook all the quarters of the Universe"[38].

5
TERRESTRIAL CHAOS

That Phaeton caused major changes to world topography is mentioned by many traditions. The Samoan islanders, for instance, assert that:

> ...The sea ...arose, and in a stupendous catastrophe of nature the land sank into the sea... The new earth [the Samoan Islands] arose out of the womb of the last earth.[39]

Likewise a Tahitian tradition states:

> In ancient times *Taaroa*, the principal god, according to their mythology, the creator of the world, being angry with

> men on account of their disobedience to his will, overturned the world into the sea, when the earth sank into the water, excepting a few *aurus* [projecting points] which remained above its surface, constituting the present clusters of islands.[40]

The last two traditions suggest that these Pacific islands were once part of a large now-vanished continent. A pre-Columbian Maya manuscript, known as the *Troana Codex*, apparently describes its destruction:

> ...there occurred terrible earthquakes, which continued without interruption until the 13th Chuen. The country of the hills of mud, the land of Mu, was sacrificed: being twice upheaved it suddenly disappeared during the night, the basin being continually shaken by the volcanic forces. Being confined, these caused the land to sink, and to rise several times in various places. At last the surface gave way and ten countries were torn asunder and scattered. Unable to stand the force of the convulsion, they sank with their 64,000,000 of inhabitants 8060 years before the writing of this book.[41]

Although little credence is usually given to this account, Hawaiian traditions maintain:

> The belief of the Hawaiians of ancient times was that there was one great continent, stretching from Hawaii, including Samoa, Lalakoa (the Hawaiian version of Rarotonga) and reaching as far as New Zealand, also taking in Fiji, and there were some lowlands in between these higher lands. All this was called by one name *Ka-houpo-o-Kane*, the Solar-Plexus of Kane, and was also called *Moana-nui-kai-oo*, the Great Engulfing Ocean.[42]

The Mixtecs of Mexico in their myths speak of a now-vanished land to the east of the present American coast:

> ...In a single day all was lost, even the mountains sank into the water... subsequently there came a great deluge in which many of the sons and daughters of the gods perished.[43]

This reference to the submergence of extensive land in the Atlantic Ocean suggests that it might have been the Atlantis of Plato's *Timaeus* and *Critias*. In a lengthy narrative, Plato wrote:

> The ocean (Atlantic) there was at that time navigable; for in front of the mouth which you Greeks call, as you say, 'the Pillars of Heracles', there lay an island which was larger than Libya and Asia (Asia Minor) together; and it was possible for the travellers of that time to cross from it to the other islands, and from the islands to the whole of the continent over against them which encompasses that veritable ocean... Yonder is a real ocean, and the land surrounding it may most rightly be called, in the fullest and truest sense, a continent. Now in this island of Atlantis there existed a confederation of kings, a great and marvellous power, which held sway over all the island, and over many other islands also and parts of the continent; and, moreover, of the lands here within the Straits (of Gibraltar) they ruled over Libya as far as Egypt and over Europe as far as Tuscany...
>
> At a later time there occurred portentous earthquakes and floods, and one grievous day and night befell them, when the whole body of... the island of Atlantis was swallowed up by the sea and vanished; wherefore also the ocean at that spot has now become impassable and unsearchable, being blocked up by the shoal mud which the island created as it settled down.[44]

Referring to this last statement, Babcock remarked: "It must be evident that Plato would not have written thus unless he relied on the established general repute of that part of the ocean for difficulty of navigation[45].

References to what may also have been a former continent in the Indian Ocean occur in several south Asian traditions. One from Sri Lanka avers:

> ...in a former age the citadel of Rawana, 25 palaces and 400,000 streets were swallowed by the sea... The submerged land was between Tuticoreen and Manaar, and Manaar is all that is now left of what was once a large territory. This legend, notwithstanding the manifest exaggeration as to the extent of the injury, may be founded on fact, as the Hindu and other nations have a similar tradition, and suppose that 'Ceylon was then much larger than it is at present'.[46]

Even the Selungs of the Mergui Archipelago (off southern Burma) refer to such a continent:

> ...formerly their country was of continental dimensions. But the daughter of an evil spirit threw many rocks into the sea. Thereupon the waters rose and swallowed up all the land. Everything alive perished, except what was able to save itself on one island that remained above the waters. The forefathers of the Selungs then practised great magic and this caused the waters to fall. Then other islands arose which the Selungs have inhabited ever since.[47]

The impression gained from reading such traditions is one of actual eye-witness reports of the catastrophe. Thus the Kato Indians of California describe how:

> Every day it rained, every night it rained. All the people slept. The sky fell. The land was not. For a very great distance there was no land. The waters of the oceans came together. Animals of all kinds drowned. Where the water went there were no trees... Human beings and animals alike had been washed away... It was very dark...[48]

Among the Hopi Indians of the American south-west are echoes of a similar memory in which, rather interestingly, there is mention of violent seismic activity. The account asserts that the 'big water serpent deity' was angry and:

> ...turned the world upside down, and water spouted up through the *kivas* [sunken sacred dwellings] and through the fireplaces of houses. The earth was rent in great chasms, and water covered everything except one narrow ridge of mud; and across this the serpent deity told all the people to travel. As they journeyed across, the feet of the bad slipped and they fell into the dark water, but the good, after many days, reached dry land...[49]

Although mainly localised, many traditions clearly refer to great seismic activity. For example, from Peru we learn:

> Legend says that in those days of the jaguar-faced gods called *huaca*, the Andes were split apart and the *callejon* was formed, when the sky made war on the earth.[50]

And from Brazil:

> The lightnings flashed and the thunders roared terribly and all were afraid. Then the heaven burst and the fragments fell down and killed everything and everybody. Heaven and Earth changed places. Nothing that had life was left upon the earth.[51]

Perhaps the most remarkable of all such records is that of the Zuni Indians, which graphically describes the aftermath of the catastrophe:

> As it was with the men and the creatures, so it was with the world. It was young and unripe. Unstable its surface was, like that of a marsh; dank, even the high places like the floors of a cavern, so that seeds dropped on it sprang forth, and even

the substance of offal became growing things.

Earthquakes shook the world and rent it... Creatures turned fierce, becoming beasts of prey, wherefore others turned timid, becoming their quarry; wretchedness and hunger abounded, black magic, war and contention entered when fear did into the hearts of men and creatures. Yea, fear was everywhere among them, wherefore, everywhere the people, hugging in dread their precious possessions, became wanderers... living on the seeds of grasses, eaters of the dead and slain things..!

Dread was the din and stir. The heights staggered and the mountains reeled, the plains boomed and crackled under the floods and fires, and the high hollow places [caves], hugged of men and the creatures, were black and awful, so that these grew crazed with panic and strove alike to escape or to hide more deeply. But erewhile they grew deafened and deadened, forgetful and asleep. A tree lighted of lightning burns not long.

Presently thick rain fell, quenching the fires; and waters washed the face of the world, cutting deep trains from the heights downward, and scattered abroad the wrecks and corpses of stricken things and beings, or burying them deeply. Lo! they are seen in the mountains to this day; and, in the trails of those fierce waters, cool rivers now run, and where monsters perished lime of their bones [*aluwe* – calcareous nodules in malpais or volcanic tuff: F H Cushing] we find, and use in food stuff. Gigantic they were, for their forms little or great were often shrivelled or contorted into stone. Seen are these also along the depths of the world. Where they huddled together and were blasted thus, their blood gushed forth and flowed deeply [due to sudden raising of temperatures to abnormal levels rupturing blood vessels?], here in rivers, there in floods; but it was charged and blistered and blackened by fires, into the black rocks of the lower *mesas apkwina*, lava or malpais: F H Cushing].

There were vast plains of dust, ashes and cinders, reddened as in the mud of a hearth-place. There were great banks of clay and soil burned to hardness – as clay is when baked in the kiln-mound – blackened, bleached or stained yellow, grey, red or white, streaked and banded, bended or twisted. Worn and broken by the heavings of the underworld and by the waters and breaths of the ages, they are the mountain-terraces of the Earth-Mother, 'dividing country from country'. Yet many were the places behind and between these – dark canyons, deep valleys, sunken plains – unharmed by the fires, where they swerved or rolled higher – as, close to the track of a forest fire, green grow trees and grasses, and even flowers continue to bloom. Therein... tarried the people. Dry and more stable was the world now, less fearsome its lonely places; since changed to rock were so many monsters of prey, some shrivelled to the size of insects; made precious as amulets for the hunter and warrior, as told in other talks of our ancient speech".[52]

Prof J W Gregory recorded native folklore from all along the Great Rift Valley in Africa, which refers to a remote period characterised by immense physical changes. He observed:

> ...The Somali say that when their ancestors crossed from Arabia to Africa there was a land connection between the two, across the Straits of Bab-el-Mandeb. The natives of Ujiji, at the southern end of the line, have a folklore that goes back to the time when Lake Tanganyika was formed by the flooding of a fertile plain, rich in cattle and plantations... There is geological evidence to show that great earth movements have happened along this Rift Valley, as it may be termed, at a *recent* date, which makes it distinctly probable that these traditions are recollections of geographical changes.[53] (Our italics).

6
Darkness

Many catastrophe traditions refer to the coming of unnaturally prolonged darkness. The Central American Aztecs preserved such an account:

> The third sun is called *Quia-Tonatiuh,* sun of rain, because there fell a rain of fire; all which existed burned; and there fell a rain of gravel. Now, this was in the year *Ce Tecpalt,* One Flint, it was the day *Nahui-Quiahuitl,* Fourth Rain. Now in this day, in which men were lost and destroyed in a rain of fire, they were transformed into goslings; the sun itself was on fire, and everything, together with the houses was consumed.[54]
>
> ....a tremendous hurricane that carried away trees, mounds, houses and the largest edifices, notwithstanding which many men and women escaped, principally in caves and places where the great hurricane could not reach them. All this time they were in darkness, without seeing the light of the sun, nor the moon, that the wind had brought them.[55]

And:

> After the destruction of the fourth sun, the world plunged into darkness during the space of twenty-five years. Amid this profound obscurity, ten years before the appearance of the fifth sun, mankind was regenerated.[56]

In British Columbia, Canada, the Akawais remember in their traditions a period of prolonged darkness, and the intense cold it caused, at the time of an immense world-sculpting flood[57].

Commenting on this phenomenon de Bourbourg remarked:

> A vast night reigned over all the American land, of which tradition speaks unanimously: in a sense the sun no longer existed for this ruined world which was lighted up at intervals only by frightful conflagrations, revealing the full horror of their situation to the small number of human beings that had escaped from these calamities.[58]

Japanese and Hawaiian traditions recall a time of continuous darkness too[59]. An ancient Hawaiian rhyme runs:

> ***The earth is dancing...***
> ***Let darkness cease...***
> ***The heavens are enclosing...***
> ***Finished is the world of Hawaii.***[60]

In Samoan traditions low clouds appear to have enveloped the world and plunged it into darkness. It was during this period that the islands of Samoa, Tonga, Rotuma, Wallis and Fotuna were upheaved from the bed of the ocean[61]. During these events, the Samoans insist that the "heavens fell down" and were so low that people could not stand upright without touching them – a belief also held by Amerindian nations and the Dusan tribe of Borneo[62].

7
Hail and Fire

Several traditions associate great falls of hail, ice, fire, dust and other substances with the aforementioned calamities, and clearly accord them celestial origins. Thus, in one account we read:

> And every island fled away and the mountains were not found. And there fell upon men a great hail out of heaven, every stone about the weight of a talent: and men blasphemed God because of the plague of hail; for the plague thereof was exceeding great.[63]

These were not icy hailstones, but probably the 'stones of barad' crashing out of the sky and mentioned in the *Book of Joshua*. But the coming of ice is referred to in the *Old Testament*:

> *From whose womb did the ice come forth,*
> *And who has given birth to the hoarfrost*
> *of heaven?*
> *The water became hard like stone,*
> *And the face of the deep is frozen.*[64]

From Finland, the epic *Kalevala* describes falls of 'hailstones of iron' from the sky when the sun and moon had 'disappeared', and the world was sprinkled with 'red milk'[65]. This 'red milk' or 'blood' appears in many other legends (*eg*, Mount Haemus) relating to this catastrophe and appears to have a scientific explanation, which will be referred to later.

It would seem that the ancients considered the destruction of Adamite man to have come from heaven in the form of fire, torrential rain, stones and ice.

8
Ice-bound

As previously mentioned, the formation of widespread ice was indicated in the *Old Testament*. More interestingly the Norse sagas provide fuller details of the onset of such conditions *following* the departure or demise of the Fenris Wolf and Midgård Serpent:

> First there is a winter called the Fimbul winter, the mighty, the great, the iron winter, when snow drives from all quarters, the frosts are so severe, the winds so keen, that there is no joy in the sun. There are three such winters in succession, without any intervening summer... as soon as the streams that are called *Elivogs* [rivers from under ice] had come so far that the venomous yeast which flowed with them hardened, as does dross that runs from the fire, then it turned into ice. And when this ice stopped and flowed no more, then gathered over it the drizzling rain that arose from the venom and froze into rime, and one layer of ice was laid upon another

clear into *Ginungagap*. All that part of Ginungagap that turns to the north was filled with thick and heavy ice and rime, and everywhere within were drizzling rain and gusts. But the south part of Ginungagap was lightened up by the glowing sparks that flew out of Muspelheim. (*Prose Edda*).

Again, the location of Ginungagap is uncertain. It may, however, have stretched from Norway to the north and west, or connected Greenland and Vinland (North America)[66].

Numerous other traditions could be cited which refer to a period of sudden grim cold afflicting early Man, although those mentioned must suffice.

9
THE TRADITIONS ASSESSED

Undoubtedly the scientific acceptability of these ancient recollections as genuine evidence for the reality of former events is decidedly limited, since by their very nature they are inherently unscientific. Nevertheless, these same memories, when assessed collectively, consistently appear to describe a most amazing episode of Earth history upon which orthodoxy, represented by astronomy, geology and archaeology, has so far remained largely silent. It is, in fact, this internal consistency of these memories which – irrespective of the original geographical or cultural source of the material – is so impressive. Whatever else may be thought of these traditions it is certain that they cannot just be swept aside as being of no consequence, for, within their limitations, they constitute an eloquent testimony to a truly momentous chapter of events.

Table 3B summarises major issues traceable in the traditions globally. If these traditions constitute racial memories and eye-witness accounts of the same enormous topographical changes as have been discussed in Part One, and the terrible biological extinctions and decimations reviewed in Part Two, they represent highly important supplementary records of those calamitous events. Indeed, they form the third prong of a trident-like register comprising geology/palaeontology, botany/zoology and tradition/legend. That all three tell virtually the same story is surely not fortuitous!

Table 3B

Traditions specifying particular catastrophic effects. Europe and Asia

Aerial falls: hail, gold, gravel, stones, dust	Aerial falls: combustible/resinous materials	Aerial falls: ferruginous substances	Effects on vegetation	Axial/rotational changes	Boiling rivers/lakes/oceans	Break-up and fall of celestial visitor	Collapsed sky	The coming of ice	Conflagration/firestorm	Cyclonic winds	Deluge/flood	Description of celestial visitor	Lightning	Poisoned atmosphere	Prolonged darkness	Steam	Stellar derangement	Thunder/noise/din	Topographical changes	Records of lost lands and lakes	References to pre-Diluvian civilisation		
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Table 3B (Continued)

Traditions specifying particular catastrophic effects. The Americas

Aerial falls: hail, gold, gravel, stones, dust	Aerial falls: combustible/resinous materials	Aerial falls: ferruginous substances	Effects on vegetation	Axial/rotational changes	Boiling rivers/lakes/oceans	Break-up and fall of celestial visitor	Collapsed sky	The coming of ice	Conflagration/firestorm	Cyclonic winds	Deluge/flood	Description of celestial visitor	Lightning	Poisoned atmosphere	Prolonged darkness	Steam	Stellar derangement	Thunder/noise/din	Topographical changes	Records of lost lands and lakes	References to pre-Diluvian civilisation		
□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□	ALASKA: Kolushes	NORTH AMERICA
□	□	□	□	□	□	□	□	□	■	■	■	□	□	□	□	□	□	□	□	□	□	Tlinkits	
□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□	ALEUTIAN Is	
□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□	ARIZONA: Papagos	
□	□	□	□	■	□	□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□	Pawnees	
□	□	□	□	□	□	□	□	□	□	□	■	□	■	□	□	□	□	■	□	□	□	Pimas	
□	□	□	□	□	■	□	■	□	■	□	■	□	□	□	□	□	□	□	□	□	□	BR COLUMBIA: Kaska	
□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□	Loucheux	
□	□	□	□	□	□	■	□	□	□	■	■	□	□	□	□	□	□	■	■	□	□	Okanagan	
□	□	□	□	□	□	□	■	□	□	□	■	□	□	□	■	□	□	□	■	□	□	CALIFORNIA: Katos	
□	□	□	□	□	□	■	□	□	■	□	■	□	□	□	□	□	□	□	□	□	□	Southern Utes	
□	□	□	■	□	□	■	■	□	■	■	■	□	□	□	□	■	□	■	□	□	□	Wintun	
□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	COLORADO: Utes	
□	□	□	□	□	□	□	□	■	□	□	■	□	□	□	□	□	□	□	□	□	□	DAKOTAS: Chickasaws	
□	□	□	□	□	□	□	□	□	□	□	■	■	□	□	□	□	□	□	□	□	□	Delaware Indians	
□	□	□	□	■	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	GREENLAND: Eskimos	
□	□	■	□	□	□	□	□	□	■	□	■	□	□	□	□	□	□	□	■	□	■	NEVADA: Tahoe Indians	
■	□	□	■	□	□	□	□	□	■	□	■	□	□	□	□	□	□	■	■	□	□	NEW MEXICO: Zunis	
□	□	□	□	□	□	□	■	□	□	□	■	□	□	□	□	□	□	□	□	□	□	N.W. PACIFIC COAST: Haida	
□	■	□	□	□	□	□	□	□	□	□	■	□	■	□	■	□	□	■	□	□	□	OKLAHOMA: Chocktaws	
□	□	□	□	■	□	□	□	□	■	□	■	□	□	□	□	□	□	□	■	□	□	S.W. STATES: Hopi	
□	□	□	□	□	■	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□	WASHINGTON: Chimakums	
□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□	Chippewas	
□	□	□	□	□	■	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□	Makahs	
□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□	Mandans	
□	□	□	□	■	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□	□	Quilentes	
■	■	□	□	□	□	□	■	□	■	□	■	□	□	□	■	□	□	□	■	□	□	MEXICO/: Aztec	MESO-AMERICA
□	■	□	□	□	□	□	□	□	■	□	■	□	□	□	■	□	□	■	■	■	■	GUATEMALA: Maya	
□	□	□	□	□	□	□	□	□	■	□	■	□	□	□	□	□	□	□	■	■	■	Mixtec	
□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	■	□	CARIBBEAN: Caribs	
□	□	□	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□	□	NICARAGUA	
□	□	□	□	□	□	□	□	□	□	□	■	□	■	□	□	□	□	■	□	□	□	ARGENTINA: Araucanians	SOUTH AMERICA
□	□	□	□	□	□	□	□	□	□	□	■	□	■	□	□	□	□	■	□	□	□	BRAZIL: Aberdervs	
□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□	Botocudos	
□	□	□	□	■	□	■	□	□	□	□	□	□	■	□	□	□	□	■	■	□	□	Cashinaua	
□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□	□	□	□	□	Coroado	
□	□	■	□	□	□	□	□	□	□	□	■	□	□	□	■	□	□	■	■	□	□	Ipurianas	
□	□	■	□	□	□	□	□	□	□	□	■	□	□	□	■	□	□	■	□	□	□	Kataushi	
□	□	■	□	□	□	□	□	□	□	□	■	□	□	□	■	□	□	■	■	□	□	Parrays	
□	□	□	□	□	□	□	□	□	■	□	■	□	□	□	□	□	□	□	□	□	□	Tupis/Guaranis	
□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	BOLIVIA: Yurucares	
□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□	COLOMBIA: Chibchas	
□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□	EQUADOR: Cararis	
□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	■	□	□	GUIANAS: Caribs	
□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□	Macusis	
□	□	□	□	□	□	□	□	□	■	□	■	□	□	□	■	□	□	□	□	□	□	PANAMA: Cunas	
□	□	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	■	□	□	□	□	PARAGUAY: Mbocobi	
□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	■	□	■	□	■	□	□	PERU: several accounts	
□	□	□	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□	□	VENEZUELA	

Table 3B (Continued)

Traditions specifying particular catastrophic effects. Australasia, Oceania and Africa

Region	People	Aerial falls: hail, gold, gravel, stones, dust	Aerial falls: combustible/resinous materials	Aerial falls: ferruginous substances	Effects on vegetation	Axial/rotational changes	Boiling rivers/lakes/oceans	Break-up and fall of celestial visitor	Collapsed sky	The coming of ice	Conflagration/firestorm	Cyclonic winds	Deluge/flood	Description of celestial visitor	Lightning	Poisoned atmosphere	Prolonged darkness	Steam	Stellar derangement	Thunder/noise/din	Topographical changes	Records of lost lands and lakes	References to pre-Diluvian civilisation
AUSTRALASIA & OCEANIA	AUSTRALIA: Aborigines	□	□	□	□	□	□	□	□	□	■	□	■	□	□	□	□	□	□	□	□	□	□
	Kurnia	□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□
	Lake Tyers Tribe	□	□	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□	□	□
	FIJI	□	□	□	□	□	□	□	□	□	■	□	■	□	□	□	□	□	□	□	□	□	□
	HAWAII	□	□	□	□	□	□	□	■	□	□	□	■	□	□	□	□	□	■	□	■	■	□
	LEEWARD Is: Tahitians	□	□	□	□	□	□	□	□	□	■	□	■	□	□	□	□	□	□	□	■	□	□
	NEW ZEALAND: Maoris	□	■	□	□	□	□	□	□	□	■	■	■	□	□	□	□	□	■	□	■	□	□
	PAPUA	□	□	□	□	□	□	□	□	□	■	□	■	□	□	□	□	□	□	□	□	□	□
	SAMOA	□	■	□	□	□	□	■	■	□	■	□	■	□	□	□	□	□	□	□	■	□	□
	POLYNESIA: general	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□	□
AFRICA	Bantus	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□
	Bermagai	□	□	□	□	□	□	□	□	□	■	□	■	□	□	□	□	□	□	□	□	□	□
	Egyptians	□	□	□	□	□	□	□	□	□	■	□	■	□	□	□	□	□	□	□	□	□	□
	Hottentots	□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□
	Kangas	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□	□	□	□	□
	Loangas	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□	□	□	□	□
	Masai & Basutos	□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	■	□	□
	Ovahereros	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□	□	□	□	□
	Somalis	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	□	□
	Sudanese	□	□	□	□	□	□	□	□	□	■	□	□	□	□	□	■	□	■	□	■	□	□
	Wanyoros	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□

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Part Four

THE COSMIC CONFLICT

1
An 11,500 years old Trail

Earlier pages have presented massive geophysical, biological and climatological evidence which, together with certain subsidiary traditional material, indicates that a major catastrophe struck this planet approximately 11,500 years ago. Quite a large number of details indicative of such a date have been cited to provide a general temporal framework within which other associated aspects of the event and its apparent geological youthfulness can be better assessed. Yet is the message of these cited dates actually true or mere deception? Indeed, what evidence if any genuinely exists which validates even a general date for this calamity?

Several avenues of approach exist which permit us to pinpoint with reasonable confidence not only the probable century but, rather surprisingly, the time of year when this debacle occurred.

Viewed scientifically, the most reliable line of enquiry involves our ability to Carbon-14 date with very fair accuracy the remains of countless animals and plants overwhelmed by the event. Conventionally, of course, these remains are commonly assigned a 'late Pleistocene' antiquity and the many radiocarbon dates they have yielded (see Appendix B) are usually regarded as marking the final Weichselian/Wisconsinian phase of alleged 'Ice Age' times (see table 1A).

What, however, are radiocarbon dates?

In 1939, Serge Korff discovered the existence of radiocarbon. He noticed that cosmic neutrons, on reaching Earth's upper atmosphere from outer space, produced secondary neutrons on their initial collision with the naturally pre-existing nitrogen occurring at high altitude. Korff predicted that the neutrons, on colliding with the abundant isotope Nitrogen-14, would react to release a proton and form radioactive Carbon-14 (C^{14}). This carbon, he reasoned further, would then combine with oxygen to produce $C^{14}O_2$, which is ultimately absorbed by all living matter. Plants absorb it through photosynthesis, and animals (if they are herbivorous) by consuming plant-food or (if they are carnivorous) by devouring herbivores who habitually ingest Carbon-14-impregnated plant-food. New C^{14}, furthermore, is continuously added to the Earth's supply about as rapidly as the old dissipates.

During the years immediately following World War II, Dr W F Libby developed and refined Korff's method, one of the fundamental premises of which is the assumption that, when an organism dies, it ceases to assimilate C^{14}, and the radiocarbon already present within it decays without further C^{14} replacing it.

The rate of decay, or number of disintegrations per minute when measured by a Geiger counter, decreases with the increasing age of the sample concerned, with only one half of the original number occurring when the C^{14} is 5,568 (±30) years old. This is the 'half-life' of Carbon-14. With so brief a half-life it is obvious that the process represents a radioactive clock, of enormous importance and value to the prehistorian concerned with events no older than about 50,000 years. As geological phenomena and organic remains relegated to late 'Ice Age' times mostly fall within a span of time appreciably younger than this critical 50,000-year datum, C^{14} is clearly an exceptionally useful tool for determining with fair precision the actual ages of the remains of individual plants and animals collected from this segment of Earth history.

While C^{14} appears, theoretically, to be an ideal dating technique, it has not always proved so in practice. It has certain drawbacks. Far from being a simple laboratory process, various factors exists which sometimes profoundly affect results, particularly those concerning material older than 5,000 years or so ago. Originally it was assumed that the rate of cosmic neutron arrival was constant. If that were so, then the rate of C^{14} production and the rate of C^{14} decay would have reached a natural balance long ago. This has not occurred. It has, in fact, been established that C^{14} production has fluctuated appreciably during the last 6,000 years[1], even though the *rate* of decay has probably remained unchanged. Similar fluctuations may also have occurred at other times during the last 50,000 years *before* the last six millennia.

Hence, organic remains relegated to the aforementioned period quite often exhibit significant discrepancies between the C^{14} levels they contain, with consequent effect on the dates derived from these. Not unexpectedly, the variation becomes progressively larger the older the material involved. Notwithstanding such factors, many previous writers used C^{14} dates to determine the time when the 'Pleistocene' epoch ended and the Holocene began. Broadly speaking, the resultant dates exhibit remarkable general unanimity.

Those obtained for late Weichselian terrestrial plants and marine shells from various localities in north-western Europe by Mangerud and Gullikson all fell within the period (13,000–11,000 years BP[2]), while a strikingly similar date – 13,500–11,000 years BP, based solely upon an interpretation of C^{14} dated geological features – was established for the demise of a 'late Pleistocene' mastodon discovered in peat-bog deposits near Michigan City, Indiana, USA[3]. (These 'Before Present' dates are measured, more precisely, from AD 1950, the date chosen by a Cambridge conference in 1962). These agreed closely with the average C^{14} date – 11,335 (±170 years) BP – of organic remains collected from the basin of the Yenisei River in Siberia, and thought to possibly date from earliest Holocene times[4].

Although nineteen C^{14} dates, ranging from 12,168 (±1,500 years) BP to 10,090 (±140 years) BP yielded by animal and plant remains scattered across the northern hemisphere gave a mean age of 10,918 years BP for the end of the Ice Age in which the original organisms supposedly lived, this date was felt to be "probably about 300 years too low"[5]. The appropriately adjusted date, 11,218 years BP, compared favourably with the 'average' Siberian date noted above, and suggests that the latter was probably very 'late Pleistocene' rather than early Holocene.

11,218 years BP also agrees well with the "within a few centuries of 11,300 BP" date advocated by Webb and Bryson for important climatic and botanical changes traced at the end of the supposed 'late glacial' episode in northern Mid-West USA[6]. Again, the final 'deglaciation' of Airport Lake on Unmak Island in the Aleutians has been likewise dated as occurring between 12,000 and 11,000 years BP[7], and of the southern flanks of the Brooks Range on mainland Alaska at approximately 11,800 years BP[8].

Almost identical 'general' C^{14} dates have been obtained for a variety of significant physical and biological changes traceable all over the southern hemisphere. Thus, a sea level rise around Nelson Bay, Cape Province, South Africa, coincided with the disappearance of dominant grassland on the adjacent hinterland sometime between 12,000 and 11,000 years ago[9]. Further eastward, during the *same* time interval, rain forests rapidly expanded across north-eastern Queensland, Australia, simultaneously with an increase in rainfall (100–175% more than experienced there today) which also affected West Irian (New Guinea) to the north, and the east African countries of Uganda and Kenya[10].

Not surprisingly, such climate changes induced variations in growth patterns among various organisms. Thus, very 'late Quaternary' marine bivalves from Arctic Canada exhibit marked variations in the oxygen and carbon isotopic compositions of their shells[11], signifying the occurrence then of profound sea-temperature changes too[12].

Suffice it here to say that globally scattered datable material, universally regarded as of terminal 'Pleistocene' or earliest Holocene age, and as diverse as the remains of vertebrates, molluscs, plants, geological features, climatic and oceanic changes, so-called 'deglaciation' processes, and isotopic growth patterns in bivalves, everywhere points to the same 'general' date of 11,500 years BP. The additional evidence comprising the bulk of Appendix B substantiates that conclusion very forcefully.

Of special importance is the fact that the host of individual studies which have contributed to this 'general' date have been conducted independently on different material from widely-sundered localities over a period of several decades in different continents, both north and south of the equator. The result are thus not only broadly-based but stress the remarkable consistency of this class of evidence.

Yet, irrespective of the enormous scientific promise of radiocarbon dating generally, the very process embraces special problems. One of these is the contamination of samples worldwide by the release of atomic particles into the atmosphere since nuclear bomb tests began in 1945. Allowances have therefore to be made for the fact that "since 1962 atomic bomb testing has completely disturbed the natural C^{14} activity"[13]. Today, this element has always to be allowed for when new radiocarbon datings are calculated[14]

Other anomalies also sometimes occur. The following selection of these is worth considering, if only to demonstrate the many difficulties confronting scientists specialising in Quaternary chronologies. Some of the details are most instructive.

Certain mammoth remains from gravel deposits in east Norway have furnished C^{14} dates ranging from 19,000 years BP to more than 46,000 years BP. The gravels, however, apparently date from so-called terminal 'Pleistocene' times, so the interpretation of evidence like this must be that "...all the remains have been redeposited and lie in young deposits"[15]. Again, foraminifera in organically-rich 'late Pleistocene' mud cored at Santa Cruz, California, are seemingly much older than the mud itself. The conclusion must be that these organisms were entombed in it by an agent which *eroded* them out of some older stratum and reburied them when it deposited the mud[16].

Analogous cases involve timber debris. Radiocarbon dated wood from channel infill deposits on the floor of the North Sea, for example, appear to be considerably older than the host sediments[17]. In USA, coniferous wood from 'drift' deposits at Appleton, Wisconsin, yielded a date of 12,000 ±300 years BP when processed in 1965, whereas earlier attempts to date the *same* piece of wood produced *entirely different* dates – 10,856 ±410 years, 11,471 ±500, 10,241 ±650 and 11,830 ±100 years BP[18].

A comparable instance concerned wood collected from late Wisconsonian silt at Ready Bullion Creek, Alaska. One piece of wood was dated at 11,000 ±350 years BP, while a tree-root found at the *same* horizon at the *same* site turned out to be appreciably younger – 10,450 ±150 years BP[19] – younger in fact than the supposed antiquity of the deposits enveloping it. Theoretically the dates of remains occupying the *same* geological horizon at the *same* site should have been *much* closer than those actually determined.

Reviewing examples of anomalous botanical C^{14} dates like those just noted, Dr George Carter once observed that terrestrial plants differ in their carbon intake according to their individual ecological situation. Forest plants, for instance, differ from those in open countryside in their amount of isotope carbon. He also wondered if different parts of a plant differ in the amount of Carbon-14 that they naturally absorb[20]. The evidence of the various plant remains just listed suggests that this might very well be the case and that it could also have been so in the distant past as well.

Pollen sequences are often regarded as providing an unambiguous climatic record over the last 15,000 years or so. There are, however, definite limitations to the accuracy of its actual dating[21]. Between 1,500 and 20,000 years the accuracy of its dating is usually held to be ±250 years[22], although this may be an optimistic assessment. For example, pollen found in an area of West Angle Bay, Ireland, indicated *cool* conditions, whereas pollen taken from the *same* deposit in a nearby area indicated *fully temperate* conditions[23].

Other anomalous results involving dated pollen samples are known. One instance, a bog sample procured from below remains of a Romano-British archaeological site of known date gave a C^{14} date one thousand years too old[24]. This result was probably generated by the presence of an unknown quantity of 'dead' Carbon-12 (C^{14}) in the sample tested, which is liable to dilute the equilibrated mixture of C^{14} and C^{14} [25]. Variations in such mixtures within individual samples could, as at West Angle Bay, produce contradictory results. It is still a matter of debate whether the Irish deposit was formed under cool or fully temperate conditions, an uncertainty inevitably having a bearing upon the precise character of the former environmental background of that region. Radiocarbon dates can not only spring surprises but sometimes multiply uncertainties.

Again, aquatic plants and land, freshwater and marine shells are prone to providing misleading radiocarbon dates due to the fact that they may incorporate, through the watery media in which they live, deficient (old) C^{14} as all or part of their original carbon content, thus giving dates which are too old[26]. The distribution of radiocarbon in the oceans lies in the mixing zones between the upper and deeper water layers, which exhibit great differences in carbon dioxide content. This category of material can even be contaminated in laboratories from foreign carbon in the atmosphere and water supply[27], so that, due to these and possibly yet other variables, "...with samples older than 15,000 BP, errors in dating and correlations are so large that errors in apparent ages of some hundreds of years are of minor importance"[28]. At least one case is known where the error amounted to no less than 12,000 years!

Worse still, shells taken from the same vertical section of an infinitely more recent burial mound in south-eastern USA produced dates which "came out in the reverse order of age"[29].

The shells of molluscs also sometimes yield wildly incompatible dates. Separately C^{14}-dated fractions of the *outer* shell of a so-called 'late Pleistocene' pelecypod from Furry Creek, British Columbia, for example, turned out to be 11,080 ±160 years old, whereas fractions of the *inner* shell of the *same* specimen gave a C^{14} date of 11,300 ±190 years BP[30], a difference of approximately 300 years – for the same specimen!

Significant differences unquestionably exist between the isotopic composition of plants and animals, and C^{14} dating of their remains generally reflects this (see Appendix B), even when applied to contemporary biota.

Thus, blood and fat from the celebrated frozen mammoth cadaver found at Beresovka in Siberia afforded a C^{14} date of about 39,000 years BP[31], whereas pollen and plant fragments taken from its stomach (logically, the remains of its last meal) gave an unexpectedly young date somewhere between 7,000 and 6,000 years ago[32]. It is probable that both these seriously-conflicting dates are erroneous, and that the mammoth and the remnants of its last meal are of the same general antiquity as the frozen mammoth carcass from the Taimyr Peninsula in Arctic Russia, whose sinews have been C^{14} dated at 11,450 ±250 years BP[33].

Unlike ancient plant debris, fossil and subfossil bones are composed primarily of calcium mineral and C^{14}, little of the latter if they represent old individuals and more of it if they belong to younger animals. By testing collagen – the protein found in bones – it is possible to obtain C^{14} dates. This, however, becomes difficult when the collagen decreases with age to low concentrations. Moreover, it has been established that the environment of a burial can materially affect the apparent 'age' of the specimen being examined[34]. This, then, is yet another variable.

It is obvious from the foregoing that, despite their apparent accuracy, radiocarbon dates are actually anything but precise (although still a great advance on nearly all previous methods of dating ancient material) and that each example should be evaluated relative to the various factors and constraints just highlighted. For these reasons, therefore, the formulation of even a general date for the tremendous disaster under consideration is possible only by taking a large number of published dates from the relevant literature, and distilling the mean average of these. This is attempted in Appendix B, which lists over

200 samples from 574 separate C^{14} dates lying between 13,000 and 10,000 years BP.

Botanical dates have been segregated from their zoological equivalents, and New World from Old World examples. The resultant averages of each of these groupings is given separately, and the final mean of these submitted as the likely general date – 11,577 BP – of this great event. However, allowing for, say, a cumulative error of around 50 years either way, it is perhaps safest to settle on 11,500 BP as the best 'approximate' date yet available to us. Future research will doubtless refine this considerably.

A quite different avenue of enquiry concerns Plato's date for the cataclysmic foundering of the legendary island of Atlantis, said to have occurred 9,000 years before his own day[35]. Adding these 9,000 years to the 400 separating Plato's time from the time of Christ, and both of those to the 2,000 which have elapsed since then, we obtain another 'general' date of 11,400 years. This is remarkably close to that derived from averaging the C^{14} dates just discussed.

Plato, of course, spoke in comparatively vague terms, and Atlantis, if it ever existed, almost certainly *did not sink precisely* 9,000 years before Plato wrote. Significantly, augmentation by only a few score years brings Plato's date extraordinarily close to that suggested by C^{14} dating methods for the onset of some terrible worldwide catastrophe. Can this be wholly coincidental?

Focusing now on the likely time of the year when this disaster took place, palaeontological evidence seemingly provides the most reliable clues as to the actual month or months when it occurred. Plant remains in the stomachs of the refrigerated Siberian mammoth carcasses, and the amazingly well-preserve flowers and fruits discovered almost undisturbed on dead trees and bushes in Arctic lands (see *Wood Hills of the North* in Part Five) show that early summer was the season when this event erupted.

Just as telling are the vast numbers of very young animals which, with their elders, were chaotically entombed within the 'drift' deposits in caves, rock-fissures and depressions in open country. We immediately recall the numerous afore-cited reports specifically mentioning the indiscriminate slaughter of young and old alike, including foetuses. The presence at that time of so many juvenile animals indicates that the annual spring births, so general among mammals and birds, had only lately been achieved.

Other clues are contained in various traditional recollections of this event. Ovid, for example, refers to ripe grain being consumed by immense heat directed at Earth by a rampant celestial agent he referred to as *Phaeton*. Other accounts mention fruit being shrivelled by a tremendous world-enveloping heat. Ripe grain and well-formed fruit, and the acorns and nuts recorded from many 'drift' deposits in high latitudes all indicate late summer or early autumn season. Late summer or early autumn in, say, the northern hemisphere (where many singularly preserved fruits and nuts have been discovered) would give late Spring as its equivalent in the southern hemisphere (where many examples of juvenile animals have been met with, although not exclusively so. The probability that Earth, prior to this terrible event, revolved daily in a *tholiform* or more upright manner would, of course, have lessened the difference between the seasons hemispherically, or resulted in 'breeding' and 'harvest' seasons overlapping more extensively than at present. If so, that would account for the widespread contemporaneous burial of so many now seasonally separated strands of biological evidence in the *same* globally-distributed 'drift' and analogous deposits.

Yet another line of approach concerns the ancient Persian tradition that a devastating conflict between Earth and a rampaging celestial object called *Tistrya* (Ovid's *Phaeton*) occurred when the latter was in the zodiacal constellation Cancer[36]. According to these records *Tir* was the name of the fourth month of the year, and as Cancer is the fourth constellation from Aries (when the ancient Persian year began, the celestial conflict took place in the fourth month. By modern reckoning this would make April the month when this event occurred, as in April the Sun is in the constellation of Cancer. However, in the ancient Persian scheme, *Tir* and the zodiacal sign of Cancer actually extended from 21st June to 21st July[37]. A high summer date, adequately encompassing recent 'breeding' and 'harvest' seasons north and south of the equator, thus appears to have been the date when this disaster was unleashed. It is therefore seemingly easier to fix the time of year when it occurred than to identify the actual year when it occurred.

We are, then, about to follow a trail at least 11,500 years old, which, though dead and cold in many places, is elsewhere still plainly discernible and provides valuable insights into what really must have happened all those centuries ago.

2
AN UNKNOWN ASSAILANT

The traditions briefly reviewed in Part Three, which describe a major catastrophe having struck and devastated this planet long ago, in the childhood of humanity, expressly and consistently state that the calamity was due to a confrontation between Earth and one or more errant celestial bodies of immense power. In short, external agencies are unmistakably invoked.

Several authorities who have closely studied the geophysical features which, temporally at least, appear to naturally fall within the time span of that dreadful event, have independently concluded that these can only have resulted from influences exerted uniformly on the globe as a whole. Such conclusions also necessitate one or more external agencies. We have, in fact, already seen that this very suggestion has been raised with regard to the aforementioned world fracture complex, and the extensive mountain-building activity which characterised much of 'late Pleistocene' times. It was postulated in the early 1910s by Prof Rudolf Hauthal and Prof Hans Meyer after studying 'ice age' phenomena in Andean Peru and Bolivia with regard to an even wider range of geological factors. They stated that:

> Taken in conjunction with the accumulating evidence that the Ice Period occurred simultaneously over the whole globe, the facts lead to the conclusion that the cause is to be sought outside the globe – that is, it was of a cosmic nature. No cause having a local effect on special regions of the globe can account for all the phenomena.[38]

We previously advanced a similar genesis for the coeval biological extinctions detailed in Part Two. There, we saw that animals (often conventionally but mistakenly regarded as Ice Age forms) and plants of 'late Pleistocene' age were, regardless of size, age, sex or natural adaption, suddenly and violently slaughtered *indiscriminately* on *all* continents, Antarctica excepted. That factor alone confirms the global nature of the disaster involved and that the resultant extinctions occurred *far beyond* the boundaries set for Ice Age regimes by orthodox glacialism. The recorded despair of even dispassionate biologists contemplating the sobering scale of these frightful extinctions has already been noted, surely itself a matter of much significance.

The very immensity and obvious violence of operation exhibited by all these changes unerringly indicates that forces of staggering power brought them about with alarming speed globally.

The numerous traditions descriptive of a vanished genial prehistoric world – the

Golden Age of the classicists – terminated abruptly by world-embracing disturbances, are remarkably accurate accounts of the *very conditions* required by the relevant fossil and geological evidence generally. This can hardly be another coincidence. Something, or some particular set of circumstances, quite literally brought to a sudden and violent end a long-established, environmentally equable regime worldwide. Viewed collectively, the known evidence admits of no other model. Lyellian 'uniformitarian' cycles were not involved, but catastrophic processes were. Indeed, only *very* exceptional circumstances could have produced them.

The question, then, is what actually caused such profound, widespread and swift changes if, apparently, the Earth is itself incapable of generating them on such a grand scale unaided? Precisely what external influences could have been brought to bear on our planet and simultaneously engendered so many striking results?

Traditionally, the principal celestial agent responsible for this disaster was remembered internationally by a plethora of names. Several of these have already been mentioned, although *Phaeton*[39], *Typhon*[40] and the *Midgård Serpent*[41] are probably the best known. The agencies represented by these names were anciently mythologised and were regarded as deities or terrible monsters to be revered, feared and placated. Almost always they were recollected as having been fiery, wayward and the bringers of pestilence and death. Surviving accounts of their visual appearances and their activities in the heavens – one interesting account which we shall consider more fully later details the main object's journey among the planets before reaching Earth's vicinity – present problems for modern scholars desirous of accurately identifying it. Was it, for instance, a comet, an asteroid, a giant meteorite or what?

That question occupies many pages soon to follow: but before grappling with its complexities we must first consider more closely what kind of agent or agencies would be *needed* to wreak so much havoc on Earth and cause our planet to react as it did. And we also need to take a more detailed look at the structure and motions of the Earth itself in order to appreciate how these would *have* to respond to acute external influences. These, in turn, should enable us to gauge the general level of *severity* needed to effect the structural and biological disruptions of the magnitude highlighted in parts one and two. Several recent discoveries have cast considerable light on these factors.

At this juncture, however, we are faced with a highly destructive agency of cosmic origin which, though traditionally remembered by a great variety of names, is as yet of undetermined identity. As an 'assailant' it is indeed 'unknown'.

3
EARTH STRUCTURE

The average person takes the Earth on which they live, its natural motions and the regular passing of successive days and nights more or less for granted. Blissful ignorance of the interplay of the complex processes which regulate Earth's seemingly orderly behaviour, and of its precise location in space, is not uncommon, while among others such factors are but very dimly understood. Here, however, such luxuries cannot be afforded if we are to accurately trace the outline of the tremendous event we will henceforth refer to as the *Phaeton Disaster*. At the very least we need a basic overview of Earth's general structure, motions and planetary status to accomplish our goal. A simple summary of these, designed to put into perspective the many details which follow, is given below.

The Earth is one of the minor members of the family of planets comprising the solar system (see fig 4.1) – enjoying, insofar as planetary scales are concerned, a modest status only. It is, however, a very well-developed 'water' planet (Venus is another), as against 'waterless' planets like Mercury and Mars, or gaseous planets like Jupiter, Saturn, Uranus and Neptune.

Orbiting the Sun at a mean distance of 93,000,000 miles (148,800,000km), once every 365 days (one Earth year) of 24 hours apiece, the Earth pursues an orbit which is not circular but an immense *ellipse*. The Earth is nearer the Sun at some months of the year than others, approaching closest to the Sun in late December each year, and its furthest distance in late June each year.

Earth's configuration resembles that of a flattened globe, where the equatorial diameter exceeds the polar by 26.70 miles (42.72km). The Earth has an axis around which it rotates once in every 24 hours. This axis, however, is not 'upright' (*ie*, at right-angles to the plane of the Earth's orbit) but inclined at an angle of 23.5° from the vertical – thereby explaining why the number of daylight hours in any given day varies in different parts of the Earth. Combined with the revolution of the Earth around the Sun, this axial tilt accounts for the four seasons – spring, summer, autumn and winter – which, of course, are reversed north and south of the equator. Thus, as the Earth moves along its orbit inclined at an angle of 23.5°, and because the orbit is elliptical, summers in the northern hemisphere occur when the Earth is furthest from the Sun and those in the southern hemisphere when it is nearest the sun.

It is important to grasp the above details because, as seen earlier, both the fossil evidence and various traditional accounts suggest a more *vertically aligned* axis prior to Phaeton's visit. If true, a vertical axis would have produced days of equal length all the year round, and the seasons (assuming they were distinguishable) would not have been so marked as at present.

Particularly critical is the fact that if the Earth were a true sphere it would have no stability of its axis of rotation, and:

> ...the smallest beetle walking over it would be able to change the axis of rotation relative to markings on the sphere by an arbitrarily large angle; the axis of rotation in

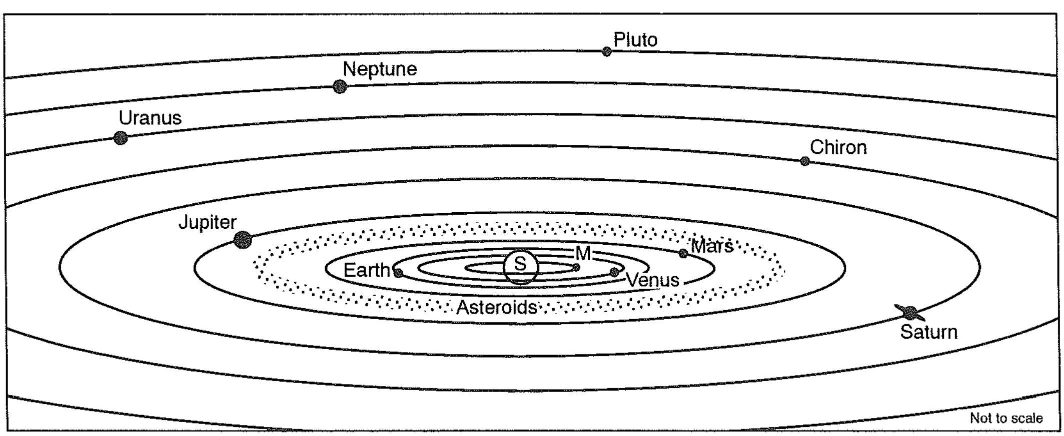


Fig 4.1. Schematic diagram of the solar system. The orbits of the planets are shown on the same plane – most planets orbit approximately so, except for Chiron and Pluto. Not to scale.

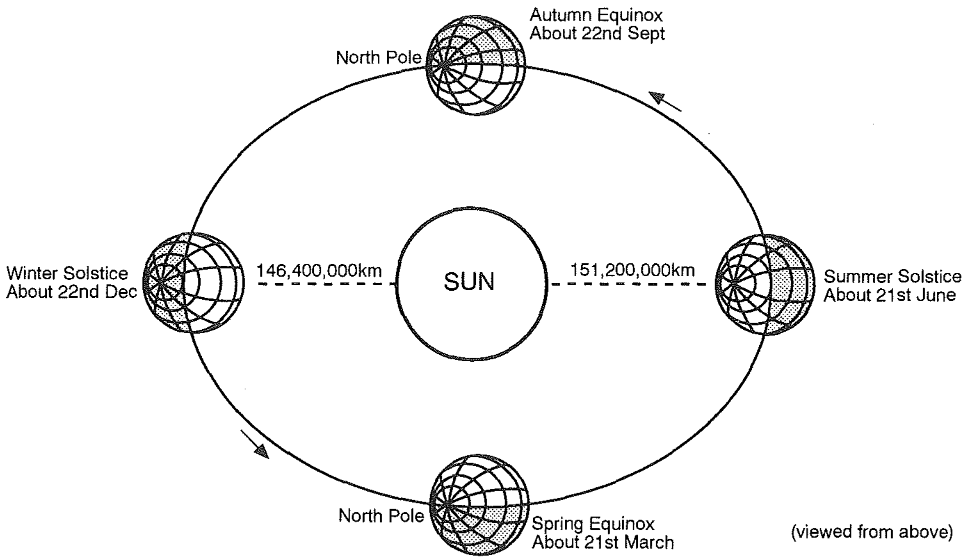


Fig 4.2. The attitude of the Earth to the Sun. Viewed as from above. Not to scale.

> space would change by a small angle only. What stability the Earth's axis possesses against movement relative to the solid Earth is derived from the geoidal shape... This complete stability against a secular change is therefore dependent upon the stability of the shape...[42].

The geoidal shape, of course, is the equatorial bulge, which, stabilising the Earth as it rotates, prevents it turning over pole to pole. This equatorial bulge also allows the application of torques by the Sun and Moon, which cause the Earth to wobble like a top and produce thereby a slow precession of the equinoxes[43]. We shall meet this latter effect again shortly in connection with the density of the Earth. "...At present the solid part of the Earth is very nearly the equilibrium shape appropriate to the present speed of rotation"[44].

If, however, some external body could exert a sufficient influence upon the Earth – for example to induce a fast torque, thereby altering its angle of rotation by a significant amount, changing the axial tilt – then the newly formed equatorial bulge would force Earth's crust to adjust itself to

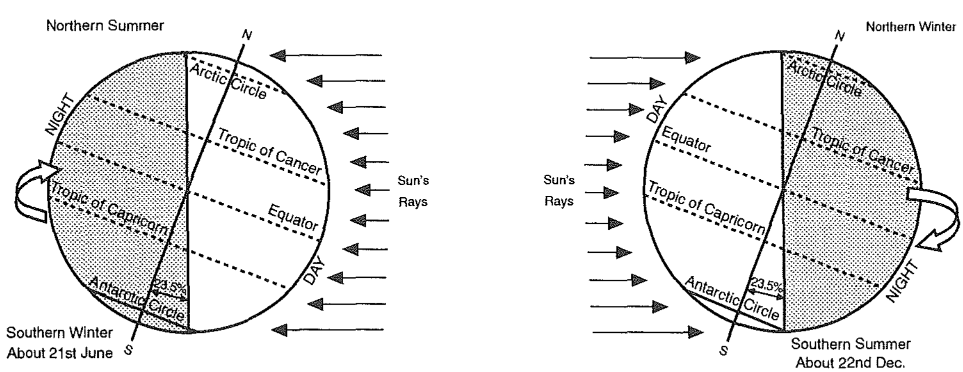


Fig 4.3. The tilt of the polar axis.

that bulge. This raises the question of whether there is a permanent stiffness or an absence of stiffness in the main geoidal shape. Certainly any severe departure either way from its present shape would betray itself very simply by a displacement of the oceans, for:

> ...the oceans which take up the equilibrium shape instantly would then dominate either at the poles or in equatorial regions. In fact, the distribution of land and water shows no significant tendency of such a type. On the other hand, the Earth's speed of rotation is believed to have changed significantly in geological time. It has been changed either by giving up angular momentum to the Moon through the agency of tidal friction – and the Moon shows signs of a tidal bulge appropriate to a greater proximity to Earth – or the speed of rotation may be determined by the resonance with atmospheric tides, in which case it must have changed substantially with changes in the structure of the atmosphere.[45]

Here, then, we find that, although the Earth's present configuration is close to the equilibrium shape appropriate to the planet's rotational speed any serious departure from that shape would generate all kinds of catastrophic physical effects. Similar dire results would occur if the speed of rotation were greatly slowed or accelerated by some means. It has been noticed that the present axis of rotation is decidedly unstable, and not apparently of any great geological age. Gold's observation that changes in the structure of the atmosphere may have altered the speed of rotation is particularly interesting for, as we shall presently see, such an atmospheric change did indeed occur as part of the Phaeton disaster. That the Moon also exhibits signs of having previously been closer to Earth is another noteworthy point, for, if nothing else, it suggests a definite though not fatal former disruption of the present Earth/Moon system. The significance of this possibility will shortly become all too apparent. We must now resume, however, our survey of the Earth's structure.

Earth's mass or weight is estimated to be about 6.6 x 10^{21} tonnes (66 followed by 20 zeros), and its density to be a value of about 5.519[46]. Such figures immediately raise problems of crucial import, for typical rocks, such as granite, underlying the dry land surface of the Earth, possess a density of only 2.7. As Putnam once commented:

> Where is this additional heavy material to be found to give such a high average value for the whole Earth? Does the density of the Earth increase at a constant rate from the surface to the centre? Or does the Earth have lighter material in its surface layers and then have extremely heavy material concentrated in some kind of central core?[47].

This last possibility is generally considered to be the most likely, although some have urged that a uniformly increasing density from the surface down to the centre rather than a concentration of denser materials near the centre is more probable. Certainly other lines of evidence suggest that the specific gravity near the Earth's centre may be 15 and possibly as high as 18[48].

Compared to any single object on its surface, then, the Earth is enormously heavy and gives most observers a reassuring impression of vast strength and permanence. Viewed from a planetary standpoint, however, this is somewhat illusory, for the Earth's crust is comparatively very thin, varying in thickness from a mere 5–30 miles (8-48km)[49], with the thickest portions believedly underlying the mountain ranges. Proportional to the Earth as a whole, the crust is therefore scarcely any thicker than an onionskin is to an onion.

The crust itself consists of three main layers. An uppermost one of loose or unconsolidated deposits, such as gravel or ooze, in many places comprises the actual crustal surface. Below this is a layer of moderately hard consolidated rocks, such as limestone and sandstone, which are often stratified and fossiliferous; and lowest of all is a layer extending downwards to the lowermost portions of the crust, composed of very hard crystalline rocks, such as granite and serpentine, of igneous (volcanic) origin, and devoid of fossils.

Most of the depressions caused by the inequalities of the Earth's surface are occupied by water, so that only a mere 29.22% of land actually appears above sea level. This unequal division of land and sea leads to some very interesting statistics concerning the distribution of water on Earth. Thus:

Water	Cubic Miles
in the oceans	329,000,000
in the atmosphere	3,600
in glaciers and ice fields	3,250,000
in lakes and rivers	55,000
in the Earth's crust	20,780,000
Total	**353,088,600**

These figures show that the oceans constitute close to 95% of the total amount of water on the Earth and existing snowfields and glaciers only about 1%[50].

Despite their relatively great overall volume and the tremendous pressure they exert upon the crust, compared to the size of the Earth the oceans are little more than puddles occupying hollows on its surface, and immeasurably smaller than the oceans of semi-fluid molten magma that underlie the crust. Indeed, the estimated total amount of magma within the Earth exceeds the oceans in volume 1000:1 and in mass 5000:1[51]. The genesis of magmatic fluids, however, remains unknown, nor is it known at what depth in the planet's interior they originate[52]. It was once believed that the whole interior below the crust was molten, and that volcanoes, being points of crustal weakness, were surface outlets for this fiery incandescent material which, on exposure to air, cooled as lava. This is now known to be untrue.

> The data available to us indicate that the depth of the source for most volcanoes is shallow. Furthermore, the magmatic source for a volcano is very localised, compared to the total area of the Earth...[53]

A shallow origin for the source of the magma appears to be exactly that required by those Earth models which postulate that the 'mantle' – the material, solid or otherwise, underlying the crust but above the Earth's core – is multi-layered and visco-elastic[54]. In such models it is believed that these layers move at slightly different speeds from one another as the Earth rotates once every 24 hours, the resultant friction between them being a source of heat and magma. We shall discover the great significance of these possibilities when, shortly, we identify the external influence which so catastrophically brought 'Pleistocene' times to an end.

Nevertheless, quite prodigious quantities of magma can be ejected even by a moderate volcanic eruption. Thus, in 1887 Mauna Loa in Hawaii produced roughly 5,000,000 cubic yards (about 2,500,000 tonnes) of lava *per hour*[55]; and considering the lava erupted continuously for approximately 150 hours, some idea of the immense volume of magma which reached Earth's surface on that occasion is easily formed. Moreover, the lava was of a very heavy basaltic type, and was apparently lifted a minimum height of 20,000ft (6,250m) to the surface from its source within the Earth.

Deep fissures in the lithosphere (Earth's crust and mantle) also sometimes permit magma to reach the Earth's surface. In several regions, as in the Deccan of western India, the Columbia Plateau of the north-western United States and the Parana River region of South America, vast floods of basaltic lavas have welled up through fissures in the past and overspread huge areas as accumulations often hundreds of feet thick. These magmatic outpourings significantly altered local topographies.

Forces exerted on the magma include, along with the natural gravitational ones of the Sun and the Moon, the Earth's speed of rotation (a centrifugal force) which creates the equatorial bulge mentioned previously. These pressures exert great thrust, since the viscous or semi-fluid magma, unlike the ocean waters, is totally enclosed. Evidence suggests that the magma directly under the crust rotates at a similar speed to the crust, but that all the magma in specific vertical areas will, depending on densities, pressures and temperatures, possess an angular momentum – 0 at the poles to 1,000mph (1,600kph) at the equator. The speed of rotation probably varies also at different depths within the Earth's interior. These magmatic movements may conveniently be referred to as the *magma tide*.

Any sudden or marked realignment of the Earth's axis or in Earth's speed of rotation would induce changes in the magma tide as it adjusted to the new equator or altered rotational speed. Such changes, however, might not be uniform throughout, owing to a 'drag' factor deep in the magma itself, although overall they would certainly impose terrible strains on the lithosphere generally. That widespread magmatic adjustments occurred at the time of Phaeton's visit must be obvious from the evidence presented earlier. The actual operation and the effects generated on that occasion will be discussed shortly.

Still deeper within the Earth is the core. This believedly consists of an inner and an outer core. Nobody, of course, has ever seen Earth's core, but the general consensus of opinion is that it is a solid or near-solid mass with a high metallic content. There is, however, a sizable body of opinion which prefers to regard it as a largely liquid core of immense density. The core's actual diameter is also as yet undetermined, and may indeed be undeterminable if it is not spherical, but it is thought to be many hundreds of miles, and perhaps to be very much greater. As a unit, the core is extremely important and is intimately connected with the Earth's magnetic field, to which we must now give attention.

4
GEOMAGNETISM

The Earth possesses an electrically-charged magnetic field, referred to simply as *geomagnetism*. Earth is not alone in possessing such a field, as essentially similar ones exist on the Moon[56] and on Mercury[57], to name just two other bodies in the solar system. Not improbably such fields are commonplace throughout the Cosmos generally.

Laboratory experiments have shown that a rotating spherical magnet takes with it a magnetic induction field which, in turn, gives rise to an induced electromagnetic force (EMF) in a connecting circuit. Interestingly, the EMF formed by the Earth's field tends to slow down the planet's rotation, a factor of much significance.

The Earth being a rotating, approximately spherical, electrically-conducting magnetic body, is thus a kind of gigantic equivalent of the rotating magnet in the laboratory mentioned above. The Earth's magnetic poles, which, when united, form a di-pole (two oppositely-charged separated poles), are slightly off-centre (*ie*, they do not coincide with the geographical poles). They are aligned approximately along the axis of rotation but in the opposite direction to that of the angular velocity vector (see fig 4.4). As early as 1803, it was demonstrated conclusively that the Earth is negatively charged[58], a finding amply confirmed by many further experiments. From these discoveries and the

Earth's present electrical condition, the magnetic di-pole is known to be similarly charged[59].

Being electrically-charged, the Earth will attract to it and accelerate positively-charged particles in the solar wind flow[60]. This positive charge even manifests itself in the atmosphere and causes a downward electric field of between 100 and 500 volts per metre at ground level on a clear day[61].

R E Juergens has noted that, as space is now known not to consist of a near-vacuum as previously thought, but is a plasma of dissociated ions and electrons, electrically-charged bodies such as planets could, in certain circumstances, perturb each other, and that, in order to shield themselves, possess a space-charge sheath capable of assembling a sufficient charge to match the electrical potential of the surrounding plasma. Juergens suggested that this charge is actually the magnetosphere (fig 4.4), and that a body which has either orbited the Sun far out in the solar system or which has traversed interstellar space may have thus acquired an exceedingly high electrical potential. He further suggested that such a body, if or when passing on an intersecting orbit with a planet in the solar system would probably *not* collide, due to the cushioning effect of the space-charge sheaths of the bodies involved. However electrical discharges could be expected to occur between them as the bodies endeavoured to equalise their electrical potential. The discharges could assume enormous proportions and produce catastrophic effects on both bodies[62].

Earth's electromagnetic field, therefore, apparently performs a function of great importance, inasmuch as, in the event of the near approach of some highly-charged celestial body, it acts as a shield to minimise the cataclysmic results that would otherwise occur. Any breach of the field would, of course, be disastrous.

All authorities agree that the Earth's electromagnetism is generated in the Earth's core, and emanates from the movements of the molten fluid (assuming that this is what the core consists of). This motion is created by the effects of the Earth's precession on the solid crust and on the core itself. Indeed: "The relevance of precession to the geomagnetic field is that the rate is determined by the magnitude of the equatorial bulge"[63].

It is therefore widely believed that electric currents are a major component of the geomagnetic field, with the dynamo being driven by the combined gravitational influence of the Sun and Moon – the cause of precession in the first place. Thus, any serious distortion (up or down) of this Solar/Lunar gravitational pull would disrupt the precession to such an extent that Earth's magnetic field would drop (weaken) due to a reduction in the electric current being produced – even to the extent of causing the dynamo to go into reverse for a short period. This would amount to a magnetic reversal! As we shall now see, good evidence exists for such a reversal having occurred at the time of the Phaeton disaster.

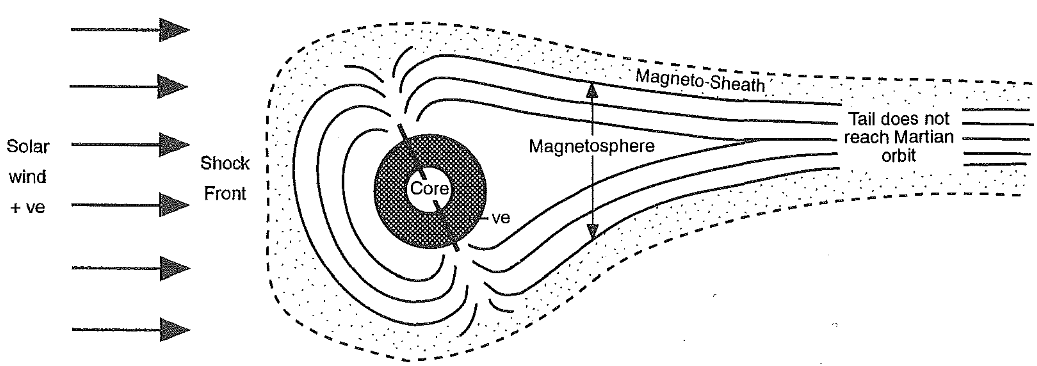


Fig 4.4. The space charge-sheath and magnetosphere of the Earth. *After P Dyal and C W Parkin.*

5
Reversed Polarity

While in liquid condition igneous rocks are non-magnetic, but when cooling to about 580° Celsius, or Curie Point, acquire and retain a magnetic state, the orientation of which reflects the magnetic polarity of the Earth at the time the cooling takes place. This is often referred to as *palaeomagnetism*. The magnetised rocks may later become displaced, or the orientation of the Earth's magnetic field altered. The widespread occurrence of solid rocks possessing a reversed polarisation has long interested geophysicists, who have spent many decades investigating the causes and significance of this apparent anomaly. Certainly there is now universal agreement that the only plausible explanation for the phenomenon is: "...that the Earth's magnetic field was itself reversed at the period when the rocks were formed"[64].

Researches have also shown that: "The north and south geomagnetic poles reversed places several times"[65]. And the process is envisaged to have been abrupt: "...the field would suddenly break up and reform with opposite polarity"[66]. Moreover, as the source of terrestrial magnetism is believed to lie in electric currents on the surface of the Earth's core:

> ...substantial changes in the speed of Earth's rotation become easier to explain... Whatever the mechanism, there seems no doubt that the Earth's field is tied up in some way with the rotation of the planet. And this leads to a remarkable finding about the Earth's rotation itself... the Earth's axis of rotation has also changed. In other words, the planet has *rolled about*, changing the location of its geographical poles.[67] (Our italics).

Reversed polarity in rocks, therefore, is apparently connected with catastrophic conditions like those previously described in this book, and very definitely with some type of axial shift. But the intensity of such polarity greatly exceeds the norm and strongly suggests the involvement of non-terrestrial influences – although under normal circumstances the intensity of magnetism acquired by cooling rocks depends on the speed with which the original molten material cools and on the size, composition and form of its constituent particles. Thus, although some variability in the intensity of the magnetism acquired by igneous rocks under normal conditions is predictable, rocks exhibiting reversed polarity possess magnetic charges ten times and often up to *one hundred* times stronger than could have been produced by known terrestrial conditions. As Manley has observed:

> This is one of the most astonishing problems of palaeomagnetism, and is not yet fully explained, although the facts are well attested"[68].

Despite the demonstrated occurrence of an unexpectedly large number of magnetic reversals throughout Earth history, it cannot be mere coincidence that a particularly well marked reversal took place around the general date (11,500 years BP) advocated in this book for the Phaeton disaster. Reversedly magnetised sediment near Gothenburg in southern Sweden, for example, has been dated as being between 12,600 and 8,600 years old[69]. The mean average of these dates falls surprisingly close to 11,500 years BP, and within the so-called Laschamp geomagnetic event (17,000 to 7,000 years ago)[70], which latter also suggests that the inclination of the Earth's magnetic axis at that time may have been 30° from its present orientation. Such possibilities have prompted various authorities to enquire whether, at times of polarity reversals, the magnetic pole follows the polar axis, or vice versa, and Cox and Doell to remark that, although unlikely:

> It is, of course, possible that the coincidence of the palaeomagnetically-determined di-pole axis and the present rotational axis is fortuitous.[71]

The geological youthfulness of these polarity reversals not only finds correlations with the comparable modernity of many of Earth's present topographical features, as specified in Part One, but is also strongly suggested by the clusters of palaeomagnetic anomalies discovered in north and central Europe, eastern Canada, the Gulf of Mexico and New Zealand, centred around the date 12,500 BP[72]. These are widely regarded as representing a global magnetic reversal about that date, which has come to be named the 'Gothenburg flip'. Significantly, a drop in the strength of the Earth's entire magnetic field appears to have occurred sometime between 13,750 and 12,350 years ago[73]. This was attended by various other important changes, including earthquakes, vulcanism, water table fluctuations and large scale climatic variations. Of these, severe earthquakes in particular may even induce axial wobble, and polarity reversals. Discussing such possibilities, Kennett and Watkins noted that:

> Heirtzler has recently speculated on a relationship between earthquake activity (and by implication upper mantle activity) and geomagnetic polarity change. He reasons that because there is evidence to show that earthquakes of magnitude 7.5 or greater may cause wobble of the spin axis, it is therefore conceivable that an Earth wobble may be of a magnitude sufficient to cause reversal of the geomagnetic field[74].

Inevitably such axial wobbles and crustal strains generate both seismic and volcanic activity. It is not surprising, therefore, that a relationship has been traced between periods of severe vulcanism and geomagnetic changes, and that these have, in turn, greatly influenced climatic regimes and caused widespread biological extinctions. Indeed, as Kennett and Watkins have observed:

> Of eight observed micro-faunal extinctions and appearances in the Southern Ocean, six either occurred during or very close to geomagnetic polarity changes. We suggest that the climatic changes which can result from volcanic maxima are much more plausibly the cause of such extinctions and appearances than increased radiation at the water surface during any di-pole collapse accompanying a polarity change...[75].

It will be recalled from Part Two that the annihilation of the Siberian and Alaskan mammoths and their contemporaries, approximately 11,500 years ago, was accompanied by massive vulcanism and that similar coeval evidence has been noted from California, South America and several other localities. Innumerable other regional changes of varying intensity and longevity occurred coincidentally in different parts of the world, and combine to produce an overall picture of epic turmoil. And since vulcanism and earthquakes frequently go hand-in-hand, of what magnitude were the earthquakes and eruptions which accompanied the latest uplift of the Rockies, Alps, Himalayas and many other prominent mountain ranges? As seen in Part One, these attained their present elevations at the very close of so-called 'Pleistocene' times. Consider R T Chamberlin's description of the rise of the Andes in South America:

> Hundreds, if not thousands, of cubic miles of the body of the Earth almost instantaneously heaved upward produced a violent earthquake which *spread... throughout the entire globe*. Many world-shaking earthquakes must have been by-products of the rise of the Sierras.[76] (Our italics).

Another celebrated authority, Eduard Suess, wrote in much the same vein when he said:

> The earthquakes of the present day are certainly but faint reminiscences of those

> telluric movements to which the structure of almost every mountain range bears witness. Numerous examples of great mountain chains suggest by their structure... episodal disturbances of such indescribable and overpowering violence, that the imagination refuses to follow the understanding.[77].

Here, surely, were earthquakes and eruptions that far transcended those which, according to Heirtzler, would be needed to cause wobble of the spin axis – a wobble which, in Kennett and Watkins' opinion, would conceivably have been large enough to have reversed Earth's magnetic field.

Thomas G Barnes has examined another aspect of reversed polarity. He noted that all available data show an exponential decay in the Earth's magnetic field, with a half-life of only 1,400 years. This led him to conclude that:

> It is obvious that this magnetic decay phenomenon could not have been going on for more than a few thousand years, as the magnetic field would have been implausibly large for the Earth. This is strong physical evidence that there must have been a *relatively recent* origin of this electromagnet or some unknown *catastrophic* (our italics) 're-energising' event.[78].

This re-energising event was presumably that which imparted magnetic charges to igneous rocks ten to one hundred times stronger than normal. In our submission this was the Phaeton visitation which, as we have seen, *was* catastrophic. We must mention, however, that some authorities have suggested that the process of polarity reversals actually occupies a very considerable period of time, the reversal itself perhaps as long as 1,000–3,000 years, the decay from 2,000–3,000 years, and the recovery of the magnetic field a further 2,000–3,000 years.

Such views reflect a 'uniformitarian' approach requiring the Earth's magnetic field to be self-reversing under specific conditions – and that it does this without outside influence. It has, for example, been pointed out that the Sun's magnetic field reverses itself during each 11-year solar cycle[79]. No evidence exists, however, for any such regular reversal of Earth's magnetic field. Nevertheless, as indicated above, it is entirely possible that abrupt reversals could conceivably occur under catastrophic conditions. The extremely highly-charged igneous rocks mentioned earlier are apparently examples of such reversals. Certainly, one or more highly-magnetised errant celestial bodies of great density, or large mass, making a close approach to the Earth, could produce exactly the above described effects.

Like many of his imitators, the leading modern 'catastrophist', Immanuel Velikovsky, has urged that the near-approach to Earth of some such large celestial body (in his opinion a comet which became the planet Venus) would have caused the Earth to cease rotating[80]. Velikovsky's conclusions were largely based upon the *Old Testament* story of *Joshua* which, with equivalent legends from other sources, asserted that in early historical times the Earth actually stopped rotating. Viewed scientifically, the braking to a halt of the Earth in space is theoretically possible, but only if a sufficiently massive external influence is involved. The internationally famous astronomer, Dr Carl Sagan once devoted considerable time analysing Velikovsky's arguments[81]. Although concluding that Velikovsky's concepts were very probably erroneous, Sagan found that a cessation of Earth's rotation was certainly feasible given the right combination of circumstances. He especially discussed the thermal energy produced by any slowing of the Earth's natural rotation, observing:

> ...thermal considerations are in fact fatal to the Joshua story. With a typical specific heat capacity of cp~$8x10^6$ erg gm^{-1} deg^{-1}, the stopping and restarting of the Earth in one day would have imparted an *average* temperature increment of... 100°K, enough to raise the temperature above the normal boiling point of water. It would have been even worse near the surface and at low latitudes... 240°K. It is doubtful that the inhabitants would have failed to notice so

dramatic a climatic change. The deceleration might be tolerable, if gradual enough, but not the heat.[82].

Elsewhere, Sagan states that a gradual deceleration of the Earth's rotation could take place over a period shorter than a full day[83], and that the minimum time for an external influence to make itself felt upon the Earth as a whole is just 85 minutes[84]. Sagan, who concluded that no cometary influence like that envisaged by Velikovsky could have slowed or halted the Earth's rotation, was, of course, considering *comets* as the disruptive agents since this was Velikovsky's thesis. If, however, comets were not the culprit bodies, but some other body or group of bodies acting in concert, then Sagan's conclusion, while correct relative to Velikovsky's arguments, may very well be inapplicable to the great world disaster highlighted throughout this book. As we shall see shortly, Phaeton was almost certainly not a comet but some other type of celestial object.

6
THE THERMAL FACTOR

Geomagnetic changes involve vast quantities of thermal energy already possessed by the Earth. Much of this is caused by internal tidal friction – magmatic flow versus the semi-rigid outer crust, resulting from the planet's natural rotation. The outcome of this is to convert rotational and/or orbital energy to thermal energy. Any alteration to Earth's present *modus operandi* would, if it involved a rotational or orbital change arising from tidal friction, lead to a loss of orbital energy accompanied by either a loss of, or no change to, angular rotational momentum. Dr Harold Urey, investigating this matter relative to the hypothetical near-approach to the Earth of a large comet, concluded that the loss of thermal energy amounted to 10^{31} ergs[85]. Others have suggested still higher figures and, again, have usually postulated the close approach of at least one sizable celestial object as being necessary to cause such a loss.

Influenced by the ideas of writers like Whiston, Donnelly, Beaumont and Velikovsky, this object has usually been thought of as a large comet, although, as shown later, its identity was almost certainly not cometary. At least one leading authority on celestial mechanics, J Derral Mulholland, has examined the validity of Velikovsky's ideas and of possible collisions between Earth and other planet-sized celestial bodies. Although not specifying the size of his hypothetical planet, it may be safely presumed that Mulholland had in mind one the size of Venus or Mars, since these two planets featured so prominently in Velikovsky's writings. Accordingly, Mulholland wrote:

> If a planet-sized object were to pass close to the Earth, then giant tides would be raised; there would be global earthquakes; the north pole would change direction; the day, the month, the seasons, the year would all change. Faith is not involved here; these are unavoidable consequences of the laws of motion as we presently know them. We must accept that the dynamical aspects of Velikovsky's visions of hell on Earth are largely acceptable. This is not to admit that the events he described ever happened... today the celestial mechanics of Sir Isaac Newton and Simon Newcomb are no longer the ultimate measure. Today, celestial mechanics is a living, vital science that

> admits of non-gravitational effects, of electromagnetic interactions, of flexible astral bodies and of statistical descriptions of some types of occurrences involving large numbers of bodies. In spite of our new knowledge, some unrecognised influences may yet remain.[86].

Obviously, any near-approach to the Earth of a massive celestial object possessing high electromagnetic potential would, through slowing or halting Earth's rotation and generating internal tidal friction, greatly increase the natural level of Earth's thermal energy.

In such circumstances, therefore, frightful earthquakes (as Mulholland admits) leading to axial wobble (as Kennett and Watkins postulate), an abrupt geomagnetic reversal and a change in the location of the geographical poles (as Runcorn, Kennett and Watkins, Mulholland and others have concluded), as well as dramatic climatic changes and a general rise in temperatures – especially near the surface and at low latitudes (as Sagan admits) – could be expected to occur concurrently on a global scale.

It can hardly be coincidence, therefore, that *all* these derangements appear to have occurred more or less simultaneously on Earth – geologically very recently.

Nor can it be coincidence that these same physical changes are remembered graphically in a host of legends, traditions and ancient texts the world over. Even Sagan's deduction that world temperatures would have risen above the boiling point of water finds confirmation in various traditional accounts, a particularly telling point when it is realised that this was a transient phenomenon incapable of leaving in the geological record much in the way of permanent evidence for its actual occurrence. Dealing specifically with this 'evidence' Bellamy has commented:

> The reports of a flood of 'hot' water are rather numerous. Various North American tribes, such as the Makah, Quileute and Chimakum Indians, mention in their myths the surprising temperature of the waters which, as they correctly report, were surging towards the north.[87]

Elsewhere, Bellamy provides further examples of these singular ancient recollections: the Voguls of Finland believed that a great Deluge of boiling water once roared over the world; the Salinas Indians of California describe a flood of hot water which anciently overwhelmed the entire globe; the Ipurinas of northwestern Brazil tell how the Earth was once drowned by a tremendous flood of hot water because the Sun tipped over; and Talmudic records report how the antediluvians perished in boiling water at the time of Noah's Flood[88].

It is difficult to see how numerous isolated peoples, sharing a common memory of a vast global inundation long ago, could have independently invented the idea of its waters being hot. Their accounts, scattered and variable though they are, must refer to the former real existence of such waters and to the real occurrence of the physical conditions necessary for their production.

The normal friction between Earth's semirigid outer crust and its viscous magmatic interior, as well as the thermal energy naturally generated by it, would have been greatly intensified during any event like a Phaeton disaster. Viscosity of magma is profoundly affected by stress or removal of stress, while the magma's centrifugal speed as Earth rotates, and the drag that would be imposed upon Earth by any closely-approaching celestial gravitational influence, are other factors governing the behaviour of hot plastic-like magma under cataclysmic conditions[89]. Under stressful conditions, such as Phaeton's visit engendered, the magma tides must have reacted very much along the lines postulated by Donald Patten when he wrote:

> Based on spherical volumes, with the diameter of the Earth about 8,000 miles, it can be seen that the oceans of magma are infinitely greater than the relatively thin and shallow pools of water lying on top of the Earth's crust.
>
> Hence the tidal upheaval from within the Earth must have been very much greater than the tidal upheaval on the Earth's surface, involving her relatively minute oceans. Therefore upheaval or thrust internally and compression externally must have been

simultaneous; only their proportions were different. With this volume of magma in tidal upheaval, the Earth's crust acted something like a bellows. And the Earth's relatively shallow oceans merely washed around as the Earth's crust heaved and sagged[90].

Continuing his theme with reference to the conclusions of geologists like Dr George Gamow[91] and Dr Adrian Scheidegger[92], Patten added:

> Any fluid, when constricted, will exhibit a greater thrust... The fluid ocean is unconfined; the fluid magma is completely confined. This affects the gathering or concentration of thrust in certain belts or regions. Also the nature of water is somewhat different than magma as a fluid. At high temperatures, magma becomes increasingly fluid, and at lower temperatures, it becomes increasingly viscous... At the high temperatures inside the Earth, magma has a nature which is neither exactly like a fluid, nor exactly like a solid. It is described as 'plastic-like'. It is something like asphalt, beeswax, honey or molasses. It will flow, but at retarded rates[93].

Clearly the hotter magma becomes the more easily and quickly it will flow and the more responsive it would be to any approaching external gravitational influence. Under such conditions, the thermal energy resulting from the enhanced friction between it and the confining terrestrial crust would be truly enormous, leading in time to the magma becoming a very mobile mass within the Earth's shell. It is thus not unduly difficult to see how, or why, in the Arctic, the depth of the Eurasian Basin is anomalous, and:

> ...represents a regional collapse of the Earth's surface due to material being removed from the lower mantle.[94]

Or why there was an apparently coeval collapse of a huge tract of the old landmass of Beringia (see map 1C) immediately east of the present Kamchatka peninsula, or why there were partially compensatory massive up-wellings of magmatic lava then in the Deccan, on the Columbian Plateau, and over much of the floor of the central Pacific basin.

It is especially noteworthy, therefore, to find references in the Phaeton cycle of legends to the rocks boiling and melting at the time of that disaster. Many instances, particularly from mountainous districts, of rocks recently folded, bent and warped while clearly still in a molten state were highlighted in Part One. There, also, consideration was given to the almost unimaginable heat generated by colossal rock masses sliding juggernaut-like over one another when the Alps, Rockies and Himalayas, in attaining their present elevation, were moved long distances laterally in various geographical directions. With so much thermal energy unleashed by these and other related causes, it is little wonder that so many nations possess recollections of a terrible world conflagration and of boiling flood waters at the time of the Phaeton disaster.

The association of a worldwide conflagration and a global deluge, however, has proved especially vexatious for classicists because this reported juxtaposition seemingly makes little or no sense. These scholars perceive no underlying calamity capable of producing both types of destruction on a planetary scale more or less simultaneously. The otherwise excellent mythologist G Knaack, for example, found himself supposing that the linking of the two agents was due to an invention of some later compiler, thus:

> Mention of the rivers that Zeus unleashed gave the later reviser the idea of the deluge.[95]

Such interpretations ignore the fact that: numerous independent accounts repeatedly insist that a terrible world conflagration was extinguished by an immense deluge which also destroyed that untouched by the fire; and that the association of the two motifs is embedded in traditions far older than the classical Greek and Roman Phaeton accounts. Englehardt recognised this when he remarked:

> The very fact that several sources report on a link between Phaeton's destruction and

Fig 4.5. Folding and overthrusting. Limestones and shales over 12,000ft (3,750m) above sea level at Cortadera, Peru, exhibiting three repeated overthrusts. *Official photo: Portrerillos Company. Extracted from F A Perret's "The Eruption of Mont Pelée", by permission of the Carnegie Inst, Washington DC 1929, and R S L, Oxford.*

> the Deucalion flood, or more generally, between catastrophes of fire and water, in spite of the difficulty in rational explanation, favours the fact that it is not a matter of later constructions but that here, via mythological hypotheses, a part of stubborn reality comes to light from under a veil. Therefore we shall have to conclude from the sources that the fiery catastrophe that was interpreted as Phaeton's fall was really followed by a short-lived but extensive inundation which ended the lives of so many men that one could talk of a destruction of mankind.[96]

Today, our possession of knowledge unknown to the earlier classicists and mythographers permits a better understanding of how the Earth would react physically if subjected to a catastrophe like the Phaeton disaster and its attendant stresses.

Is it not, therefore, exceedingly remarkable that many of the physical effects mentioned in the catastrophe legends exactly reflect the physical conditions deducible from detailed analyses of the interplay of the relevant natural forces activated by a hypothetical near-collision between Earth and a sizable celestial object; or that the field evidence for the former real occurrence of such an event and its effects is both abundant and incontrovertible? The coincidences are surely too numerous to be products of mere chance.

7
INSTABILITY

The reality of a geologically recent alteration to the inclination of Earth's axis of rotation which, as indicated in parts one and two, can be repeatedly inferred from abundant geophysical and biological evidence associated with the end of the so-called Ice Age, is a matter of prime importance to a proper understanding of what happened to our planet about 11,500 years ago.

As noted earlier, an axial change may have occurred coincidentally with the last great polarity reversal known to us, the 'Gothenburg Flip', and that earthquakes of 7.5 or more on the Richter scale of severity – such as those recorded in Part One as having attended the gigantic crustal disturbances, extensive mountain building and intercontinental rifting characteristic of 'late Pleistocene' times – are sufficient under particular circumstances to generate axial instability[97]. As concurrently-operating phenomena, these 'late Pleistocene' dislocations could not have arisen of their own volition, but can only have been initiated by some external cause.

Thus, the genesis of several singular axial and orbital fluctuations exhibited by Earth even today can be traced back directly to the tremendous events of 11,500 years or so ago. A brief survey of some of these provides a clearer picture of how and why Earth presently functions as it does.

Contrary to popular belief, neither Earth's elliptical orbit round the Sun[98] nor its daily speed of axial rotation[99] is absolutely fixed. Both have varied, sometimes quite appreciably, over a period of time and may yet do so again.

Many authorities have linked these orbital and rotational fluctuations to the onset[100] as well as the melting[101] of the alleged 'Pleistocene' ice-sheets, with climatic changes[102], migrating monsoonal regimes[103], and with increases in solar radiation reaching the Earth's upper atmosphere[104]. Stated bluntly, the Earth's orbit (although not depicted as such in diagrams of the solar system) 'wanders' somewhat erratically along its course, and the Earth itself spins irregularly and 'wobbles' as it moves round the Sun. Such instabilities are symptomatic of a flawed equilibrium. Their connections with so many aspects of present and recent world climates illustrates their crucial role in initiating and maintaining those regimes.

By human standards fluctuations in the earth's daily speed of rotation appear to reflect a longterm disorder exhibiting an approximate 10-year cycle of operation[105], and is seemingly the result of a combination of imperfectly balanced features deep within the Earth itself[106], including core-mantle coupling[107] – of which more shortly. In reality, however, the origin of these fluctuations appears to be remarkably youthful.

The rotational irregularities in particular are intimately linked with the 'Chandler Wobble', caused by the fact that Earth's axis of rotation fails to coincide with its axis of inertia. Of these, the former describes around the latter a cone-like motion – a small rapid wobble[108] – known as *nutation*, which it performs over a more or less set period. The period has been termed the Chandler or Newcombe Period and the resulting unbalanced motion the 'Chandler Wobble'. The relationships between these motions have been investigated by several astronomers and geophysicists in recent years[109], while others have explored not only additional excitations of the wobble by various climatic factors, such as atmospheric changes[110], but, subscribing to Earth models requiring a multi-layered visco-elastic core, that viscosity of the deep mantle[111] and core region[112] can also enhance wobble and its speed of action. Yet others have studied the apparent connections between large earthquakes and excitations of the Chandler Wobble[113], complementary to Heirtzler's calculations respecting the degree of seismic intensity needed to induce, theoretically at least, polarity reversals and a change in the location of Earth's geographical poles or spin axis.

Significantly, one of the most marked orbital changes yet traced, and certainly the one so far most studied, occurred at the end of the 'Pleistocene' epoch between 11,000 and 11,500 years ago. It was virtually coincident with the inauguration of the climatic and atmospheric changes just listed, and with the advent of the environmentally-disturbed Younger Dryas episode referred to earlier. This, it will be recalled, was epitomised by singular and abrupt alterations to oceanic circulation, wind intensities, northern snowfall levels and to large segments of the plant and animal kingdoms. These all were changes, it was also suggested, conceivably generated by some sort of adjustment to the tilt of the Earth's spin axis.

Orbital and rotational changes, of course, could be expected if the tilt of Earth's spin were altered – although that could probably only occur as a response to some powerful influence outside Earth itself.

Be that as it may, all these changes are unquestionably interrelated, while their direct association with the end of the alleged Ice Age times and the onset of the highly variable Younger Dryas episode indicates that many if not all the effects developed more or less synchronously about 11,500 years ago, through arising from a common cause.

In the general scale of geological events they occurred but yesterday.

It is thus scarcely surprising that Earth is far from being the most perfectly functioning planet that a surprisingly large number of people assume it to be. On the evidence of its fluctuating motions and behaviour patterns, it has not merely recently sustained serious disruption to many of its natural physical and atmospheric features but is still slowly recovering from the traumatic event which imparted them.

In that connection it must also be significant that analogous planetary instabilities of apparently recent date, and which will be considered in greater detail shortly, are traceable elsewhere in the solar system. Before dealing with that evidence, however, we should contemplate the far-reaching implications of the further aspects of pole-shift set out below.

8
Pole Shift

Among the terrestrial effects listed by almost every investigator of a theoretical near-collision has been a shift in the inclination of Earth's axis. Authorities of the calibre of Runcorn and Mulholland have admitted that axial shifts could be expected to occur on such occasions. This subject, however, was debated far earlier, although usually in connection with a specific event – a great world catastrophe during the infancy of mankind. The ancient Egyptian Ipuwer Papyrus, for example, describes terrible devastation created by an early cataclysm which "turned the Earth upside down"[114]. The Ermitage Papyrus, now preserved in St Petersburg, refers to a similar ancient world convulsion[115]; while a third Egyptian papyrus tells how the Earth was nearly destroyed by fire and water during a tremendous celestial upheaval long ago when the south became north and the world turned over[116]. The celebrated Greek philosopher Plato described a similar axial dislocation, caused by a vast flood "which foamed in and streamed out" and made the Earth move irrationally:

> ...forwards and backwards, and again to right and left, and upwards and downwards, wandering every way in all six directions.[117]

Not only does Plato's remarkable statement remind us of Runcorn's conclusion that Earth 'rolled about' on the occasion of a massive magnetic reversal, but it suggests that the Earth wobbled wildly in *many* directions. It also reminds us of the Greenland Eskimo belief that Earth formerly turned over, and that the Andaman Islanders fear a repetition of a great natural disaster that occurred in the days of their remote ancestors when the world capsized[118]. Also it is significant that, on viewing a comet in the heavens, the peasantry of Menin in Flanders used to exclaim: "The sky is going to fall; the Earth is turning over"[119].

We are also reminded here of the aforementioned ancient Chinese and other early traditions describing a time when the stars poured across the heavens and Earth settled down to a *lower position* than it had previously occupied. All these apparently refer to an axial change witnessed by early Man.

Modern interest in such momentous events revived last century. The then-recent Spitzbergen discoveries, for example, suggested to some that those islands must have once lain 20° nearer the equator than they do today[120] – and as the modern theories of continental drift and plate tectonics had not then been formulated, it was considered that a change in the position of the poles (an axial tilt), causing profound climatic alterations, must have occurred. This explanation was usually that offered to account for the obvious very rapid refrigeration of the hairy mammoth and woolly rhinoceros cadavers found in northern Siberia.

Geologists were asked by mathematicians and astronomers what geological conditions would be necessary to cause such polar shifting. The most likely cause, the geologists opined, was a redisposition of the weight of the Earth's surface. This possibility was closely analysed by Sir George Airy, then astronomer royal, who *assumed* a sudden elevation of a mountainous mass in latitudes "most favourable for production of a large effect", that would prevent the axis of rotation from coinciding with the axis of the globe geoid. This, he argued, would cause the Earth to wobble and the poles to wander. The smallness of the inferred effect was, however, discouraging and Airy concluded that:

> ...the shift of the Earth's pole would be only two or three miles, and this, though it would greatly surprise astronomers... would produce no such changes of climate as those which it desired to explain.[121]

A reinvestigation of the problem by Sir George Darwin using the same formula was hardly more encouraging: only a relatively small amount of polar shift was possible, a mere two degrees in fact. But serious objections to the validity of this approach were voiced, even in the 1870s. One mathematician emphasised a particularly important point – one still crucial to any modern assessment of the problem. He advised:

> Mathematicians may seem to geologists almost churlish in their unwillingness to admit a change in the Earth's axis. Geologists scarcely know how much is involved in what they ask. They do not seem to realise the vastness of the Earth's size, or the enormous quantity of her motion. *When a mass of matter is in rotation about an axis, it cannot be made to rotate about a new one except by external force. Internal changes cannot alter the axis, only the distribution of the matter and motion about it.* If the mass began to revolve about a new axis, every particle would begin to move in a different direction.[122] (Our italics)

The geologists' specifications had proved too imprecise, and Airy, Darwin and others had assumed a 'uniformitarian' solution apparently incapable of actually occurring.

A much better explanation of climatic changes attendant upon markedly reoriented geographical poles, was advanced by the Austrian meteorologist Julius Hann, who was quoted by W B Wright as follows:

> The simplest and most obvious explanation of great secular changes in climate, and of former prevalence of higher temperatures in northern circumpolar regions, would be found in the assumption that the Earth's axis of rotation has not always had the same position, but that it may have changed its position as a result of geological processes, such as extended rearrangement of land and water.[123]

As seen in Parts One and Two, a radically different disposition of land and water evidently existed until Phaeton's visit. Large continental landmasses such as Fennoscandia, Appalachia, Beringia, Tyrrhenia and others in the southern hemisphere existed in regions presently occupied by oceans now often miles deep. Their combined weight was stupendous and its redistribution through crustal collapse catastrophic.

We have also seen that many of these changes occurred around 11,500 years ago at the onset of the Younger Dryas episode, when, among other effects, large-scale northern ice-sheets are said to have abruptly melted and snowfalls suddenly intensified. Seemingly contradictory (and certainly at odds with our contention that the ice age of conventional geological doctrine never actually existed), these effects are actually explicable if the surface erosion (and deposition of extensive 'drift' deposits) usually but mistakenly attributed to massive glaciation were really legacies of the naturally violent action of immense volumes of water displaced by enormous sudden rearrangements of Earth's crust due to extensive subsidence of landmasses like those just mentioned.

It can be no coincidence that several recent studies of precisely these factors have linked, on the one hand, continental lithospheric thickness[124], and, on the other, widespread deglaciation of supposed northern ice-sheets[125] to the probability of 'polar wandering' during alleged 'Ice Age' times. Replacing finite ice-sheets (and subsequent deglaciation) with finite regions of lithospheric thickness (and the subsequent collapse or subsidence of these), would appear to engender the same general effects if subjected to some external force disrupting the inner workings of Earth as a planet. Not only has all this a further bearing on the chimerical nature of the celebrated 'Ice Age', but it is related to viscosity of the Earth's mantle and core and the likely behaviour under stress of both these aspects of Earth's structure. As we shall now see, the Earth's crust could actually slide or slip to a catastrophic degree.

9
Crustal Slippage

It may be erroneous to argue that a relocation of Earth's spin axis would necessitate the pulling over of the entire globe into a new orientation. In 1952, K A Pauly revived a theory previously developed by the astronomer A E Eddington, purporting to explain the cause of the 'Ice Age' as due to the sliding of the lithosphere over the viscous magma underlying it through tidal friction originating from the Moon[126]. This is tantamount to saying that crustal slippage had occurred.

We have noted that the hotter magma becomes the more viscous and asphalt-like is its condition. Oceans of highly heated magma would provide an excellent fluid surface over which comparatively solid crustal rocks could theoretically slide. Obviously a lesser force is needed to produce crustal slippage than to tilt the whole globe in some new direction, for the crust is only a portion – and a comparatively small one at that – of the Earth's total mass, and the momentum required to achieve this is directly dependent upon that mass.

To ensure that the axis of the Earth's core is that of the planet generally, while simultaneously permitting the crust to slide over the magma, the friction between these two layers (the source of much thermal energy) must be obviated – and in order to alter the position of the crust relative to Earth's spin axis, the regions comprising the equatorial bulge must be stretched while polar territories must be at least partially truncated or compressed. Significantly, both phenomena occurred at the close of 'Pleistocene' times.

In the concept of a rotating multi-layered visco-elastic planet like that referred to earlier, the arguments that the irregular coupling of Earth's differentially-revolving viscous core and mantle, even now producing variations in the length of day, begins to look like an after effect of geologically recent crustal slippage. Normal mantle viscosity enhanced by powerful external influence, combined with sudden 'deglaciation'[127], thus seemingly caused not only extensive crustal slippage and fracturing, vulcanism, seismic activity and orogeny, but also a change in the actual inclination of the Earth's spin axis. Acting in concert, such phenomena would have been sufficient to produce all the geophysical changes enumerated up to this point.

Nevertheless, although Eddington's theory unquestionably contains several attractive features, such as accounting for warmer areas formerly existing at the poles and *vice versa* in other latitudes, it has certain serious drawbacks.

Thus, as early as the 1920s, another authority, Harold Jeffreys, highlighted a flaw in Eddington's theory. He wrote:

> Has the inclination of the Earth's axis to the plane of its orbit varied during its history? The answer... is a definite 'Yes!' The theory of tidal friction... assumes the equator and the plane of the Earth's and Moon's orbits to coincide... they do not.[128]

This difference between the plane of the Earth's and the Moon's orbits strongly suggests, however, that it is the terrestrial axis that has altered. We have, moreover, previously noted that the Moon was apparently once closer to Earth, so it is conceivable that, even if displaced, the Moon may have still retained the original plane of its orbit.

Did these apparent changes result from the same cause? We may never know the answer to this question although, while it is theoretically possible to interpret these displacements as due to two entirely separate events, perhaps aeons apart, it surely overstretches credulity to argue that any influence powerful enough to have altered the inclination of Earth's axis would have somehow contrived to exclude such a near celestial neighbour as the Moon from its sphere of action.

Jeffreys was another authority who concluded that only an *external* force could induce a change in the orientation of the terrestrial axis. He remarked:

> If we consider the axis of the Earth's angular momentum, this can change in direction only through couples acting on the Earth from outside.[129]

Almost all authorities are as one, therefore, in concluding that only a powerful external agent could have altered the inclination of Earth's axis. We have outlined the principal hypotheses advanced from time to time purporting to explain how this could or might have happened dynamically. Broadly speaking, these advocate that either the *entire* globe was realigned axially, or that only the Earth's *crust* changed position by sliding over the underlying viscous magma. Since, however, Earth's axis *has* obviously changed, and geologically very recently at that, the first group of explanations concern the very heart of the problem, and indicate that the entire Earth has indeed assumed a new axial inclination. This does not exclude crustal sliding as having occurred simultaneously with axial displacement.

The aforementioned crustal deformations, especially the crustal foreshortening around the present polar regions, as well as the extensive rifting and fracturing – as Hobbs[130] and others have concluded – occurred on a planetary scale everywhere at about the same time. As others have contended, the Earth's axis must have been inclined in a more vertical plane than today[131]. These crustal deformations collectively constitute excellent evidence that crustal sliding occurred in at least some regions concurrently with an axial realignment.

In this respect the precession of the equinoxes and the Chandler Wobble – a circle that the polar axis describes about itself every 432 to 436 days[132] – may represent not only further results of a recent perturbation of Earth by some massive external influence but also 'hunting' by the Earth as a unit in its endeavours to regain complete stability.

It seems, therefore, more than likely that both the above categories of explanation are essentially correct, that they are not mutually exclusive, and that both planetary and crustal changes of the magnitude discussed took place simultaneously.

Finally, is it not interesting to find accredited authorities suggesting that global fracture patterns, such as would occur at the time of crustal slippage and axial realignment, indicate that, immediately prior to the time of fracturing, the inclination of the terrestrial axis was more vertical than at present?

If so, it is surely important to consider the following points very carefully. The present plane of the equator to the orbital plane (the obliquity of the ecliptic) is currently 23°27′8″, and has been calculated to vary between 21° and 24° over a period of 40,000 years[133]. This governs the seasons as they now occur, and provides the one day/one night per year presently experienced at the poles. If the obliquity were nil, however (*ie*, if the plane of the equator and the orbital plane coincided), and the rotational axis were vertical, the following effects would dominate:

- Day and night would be of equal length everywhere on Earth.
- Environmental conditions would differ profoundly from those of today, with a widening of the temperate zones and a marked narrowing of the cold and torrid zones.
- Milder polar conditions would prevail and the present ice caps would not exist, or would exist only very feebly, at the poles.
- The differences in the seasons would diminish with fewer extremes of climate everywhere, with some regions never experiencing a proper winter.

These factors, and the aforementioned fact that virtually all the world's major mountain ranges were appreciably lower before the 'Pleistocene' Phaeton visitation, enable us to readily appreciate how such conditions can only have been conducive to vigorous plant growth on almost every land area; that deserts can only have been small or non-existent; and that ocean currents must inevitably have been generally warmer. The further possibility that, before this terrible event, Earth may have rotated more slowly – with a day lasting perhaps as much as 30 hours – also means that there would have been longer growing-time for plants, both daily and seasonally; and that any disruptive external influence, of the magnitude necessary to enforce a shift in the orientation of the geographical poles, would have braked the Earth to a halt more rapidly than seems possible with its *present* rotational speed. The corollary to this would be that the resultant crustal dislocations and worldwide increase in thermal energy would have occurred somewhat more quickly, and certainly at a catastrophic pace.

All the details, therefore, begin to come together. Facts which at first sight appear anomalous, and ideas that initially seem fanciful or unlikely, now interlock like pieces of a giant jigsaw. Dare we ignore the significance of such a pattern?

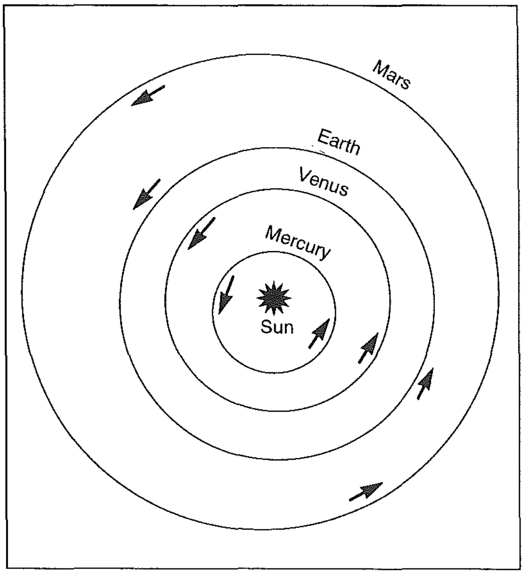
10
THE SOLAR SYSTEM

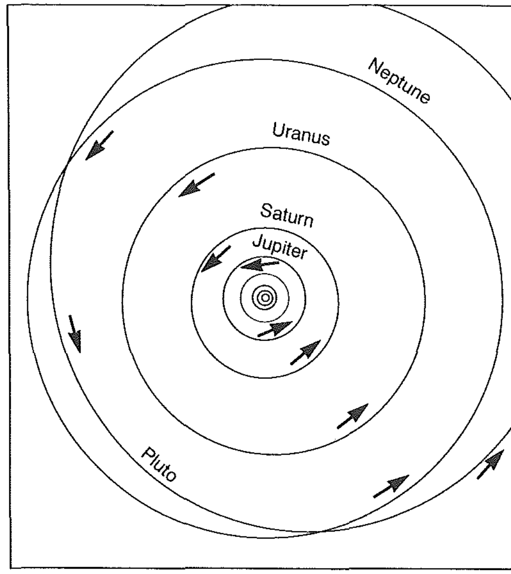
Accepting for a moment the reality of a near-collision between Earth and one or more sizable astronomical objects approximately 11,500 years ago, it follows that such an event could scarcely have been confined to just the Earth/Moon system, or failed at some stage to involve at least some of the other planets and bodies comprising the Sun's family. Indeed, even a general survey of that family discloses some very remarkable details which collectively suggest that, in the comparatively recent past, several of those bodies were subjected to and partially deranged by some powerful influence of unknown origin and identity.

As detailed description of the constituent members of the solar system would make rather tedious reading here, the salient statistics are better comprehended in comparative tabular form.

The huge astronomical distances cited are utterly meaningless, of course, to all save mathematicians, and fail to convey either the immensity of space occupied by the solar system or the isolated position of this system in the immeasurably grander vastness of the Cosmos. It is, however, important to grasp the enormity of this backdrop, for it was against this that the Phaeton disaster occurred; and since, as will shortly be shown, Phaeton traversed the solar system before reaching the environs of Earth and took an appreciable while to cross the distances involved, early humans possibly had sufficient time to perceive that a major catastrophe was approaching and make organised preparations to save themselves from the impending destruction. It must, therefore, be extremely significant that ancient records have come down to us actually describing the awesome cosmic drama produced by Phaeton during its passage through the solar system. These will be considered shortly.

If, therefore, we make a scale model of the solar system small enough to be readily understood, it will have to be the size of Piccadilly Circus in London (some 150yds or metres across), and we must use a marble-





Left: Fig 4.6. The eccentricities of the orbits of the inner planets, drawn to scale.

Right: Fig 4.7. The eccentricities of the orbits of the outer planets, drawn to scale. This diagram is eighteen times smaller in scale than fig 4.6. The orbit of Chiron is not shown, since, due to its recent discovery (1976), little is yet known about its eccentricity.

sized object to represent the Sun. This we will place in the centre of the model. On the same scale, the planets will be small seeds, grains of sand, and specks of dust, and the model will be only just large enough to accommodate Pluto's orbit. On this scale virtually all the satellites become invisible. Yet, as Sir James Jeans once observed[134], at this scale the nearest star, represented by another marble, will be somewhere near Birmingham or, if we go in the opposite direction, somewhere near Calais – some 100 miles or 160km distant. We can see, therefore, that although the Phaeton disaster was a gigantic affair here on Earth, in the context of the solar system it was a much more modest event, while in that of the Universe generally it amounted to little more than a ripple.

Before reviewing the evidences of apparently recent celestial disruption in the solar system, it will be important to note that, contrary to popular belief, the planets do not orbit the Sun on a common plane or follow exactly concentric paths. Indeed, table 4A shows that Neptune and Pluto, for instance, orbit on extremely different planes, and (figs 4.6 and 4.7) the eccentricities of the planetary orbits generally.

Also of relevance is the path taken annually by the Sun through the twelve zodiacal constellations as viewed from Earth. Traditionally these constellations are those of Aries, Taurus, Gemini, Cancer, Leo, Virgo, Libra, Scorpius, Sagittarius, Capricornus, Aquarius and Pisces. They form "...a band about 8° wide on the celestial sphere, centred on the ecliptic"[135] or plane of the Earth's orbit around the Sun, in which the Sun, Moon and planets appear from Earth to move from west to east[136] (not to be confused with the daily apparent rotation of the heavens as a whole from east to west – the former being due to the orbital motion of Earth and planets, and the latter being due to the rotation of the Earth). Strictly speaking, "...the ecliptic is a mathematical fiction corresponding not to the actual plane of Earth's orbit, but to one with all minor irregularities smoothed out"[137].

Although the Greek astronomer Aristarchus of Samos is generally credited with having discovered the obliquity of the ecliptic[138],

Table 4A.
Planetary statistics Based on the latest available information

PLANET	Mean distance from the Sun in millions of miles (kms)	Equatorial diameter in miles (kms)	Volume (Earth =1.0)	Mass (Earth =1.0)	Density (Water =1)	Surface Gravity (Earth =1.0)	Direction of axial rotation	Period of equatorial rotation	Period of revolution	Orbital velocity (km/sec)	Inclination of equator to orbital path	Inclination of ordit to plane of ecliptic	Eccentricity of orbit	Satellites
Mercury	36 (57.6)	3029 (4847)	0.056	0.055	5.4	0.380	W-E	59 days	87.97 days	47	<30°0'	7°0'	.206	-
Venus	67 (107.2)	7700 (12,320)	0.857	0.816	5.2	0.890	E-W	243 days	224.70 days	36	117°0'	3°04'	.007	-
Earth	93 (148.8)	7926 (12,682)	1.0	1.0	5.5	1.0	W-E	23h56m	365.26 days	30	23°05'	0°0'	.017	1
Mars	142 (227.2)	4215 (6744)	0.150	0.107	3.9	0.380	W-E	24h06m	687.0 days	25	24°0'	1°08'	.093	2
Jupiter	483 (772.8)	89,000 (142,400)	1318.0	317.9	1.3	2.6	W-E	9h8m	11.86 years	13	3°01'	1°03'	.048	16
Saturn	880 (1408)	74,100 (118,560)	769.0	95.2	0.7	1.1	W-E	10h4m	29.46 years	9	26°7'	2°5'	.056	17
Chiron	1282 (2052)	?	?	?	?	?	?	?	50.68 years	?	6°54'	?	.38	-
Uranus	1800 (2880)	32,000 (51,200)	59.0	14.5	1.2	0.960	W-E	15-17h	84.01 years	6	90°0'	0°8'	.047	15
Neptune	2755 (4408)	41,000 (65,600)	72.0	17.4	1.7	1.5	W-E	15h7m	164.8 years	5	28°8'	1°8'	.009	2
Pluto	3687 (5900)	3250 (5200)	0.1	?	?	?	E-W	153h0m (6dy 9h)	249.9 years	4	?	17°2'	.249	1

Metric values, where appropriate, given in parentheses.

the Greeks did not, as is often stated[139], devise the zodiac about 2,000 years ago, although they probably were responsible for allotting each sign a width on the celestial sphere of 30°. References to zodiacal constellations in the earlier records of the Babylonians, Egyptians, Chaldeans and ancient India[140] show that, as a device, the zodiac was much older than classical Greek culture, being of very great antiquity indeed.

But irrespective of when the zodiac was first devised something noteworthy happened to it subsequently.

> Because of the effects of precession and as a result of the International Astronomical Union's (IAU) adoption of constellation boundaries which are not exactly 30° long, the Sun's passage through the constellations does not correspond to its passage through the signs of the zodiac. According to the IAU boundary definitions, the Sun travels 44° through Virgo, only 7° through Scorpius [both zodiacal signs], and 18° through Ophiuchus, a constellation for which there is no zodiacal sign.[141]

This suggests that a change has occurred in the inclination of Earth's terrestrial axis – like that previously discussed – since the zodiac was first invented. In that connection it is also interesting that certain ancient traditions aver that Libra was a sign added to the zodiac *following* the Deluge. If true, that would imply an antediluvian origin for the zodiac. The traditional association of the Deluge event with Phaeton's visit gains added interest when we recall that ancient Persian accounts specify that the visit occurred when the Sun was in the zodiacal constellation of Cancer, a detail indicative of the existence even then of some type of zodiacal device or gauge.

Thus, from a quite unexpected quarter we encounter further apparent confirmation of the recency of a profound terrestrial disruption which, occurring after people had reached a fair degree of civilised existence, among other things altered an early device created, presumably, to measure time and predict seasonal cycles. That people attained such advanced knowledge so early is strongly supported by their coeval possession of the astonishing mathematical expertise highlighted in later pages.

Any celestial intruder arriving from more remote cosmic regions would tend to encounter or pass close only to planets nearest its line of advance at that specific time. Those planets which happened to be orbiting the far side of the Sun might, in such circumstances, remain comparatively unaffected by the intruder. This, we shall find, appears to be precisely what occurred during the Phaeton event.

11
THE MAVERICKS

In addition to the planets and their satellites, there are other celestial bodies and substances in the solar system, which pursue erratic paths or are unpredictable in their actions. Accordingly, they may be conveniently dubbed celestial mavericks. Some of their recorded characteristics suggest that they may have had direct connections with the Phaeton disaster.

Asteroids

The genesis of asteroids is uncertain, and has long been a subject for speculation[142]. The asteroid belt lies between the Jovian and Martian orbits and, because some attain appreciable size, are sometimes referred to as planetoids. Irregularly shaped, apparently rocky, bodies, asteroids range in size from Ceres, Pallas, Vesta, Iris and Juno – the largest, with estimated diameters up to 625 miles (1000km) – to others perhaps just metres across. Calculations suggest that up to 80,000 asteroids may actually exist[143], although most are too small to detect by present means.

Approximately three thousand asteroids have now been discovered and awarded names or numbers; others have been briefly sighted only to be 'lost' again. No asteroid is big enough to retain an atmosphere, although it has been postulated that a few of the largest may possess frozen ones represented by a coating of ice.

One of the largest, the irregularly-shaped Vesta, which has an average diameter of 325 miles (520km), is of particular interest here on several counts. Close-up photographs of it taken by a recent NASA space probe shows that Vesta has an astronomically and geologically very youthful basaltic surface, and two even younger large craters believed to have resulted from a "single great impact"[144] – although with what is as yet undetermined.

Although the origin of many asteroids is still unknown, opinions have lately been offered that at least some asteroids may represent all that remains (*ie* lower mantles and core) of "catastrophically ruptured" formerly larger bodies[145]. The significance of that interpretation will become apparent later.

Many similar asteroids appear to be free-moving pieces of some of the larger asteroids. Vesta, for instance, appears to have spawned a small family of lesser asteroids and another family of small basaltic meteorites, called *eucrites*[146]. Analyses of several eucrites which have fallen to Earth show that not only is the basalt of which they are made apparently the same as that forming Vesta's surface, but that it is likewise exceedingly youthful[147]. It has been suggested that these eucrites represent fragments of Vesta's surface blasted out radially into interplanetary space by whatever impacted with it and endowed it with two craters.

Numbers of other asteroids circle the Sun on highly eccentric orbits, several occasionally approaching closer than Mars – and at least eight cross Earth's orbit. Of the latter, Eros, with a diameter of a mere 16 miles (25km) has been known to approach to within 14,000,000 miles (22,400,000km) of Earth. Viewed astronomically this is rather close.

Collectively, the behaviour patterns of these objects are highly suggestive of some geologically recent disruption of an older, more orderly asteroid regime, or that the asteroids *en masse* (eucrites included) are themselves remnants of one or more catastrophically disintegrated bygone worlds.

Comets

Over a thousand comets have been reported since modern records were first begun, and on average six or seven new ones are discovered every year. It has been suggested that their number is in the order of 100,000, but even this huge figure may fall short of the real total.

Although various hypotheses have been formulated, comet origins are unknown[148]. Some authorities suggest the existence of cometary material far beyond the solar system, which is periodically disrupted causing pieces to be drawn off; others, like Clube and Napier[149], suggest they originated through the destruction of one gigantic object some 10,000–20,000 years ago; and Opik has wondered about comets and planets having a common origin[150]. Van Flandern has even discussed the possibility of comets being remnants of a former asteroid planet[151]. But, whatever their source, they are apparently true members of the solar system, revolving round the Sun on elongated, elliptical orbits[152].

The period of these orbits varies considerably, with 40 or so comets circling the Sun with orbital periods of 100–1,000 years, while the majority take considerably longer. Some, it has been estimated, take as long as 40,000 years[153].

There are also short-period comets and those which return at erratic intervals. For instance, Encke's comet orbits the Sun every 3.3 years, but has been known to arrive

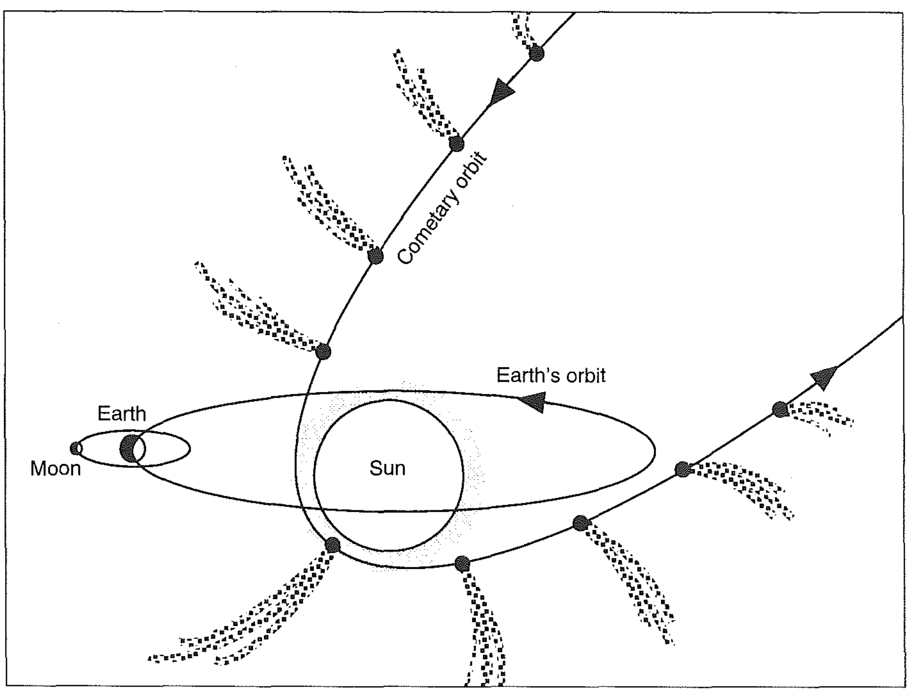


Fig 4.8. Schematic diagram showing a typical path of a comet round the Sun. Note how the comet's tail always points away from the Sun.

'early' on several occasions[154]; while Biela's comet, orbiting every 6.6 years, arrived late three times before finally disintegrating in 1852[155]. About 20 comets have been seen to divide since Biela's break-up. A photograph of Morehouse's comet of 1902 shows what seems to be the comet's tail fragmenting (fig 4.9).

Additionally, there are occasional interstellar comets which do not orbit the Sun. One such was Bronsen's comet of 1846, which arrived from remote cosmic regions, crossed the solar system, and travelled on into interstellar space, never to return[156].

While the Sun acts as a focus for all cometary orbits, Jupiter appears to act as another focus for short-period comets. Lexell's comet of 1770 and Brook's comet of 1889 both actually passed through the Jovian satellite system and almost grazed the surface of Jupiter and split in two[157]. Yet, despite such close encounters, no comet is known to have seriously affected the motions of the Sun, the planets, or their satellites. Indeed, it is the planets which affect the comets, not the reverse, with the larger planets such as Jupiter and Saturn capable of altering the comet's orbit and speed[158].

This is due to the fact that comets have insufficient mass to perturb the planetary bodies in the solar system gravitationally[159]. Even though the *coma* or 'head' surrounding the nucleus of a comet may attain a diameter of about 20,000 miles (32,000km) or even 200,000 miles (320,000km) – thus exceeding the Sun in volume but not in mass – it is actually very thin and seemingly composed largely of dust, for all but the dimmest stars can be seen through it[160].

The actual mass of a comet lies in its nucleus, the latter varying in its diameter from less than a mile (1.6km) in small comets to as much as 10 or 20 miles (16–32km) in large ones. The composition of the nucleus is still not clear, but it is thought by some to be aggregates of stones loosely held together by gravity – the equivalent of a flying gravel-bank. It has also been referred to as a 'dirty snowball' on the assumption that it is composed of 'interstellar dust' made up of compounds of hydrogen, carbon, nitrogen, oxygen, methane, ammonia and water – the last three as ice particles[161]. Another opinion postulates that frozen water is the main constituent[162]. It is also widely thought that ices compose 70–80% of all cometary nuclei[163]. It is this insubstantial mass of the comet's nucleus which makes it an *unlikely* candidate to be Phaeton, for while a collision would cause some planetary damage, almost certainly such limited mass would fail to perturb Earth's motion, fracture its crust, retard its rotation, engender a magnetic reversal or affect the polar axis.

Meteors

Literally billions of these rocky objects seem to be loose in interplanetary space. Many theories have been formulated to account for their existence. An early idea regarded meteors as the remnants of orbiting trains left by both existing and defunct comets, mainly because of the occurrence on particular dates of meteor swarms. Some meteors, however, are so large – up to a mile (1.6km) or so in diameter – that it seems unlikely that they were ever parts of comets. More recently, different explanations have been advanced. One is that meteors normally orbit in the asteroid belt but that hypothetical collisions between asteroids from time to time disrupt meteor orbits and move them into new ones across the solar system. Meteor orbits, however, are unknown, and according to some may differ appreciably from those of asteroids. Another theory postulates that meteors are fragments of parent meteoric planets which pass through the solar system[164], although nobody has so far knowingly sighted such a planet. Trains of meteors have been observed, however, which possibly support this theory – an especially memorable one occurring on February 9th, 1913, travelling NW-SE at a speed of 6 mps (9.6 kps), some 30 miles (48km) above the ground over a large area of North America[165].

A third theory postulates that meteors are slowly drawn in on spiral orbits towards the Sun from various regions of the solar system, due to the Poynting-Robertson effect[166]. This effect is relatively weak, however, and hardly strong enough to affect the largest meteors, which are actually quite massive bodies. The origin of meteors, therefore, is currently uncertain, and a satisfactory explanation of their existence well overdue.

The advent of satellite space photography has revealed numerous previously unsuspected land-forms suggestive of impact by very large meteors on various occasions throughout Earth history[167]. These features, which have constituted the central theme of at least two full-length books[168], clearly show that on impacting these meteors perpetrated widespread damage, and that while some are geologically ancient others are surprisingly recent.

Although fallen meteors (meteorites) vary in composition, 96% of all known specimens contain Chondrites (silicate and other minerals) which are absent from terrestrial rocks but are present in the atmosphere around the Sun; and they also contain iron[169]. Meteorites composed of iron or a high percentage of nickel are known as Siderites to distinguish them from non-metalliferous meteorites which are called Aerolithes. Some Siderites are of great size. One, which fell near Elbogen in Bohemia, in 1400 AD, weighed 235lbs (105kg)[170], while another, not observed to fall, has been discovered in Oregon and weighs no less than 14 metric tonnes[171]. Some meteorites are also *unexpectedly young*[172], and cosmic-ray exposure ages of meteorites generally suggest an *astronomically recent disintegration* of the original body[173].

In connection with metalliferous meteorites, it is interesting that Jews call iron *nechoshet*. This literally means 'droppings of the serpent'[174]. This is a meaningless term until we recall that, in Jewish traditions, the 'serpent' was another name for Satan, the old dragon, remembered elsewhere by a great variety of other names including *Typhon* and *Phaeton*. The fact that ancient Midrashic and Talmudic accounts of the Phaeton visitation mention a celestial bombardment of hot stones occurring then, that the early Egyptians called iron the 'bones of Typhon'[175], and that Finnish traditions refer to a prodigious fall of huge 'iron hailstones' occurring when the world was once almost drowned by a great flood, all seem to be echoes of what, to modern man, would be falls of meteors. The falls of gravel featured in various Central American traditions seem to be recollections of the same general event. It must, furthermore, be relevant that the ancient Greek word for iron was *sideros*: this, when combined with the obviously related Latin word for star, *sidus* (genitive *sideris*, plural *sidera*)[176], as 'iron star', lends new meaning to the concept of a large partially-metalliferous body which, when close to Earth, showered it with loose pieces in the form of meteor-like iron hailstones.

The singular theme common to all these ancient traditions concerns the fact that these falls of metalliferous meteor-like bodies were inextricably part and parcel of a terrible cosmic visitation which almost destroyed Earth long ago. Significantly, the sizes and quantities of many modern meteorites and those mentioned in the traditions just cited, were such that they *cannot* be cometary debris. On this point alone it follows that the celestial marauder we have been calling Phaeton was *not* the comet that many earlier investigators of the Phaeton cycle of traditions have supposed.

Ice and Methane

The final class of celestial mavericks considered here concerns icy substances. We have already noted that various types of ice believedly exist in cometary nuclei. Several planetary satellites may also possess outer coatings of ice or may consist totally of ice, and it is also thought that much ice exists on the four largest planets – Jupiter, Saturn, Uranus and Neptune – which some astronomers believe are composed mostly of hydrogen and ices of carbon, nitrogen and oxygen enveloped by an extremely cold deep atmosphere of ammonia and methane[177]. All these substances, it will be remembered, are present in comets. The conclusion that supercooled ice (at –200°F or more) is a relatively common substance throughout the solar system[178] finds positive support from recent discoveries establishing that ice particles definitely occur in comets and

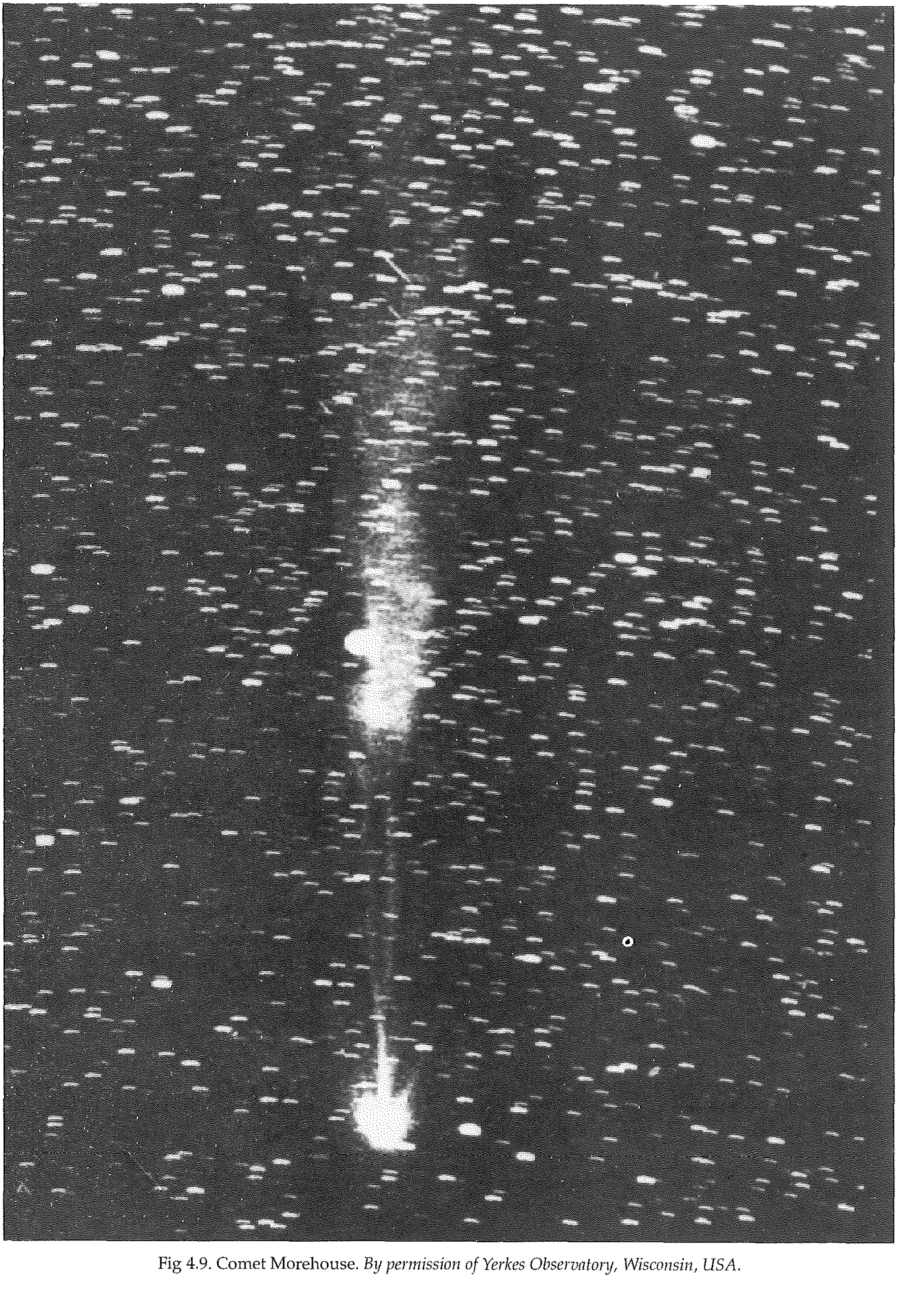


Fig 4.9. Comet Morehouse. *By permission of Yerkes Observatory, Wisconsin, USA.*

compose much of the rings of Saturn, and that sizable quantities of ice exist on at least three Jovian moons[179].

With these details before us, identification of the innumerable unheralded falls of blocks of ice, peculiar icy hailstones and glutinous substances, which have descended upon Earth from time to time as examples of further celestial mavericks may not be wholly irrelevant (see Appendix C). These disparate yet seemingly related objects may actually constitute vestiges of some infinitely greater masses of similar material that fell upon Earth at the time of Phaeton's visit. This is certainly suggested by the following details respecting the formation of hydrocarbons in space.

As previously noted, methane is one of the most abundant molecules in the solar system. It is well-known that *high temperatures* are required to reduce methane to aromatic hydrocarbons[180]. Interestingly, therefore, in ten Recent era (Holocene) sediments from Texas and Louisiana, both aromatic and aliphatic hydrocarbons have been found, aged somewhere between 14,600 and 11,800 BP (±1,400 years)[181]. Their origin is uncertain, but, considering the dates obtained for them, it is not impossible that they were formed about or during the time of the Phaeton upheaval, a *'hot'* event falling within the *same* time scale. Furthermore, hydrocarbons of high molecular weight – of which petroleum is one – comprise up to half the carbon content of carbonaceous chondritic meteorites.

The presence in varying quantities of such hydrocarbons in both comets and meteors strongly suggests that, as noted above, while the latter are almost certainly not derived from comets, the two classes of objects somehow share a common origin. One of the substances apparently linking these objects and perhaps indicating their joint original source is methane.

Petroleum is commonly thought of as having an organic (biogenic) origin, but it is now accepted that hydrocarbons, petroleum included, could be synthesised in space by a free-radical mechanism from methyl radicals, in which:

> Methyl radicals themselves could be produced from solar photons on methane.[182]

Non-biogenic petroleum thus formed might, on reaching Earth, form lakes or ponds wherever dense underlying strata prevented its natural absorption. Natural evaporation of this volatile liquid would leave behind it a skin of crude oil or asphalt. Quite conceivably, the asphalt lakes of Trinidad and Venezuela and the tar seeps of California originated in this way – particularly as all are intimately associated with the remains of late-'Pleistocene' animals and plants, victims of a much wider calamity that appears to have erupted about 11,500 years ago. That the mean average of the dates obtained for petroleum-bearing sediments in Texas and Louisiana falls remarkably close to this date is surely no coincidence.

Thus, whatever its real nature, if fiery ('hot') Phaeton was either itself partly composed of inflammable hydrocarbons developed from methane, or had, during its journey through the solar system, encountered a planetary body having, like Jupiter and Saturn[183], a largely methane-dominated atmosphere, a part of which it had perhaps captured or acquired. Its late arrival in the vicinity of the Earth/Moon system as (so numerous traditions aver) a flaming object of endlessly changing image, is at last explicable as that of an errant celestial visitor wreathed in constantly shifting, igniting and exploding clouds of methane. The aforementioned electromagnetic exchanges which would have naturally occurred between Earth and Phaeton, and were part of the electrical phenomena accompanying the attendant geomagnetic reversal[184], could also have served to ignite any hydrocarbon-laden atmosphere of the approaching astronomical visitor. In that connection readers will recall those traditions given in Part Three describing vast inflammable clouds, tremendous aerial explosions and terrible streams of fire directed upon Earth as leading elements in humankind's collective memory of the Phaeton disaster.

But if, as we shall shortly see, Phaeton apparently explosively destroyed a medium-sized planet beyond Mars, in all likelihood equipped with an atmosphere having a sizable methane content, then any dispersed portions of that body, such as the iron hailstones of Finnish lore, and many hydrocarbon-permeated meteors and comets, are respectively the stony and icy/gaseous remnants of the same now-vanished methane-pervaded world. The general location of this lost planet is that now loosely occupied by the asteroids, so Flandern's arguments about comets being remnants of a bygone asteroid world, and Opik's suggestion that comets and planets may have had a common genesis accordingly increase in interest.

12
SIGNPOSTS TO A COSMIC BATTLE

It is unnecessary here to list all the many scholars who have investigated the problems of axial shifts, changes in rotational speeds and polarity reversals, since thoroughly representative selections have been given on preceding pages. Significantly, most of these authorities agree that such changes could only be produced by enormously powerful forces acting upon Earth externally. Given that these changes really occurred, then quite literally, a war between worlds must have taken place. That, of course, is precisely what the traditions reviewed in Part Three assert.

Our survey of the solar system recorded various anomalies, several of which appear in table 4A and figs 4.6 and 4.7. Thus the Moon formerly circled the Earth more closely than it does now; Mercury's orbit is not circular; Venus rotates extremely slowly for its size, and in the opposite direction to all the other planets except Pluto; Earth has a non-circular orbit; Mars rotates too slowly for its size, and has a decidedly eccentric orbit. It also has two small irregularly-shaped satellites, Deimos and Phobos, hurtling round it at exceptionally high speed. Jupiter rotates extremely quickly for its size and mass, and, unlike all other planetary satellites, its two outermost known moons orbit it from pole to pole, each in opposite directions. Its third largest satellite, Callisto, exhibits unusually low density, suggesting to some that it possibly consists almost entirely of ice – over 10 billion cubic miles of it (if true, this makes Callisto the largest known single piece of ice anywhere).

Saturn also rotates unusually rapidly, follows a non-circular orbit, and is distinguished by its wonderful ring system held by many to be the debris of one or more fragmentised satellites. It, too, has several satellites consisting mostly of ice, as well as one, Phoebe, which orbits in a retrograde direction.

Uranus, which follows a non-circular orbit, is another rapidly-rotating planet, and has its equator inclined at an extreme angle (NNW-SSE). The axis of Uranus' magnetic dipole field is not only offset from the planet's centre, but, relative to the planet's axis of rotation, is located at the unexpectedly large angle of 60°. It has been suggested that this possibly exemplifies a polarity reversal in operation and that this has conceivably arisen from "a catastrophic collision event subsequent to the formation of the planet, intimately related to its large and anomalous obliquity to the ecliptic"[185]. Several of the Uranian satellites, which also possess equatorial tilts of 90°[186], show topographic features suggestive of catastrophic alterations; Umbriel, for example, exhibits a surprisingly "young fresh surface", and Titania a global network of geologically very young faults[187].

Although still quick, Neptune rotates more slowly and pursues an eccentric orbit. Both its moons orbit in a retrograde direction, of which the smaller, Nereid, following an enormously elongated orbit, takes no less than 359 days to complete just one circuit. Pluto rotates rather slowly, is a double planet with its satellite Charon, and has an orbit so highly eccentric that it intersects with that of Neptune. We have seen, too, that the origin of the asteroid belt between Mars and Jupiter is debatable, and that many of its constituent members orbit the Sun eccentrically. Meteors exhibit behaviour patterns which are even more eccentric; yet, although regarded by some as remnants of cometary tails or dead cometary nuclei, their origins are still unknown. Notwithstanding that, they clearly represent the debris of *something*. We have suggested, however, that, along with blocks of celestial ice which occasionally fall to Earth and the likelihood that non-biogenic petroleum can be produced from methane by natural chemical methods in space, meteors could be surviving fragments of one or more large solid bodies which have disintegrated.

The overall picture thus presented by the solar system shows that its principal members comprise a basically orderly assemblage of rotating and orbiting objects that have apparently experienced various derangements resulting in all kinds of aberrant and anomalous motions which, although of comparatively minor importance for the working of the solar system as a whole, have apparently been caused by one or more unknown influences in the past.

The outstanding question here, of course, is whether all these anomalies have accumulated over aeons of time – as the result of many essentially isolated disturbances, each of relatively local extent – or whether they represent the outcome of a single larger disruptive event affecting the solar system generally. The forces which generated the larger anomalies – for example, the acute tilting of Uranus, and the warping of Pluto's highly eccentric orbit – must have been so powerful that it is difficult to see how this could have also failed to affect other bodies in the solar family.

If the former interpretation of these anomalies is adopted, then it follows that various disruptions of the solar system are, by astronomical standards, comparatively frequent, and the history of the solar system could justifiably be said to be recurrently catastrophic. If, on the other hand, a single large disturbance – responsible for all, or at least the majority of, the observed anomalies – is the preferred interpretation, then the history of the solar system can be best defined as normally quiet and orderly but punctuated recently by a single tremendous cataclysm. The following details indicate that the latter interpretation, though startling, is almost certainly correct.

According to observations made by Mariner-4, the Martian orbit has apparently been seriously disturbed and the planet's structure severely strained at some time in the past. Aligned stress fractures observed on the Martian crust have led to the conclusion that:

> ...such a lineament system is caused by stresses in the planet's crust produced by changes in the planet's rotational equilibrium figure... The changes in angular velocity caused by tidal interaction of Mars with Phobos and Deimos are completely negligible and that of the Sun is a few percent at most: thus other mechanisms must be sought[188].

These observations appear to go hand-in-hand with the fact that the Martian magnetic field is presently no greater than 3 x 10^{-4} and has apparently been reduced by some means[189]. Moreover, calculations made of the mass and angular momentum of Mars when compared with other members of the solar system, result in an ideal axial rotation of 8 hours. Actually the rotation is slightly over 24 hours, so Mars has somehow slowed considerably, an anomaly which has prompted the question:

> How could its rotation have been slowed in the absence of substantial tidal effects? Loss of a massive Martian satellite – greater than the mass of Ceres would be needed – but where is it now?.[190]

F F Fish was equally puzzled when he concluded:

> Mars... either must have lost considerable angular momentum or never possessed the initial angular momentum that would be inferred.[191]

We have previously mentioned that Earth's axial rotation may have been speeded up from a possible former 30-hour day to its present 24-hour day, so it is entirely conceivable that the Martian day has somehow slowed down, and perhaps from the same underlying cause.

Turning now to asteroids, we may note the fairly widespread view that they are the degassed relict nuclei of comets captured by Jupiter over aeons of time – although this is admittedly debatable[192]. The rocky composition and great relative size of some of the asteroids suggests that a cometary origin for them is unlikely, so their genesis must lie elsewhere. Efforts have been made to calculate the original mass of a single body to which all the asteroids might have once belonged, but this proved to be only 0.03 of that of the Moon[193], so either a very small hypothetical world formerly orbited where the asteroid belt now exists, or numerous fragments of it are now absent from the belt – in which case that world must have been correspondingly larger. It is surely significant that some asteroids appear to exist as families through the break-up of a larger body, whereby the relevant pieces now orbit close together. The Koronis family of 18 separate pieces is one such group.

Some of these groups orbit the Sun very eccentrically. The Apollo family, for example, overlaps Earth's orbit at perihelion (the closest part of the orbit to the Sun), and of its 40-odd members, over 15 are continuous crossers of Earth's orbit. The 10 strong Amor group although only occasionally crossing Earth's orbit always crosses the Martian orbit. Both these asteroid groups follow orbits that actually pass obliquely through the main asteroid belt. This suggests that they have been pulled out from the main asteroid swarm by some passing gravitational force, or ejected as a result of a collision with some larger body. Alternatively, they may not be true asteroids at all.

Hidalgo is the name of another eccentrically-orbiting body. Although usually classed as a minor planet, this small rocky object has a Jupiter-crossing orbit, and may actually be a large asteroid[194]. Interestingly, when it was first discovered by Baade, doubt arose as to whether it was a genuine minor planet or a comet because it exhibited diffuseness. Similar uncertainty attended the discovery of Comet Arend-Rigaux, because, although its orbit resembled that of a minor planet, it appeared to be very diffuse[195]. Irrespective of their real identities, both objects have clearly been deranged at some time in the past.

Yet other eccentrically-orbiting objects of doubtful origin, but clearly pulled out of kilter from some now-altered earlier regime, and apparently in the not-too-distant past at that, are the recently discovered Pholus and object 1992 QB. Pholus lies beyond Saturn's orbit and 1992 QB lies beyond Neptune's[196]. The latter appears to be connected in some manner with the Kuiper Belt, which lies at or near the edge of our solar system, which we shall consider again shortly.

All these eccentrically orbiting objects have led some to speculate whether asteroids and meteors, despite now following widely varying orbits, once shared a common origin. Both are almost invariably stony, meteors frequently characterised by a high iron or iron-nickel content – a detail suggesting to Sears that iron meteorites conceivably formed in the asteroid belt[197]. Van Flandern has examined the possibility that comets may have originated from the disintegration of a solid planet-sized body formerly existing where the asteroid belt now occurs[198]. Presumably the aggregations and groups of stony debris that would form in free space after the fragmentation of such a solid body would, as they settled down into orbits, form their own weak but distinctive gravitational fields and attract dissociated ions and electrons from the plasma now believed to pervade interplanetary and interstellar space. By such means, it was suggested, comets could be born.

The erstwhile existence of a planet orbiting where the asteroid belt now lies has been discussed by many writers, including Ovenden, who examined the proposition in relation to Bode's Law[199], first formulated in 1772. Johann Bode observed the regularly increasing distances of the planets from the Sun, and noted that there was a vacant orbit between Mars and Jupiter. It was, of course, the search for the planet thought to follow this orbit that led to the discovery of the first asteroid in 1801.

A distinct possibility exists, therefore, that asteroids, meteors and comets share a common origin, and that meteors and the large blocks of free-orbiting celestial ice are the remnants of something larger which broke up. If true, then many comets may be of comparatively very recent origin. Ages ranging from 10 million years or more to 10,000 years or less have been proposed by different authorities for comets, but the fact is, nobody really *knows* how old comets are. Therefore, the possibility exists – as some have suggested – that comets could be replenished from some source beyond the solar system. Certainly at least a high percentage of, if not all, comets may have formed from the debris of some larger body which disintegrated in the not-so-distant past.

If such an event occurred, then the aforementioned icy missiles presumably represent frozen fluids and gases dispersed in all directions at the time of that disintegration, but which have since settled down into eccentric orbits around the Sun. Such ice masses would imply that the original parent object was sufficiently large to have supported some kind of atmosphere, more akin perhaps to that of Jupiter or Saturn than to that of Earth, and containing more methane than the terrestrial atmosphere. Methane, we have noted, is evidently more common in planetary atmospheres furthest from the Sun – thus any sizable planet formerly orbiting between Mars and Jupiter very possibly possessed an atmosphere containing more methane than those of Earth or Mars, but less than those of Jupiter or the outer planets.

We must also refer here to the anomalous minor planet Chiron, which was only discovered in the late 1970's, orbiting between Saturn and Uranus. Chiron appears to be either a very large satellite which has 'escaped' from one of those planets, or is an asteroid or a dead cometary nucleus 'captured' by one of them and diverted into its present orbit[200]. As yet little is known about it, although it is immediately obvious that its size and position violates Bode's Law. But reviewing Chiron in conjunction with the anomalous tilting of neighbouring Uranus' rotational axis, the orbital eccentricity of both Neptune and Pluto and the retrograde motion of Neptune's two moons, it is equally obvious that something out of the ordinary has occurred in the far confines of the solar system and disturbed the outer planets and their satellites. Others have noted this state of affairs as well[201].

All the foregoing, therefore, are apparently signposts to what seems to have been a celestial calamity which affected the greater part of the solar system at some time in the past, and which, as we shall later see, left free-moving debris ranging over wide areas of it.

13
THE CANDIDATES

We have seen that any external agent capable of slowing or halting Earth's rotation, or of tilting the terrestrial spin axis to some new angle, would necessarily have to be exceedingly powerful. If a lone agent or influence was involved, it would have to possess large mass and high electromagnetic potential. If several agents acted in concert, then their collective mass and electromagnetic fields would still need to be sufficiently powerful to produce such radical Earth changes. Our search, therefore, will be for some agency capable of fulfilling these rather special requirements.

The foregoing survey of maverick objects in the solar system clearly shows that, despite the relatively great size of the largest of them, none remotely possesses the mass needed to materially affect Earth's rotation or engender an axial shift. On the contrary, nearly all these objects themselves suffer perturbation, division or destruction if they venture too close to even the smallest planets.

Thus, unless there formerly existed maverick objects which were literally thousands of times more massive than the largest examples known today, no such object can have radically affected Earth. Although this observation also applies to conventional comets, so little is yet known about the recently discovered giant interstellar comets[202] that inevitably the possibility persists that such objects possess sufficiently massive nuclei as to cause the tremendous physical disturbances detailed in this book. Conceivably these objects may not, in fact, be true comets at all, but merely resemble them superficially.

We may, therefore, dismiss those earlier theories which postulated an asteroid or giant meteor as the cause of the disaster. Similarly, those which ascribe the calamity to a comet may also be discarded, since conventional comets lack the mass required to effect the relevant physical changes, either terrestrially or elsewhere in the solar system. We may note, however, that Velikovsky, who advocated a comet as the causal agent, recognised the necessity of involving a *planet-sized* object (which he went on to identify as the present planet Venus).

Having eliminated meteors, asteroids and conventional comets from our list of candidates, we proceed to the next largest class of celestial objects – the satellites. These exist in almost all sizes in the solar system, ranging from small irregularly-shaped moons, like those orbiting Mars, to the huge satellites (Ganymede, Titan and Triton) larger than our Moon. The composition of the satellites varies considerably. Rocky and comparatively heavy examples, like the Moon, are known while others, such as Callisto, are surprisingly lightweight and probably consist mostly of ice. Obviously only the most massive satellites (those as large as our Moon) qualify for consideration here.

Yet, although Bellamy has attempted to explain the great physical disturbances of 11,500 years or so ago as the result of the disintegration of an earlier Tertiary satellite of Earth, and the subsequent capture of our present Moon[203], the existence of the former was actually never more than hypothetical, and the Moon itself is insufficiently massive to have perpetrated the immense upheavals characterising those disturbances. Nor are any other satellitic bodies known which could have produced those violent events. It thus follows that satellites can be safely eliminated from our list of candidates too.

Planets constitute the next group of candidates. We have seen that, although most circle the Sun on what may be conveniently termed 'fixed orbits', certain small planets – notably Hidalgo and Pluto – pursue highly eccentric orbits, or, like Chiron, have apparently been displaced and forced into new orbits which now confound Bode's Law. The orbital stability of the planets is therefore far from being immutable, although only *very* powerful forces could cause orbital changes or propel even small (let alone large) planets into new ones. No evidence exists for Hidalgo or any other minor planet having ever approached Earth close enough to affect its rotation or axial tilt, or that Mars or Venus ever caused or contributed to the widespread terrestrial changes previously mentioned[204]. Nevertheless, many ancient records repeatedly refer to the involvement of those two planets in a celestial drama coincident with great physical upheavals on Earth. However, Mulholland has stated that:

> ...The available observational data suggest strongly that *no* planet-sized object has passed near Earth in historic time, and probably not for a much longer time...[205].

Nonetheless, *something* capable of exerting a tremendous influence approached Earth closely about 11,500 years ago and left many mementos of the encounter. The accomplishment of these effects *necessitated* the interaction of an influence approaching planetary dimensions – something close either to Earth's mass and density (see table 4A), or of smaller mass and greater density. It seems unlikely that a larger object was concerned, for had that been the case then the Earth would probably have disintegrated according to Roche's Law, which we will examine shortly.

We have exhausted all possible candidates (likely and unlikely) within the solar system and are left to consider others which, perforce, would have possessed more distant origins. Of these, the idea of a passing star (sun) is too unlikely, for it would have incinerated the entire planetary concourse – thus, like Patten[206], we dismiss it. Yet, we should not overlook the fact that specialist studies of stars nearest the solar system indicate that relatively close stellar encounters are not only much more frequent than generally believed, but occur near enough astronomically to perturb even very long distance comets[207].

Just conceivably, one of the aforementioned giant interstellar 'comets' traversed the solar system some 11,500 years ago, wreaking havoc among the Sun's family, much as Clube and Napier have suggested[208]. There is, however, no firm scientific evidence for definitely identifying the astronomical visitor as such an object, and one may just as reasonably suppose that a large and highly dangerous supernova fragment entered the solar system at high velocity around that date. It is interesting that about 40 novae erupt annually in our galaxy alone, and a supernova roughly every 30 years[209]. Thus – assuming that these rates have remained more or less constant for, say, the last 15,000 years – no less than 600,000 novae and 500 supernovae have occurred in our galaxy during that period.

Supernovae are actually quite common cosmic events, some 600 of them having been observed among the nearer galaxies since the 1930s[210]. Of the supernovae recorded in our galaxy, a surprising number have exploded unexpectedly *near* the solar system within the last 15,000 years[211] – at least *five* between 15,000 and 11,500 years BP. Of these, the Vela supernova – an exploded star (G263.9–3.3) situated at the unusually close astronomical distance of d=500pc from the solar system – could be a likely candidate, as recent calculations suggest that it erupted either some 14,300 years[212] or about 11,000 years ago[213]. Both these dates fall within the 'right' interval before the onset of the Phaeton disaster.

It should, however, be remembered that if this particular scenario has any merit at all, then the *velocity* at which the Phaeton 'object' traversed the intervening regions of interstellar space would be the most critical factor. Certainly, on such a lengthy journey through an all-pervading plasma of dissociated ions and electrons, any such high-speed object could be expected to acquire a high electromagnetic potential in addition to any electrical or magnetic field it already possessed. Such an object would be extremely dangerous.

Although it is impossible at this juncture to positively pinpoint Phaeton's real identity, and we can merely state what it was not, it must surely transcend coincidence that the gamma-ray spectrometer on the Third High Energy Astronomical Observatory satellite (HEAO 3) has lately detected a high concentration or cloud of Aluminium-26 (^{26}Al) in space, surrounding the solar system. ^{26}Al is a radioactive isotope with a half-life of about one million years, and, according to theoretical studies, is *readily produced in supernova explosions*. Ultimately ^{26}Al decays to Magnesium-26, but as this cloud is apparently still very much Aluminium-26 and not Magnesium-26, its decay is not very far advanced and suggests that the cloud may be as young as a mere 10,000 years[214].

If the cloud truly represents supernova debris, then the original explosion must, by astronomical standards, have occurred very close to the solar system. An original source no more distant than 45 light-years has, in fact, been proposed for this cloud[215].

The location of this high concentration of Aluminium-26 on the outer edge of the solar system is of special interest in relation to the location of the Kuiper Belt mentioned earlier. Recent observations made from universities in California and Hawaii have confirmed the reality of this Belt, the existence of which was first proposed by the astronomer Gerard Kuiper in 1951[216]. The Belt has been shown to be composed of numerous (probably thousands) of tiny planetoid objects – not unlike those comprising the Asteroid Belt considered earlier. Most of the objects appear to be very small, but two at least are apparently as large as 150 miles (240km) across, and still larger ones may well await future discovery. Actually locating and identifying such small objects across the enormous distance separating them from Earth is extremely difficult, so the discovery of larger bodies in this Belt may not occur for years. Nevertheless, the apparent orbit of these objects brings them for a while inside that of eccentrically orbiting Pluto, and some astronomers have already begun to wonder if the Kuiper Belt represents the disintegrated remains of a once much larger object formerly orbiting the Sun far out on the edge of the solar system as we know it.

It has been noticed that Uranus seems to have changed its speed round the Sun in June 1987, and at least one astronomer has theorised that this may have resulted from Uranus colliding with an unknown object which, to have achieved that effect, would have had to have had a diameter of some 600 miles (960km) – small by astronomical standards but considerably larger than any Kuiper Belt object yet recorded. Pluto's lone satellite, Charon, is only 700 miles (1,120km) or so in diameter, and thus scarcely larger than the object supposed to have speeded up Uranus' motion around the Sun. But Pluto's orbit is twice crossed by that of the Kuiper Belt objects, so Charon being a captured body from the Kuiper Belt is not unreasonable. Likewise the aforementioned object 1992 QB, presently orbiting eccentrically between the orbits of Neptune and Pluto, is also quite possibly a small world which has broken away from the main swarm of Kuiper Belt objects. Certainly the removal from the Kuiper Belt swarm of several objects of 700 miles (1,120km) diameter or larger renders the possibility that the size of the original object now represented by the Kuiper Belt swarm, Charon, 1992 QB and the theoretical 600 mile (960km) object which affected Uranus' speed, was appreciable and large enough to be regarded as a true planet. This, we shall discover, is a significant possibility when, shortly, we discuss Phaeton's recorded movements among the outer planets.

On the basis of the above-mentioned details, we suggest that Phaeton was spawned in an astronomically-near supernova explosion, and that Phaeton was a portion of exploded astral matter. We further suggest that, being of that nature, Phaeton precipitated a second astronomically far smaller explosion, on coming into confrontation with the combined gravitational and electromagnetic fields of the huge outer planets of the solar system, and that this produced the Aluminium-26 cloud now known to exist on the edge of the solar system. The above-cited detail that the astronomically-close Vela supernova exploded some time between 14,300 and 11,000 years ago indicates that, allowing for the time taken by Phaeton to traverse interstellar space between the point of its original disruption – 45 light years distant – and the outer confines of the solar system, the planetary derangements under discussion probably took place approximately 11,500 years ago!

Assuming for the moment that Phaeton, after initially disrupting, subsequently travelled at high velocity on a course destined to bisect the solar system, it need not have actually moved at more than one fiftieth of the speed of light to have covered the distance represented by 45 light years in just a few hundred years. If proceeding at only one hundredth the speed of light it would still have completed the distance in slightly less than one thousand years, and it would have been within the time-frame calculated for the Vela supernova event generally. Viewed from this aspect, the possibility of Phaeton having been an astral body, a remnant of a supernova, becomes entirely plausible.

The apparent youthfulness of the cloud of Aluminium-26 suggests the astronomically-close occurrence of a major cosmic event like a supernova *within* geologically recent times. Phaeton certainly entered and caused havoc throughout the solar system during times which, though ancient in terms of human endeavour, were geologically *very* recent.

There are, therefore, good reasons for supposing that all these seemingly disparate details are actually pieces of the same tremendous drama – one which embraced the entire solar system and left as its legacy after effects that *still* affect the Earth.

14
PHAETON – AN EXCEPTION TO THE RULE

A further avenue of approach respecting the real identity of Phaeton comes from the eye-witness descriptions of it preserved in the numerous traditions and legends mentioned in Part Three. A supplementary survey of these follows below, during which we shall generally refer to Phaeton by that name irrespective of the plethora of other appellations by which it has been remembered.

Firstly, in the surviving *original* fragmentary accounts by Hyginus, Euripides and Ovid, Phaeton is specifically called by that name and always described as a bright fiery body. The name actually signifies 'the shining one', an appropriate title for an entity anciently regarded as the son of the sun-god Helios. Referring to Phaeton as *Typhon*, the Roman writer Pliny tells us much the same thing:

> ...it had a fiery appearance and was twisted like a coil, and it was very grim to behold: it was not really a star so much as what might be called a ball of fire...[217].

The seventeenth century savant, Adam Rockenbach, who claimed to have drawn upon the most reliable of the earliest writers (including works now lost), added:

> It was fiery, of irregular circular form, with a wrapped head; it was in the shape of a globe and was of terrible aspect... in the form of a disc...[218].

Significantly, Avienus likened it to a great sickle[219], perhaps a description of a globular body illuminated on one side only.

An ancient Jewish tradition states that the Deluge was caused by: "...the Lord God changing the places of two stars in a constellation"[220], thus specifically identifying Phaeton as a fiery star-like body rather than a comet. The same idea was embedded in Persian legend. The bright fiery *Tistrya* was styled: "...the leader of the stars against the planets"[221]. This stars-versus-planets conflict was obviously witnessed by early people and we shall have more to say about it shortly.

The Salishan Indians of North America mention a pre-catastrophic period when the Sun was no bigger than a star[222], presumably an allusion to the small size of the Sun-like Phaeton when still far distant from the Earth.

This closely parallels the ancient Hindu account of Brahma and his attendants observing the arrival in the heavens of "an exceedingly small" white boar-shaped body which: "...in the space of an hour, grew to the size of an elephant of the largest size, and remained in the air"[223], prior to it plunging to Earth and causing a worldwide flood. Chinese traditions similarly tell how, during the time of the legendary emperor Ya-hou: "...a brilliant star issued from the constellation of Yin"[224], prior to a tremendous global upheaval.

Again, *Ta-vi* is described in tribal legends from southern California as a star-like or sun-like body rather than a cometary object. It allegedly roamed the skies at will and sometimes came close to Earth in its heavenly wanderings, scorching it, like Phaeton, in the process[225]. And correctly-interpreted observations of unusually moving 'stars' permitted the Peruvian deluge-hero to seek a mountain refuge prior to the advent of a world-drowning flood[226].

The foregoing makes it perfectly clear that Phaeton was anciently regarded as a generally round, brilliantly fiery body of appreciable size, and much more star-like or sun-like than conventional comets: and it was held to have in some way caused the Deluge.

Many traditions, however, refer to two or more cosmic visitors assailing Earth simultaneously. The Norse sagas, for example, refer to two rampaging celestial 'monsters', the Fenris-Wolf and the Midgård Serpent, that brought death and ruin to the ancient world. Described as coursing through the heavens side by side, they acted in concert, and reputedly sired the equally dreadful 'sons of Muspelheim' – Surt, Loke and Garm – a detail shown later to be of considerable significance. Old Persian texts mention an essentially similar pair of ravaging marauders, Ahriman and its snake-like offspring Azhidhaka[227], or, in other versions, Zohak and Iblis[228], which subjected Earth to all kinds of disasters. The reported serpentiform or dragon-like aspects of these assailants is noteworthy.

Even scriptural literature refers to a great war anciently fought in heaven between Lucifer (Satan) and his hosts and Michael and his angels. The former were ultimately vanquished by the latter and "cast down onto Earth"[229]. The *Book of Revelation* specifically identifies Lucifer with: "...the dragon, that old serpent, which is the Devil and Satan"[230].

Other biblical sources award different names to these antagonists, sometimes simultaneously furnishing additional details. Thus, in a prophetically phrased passage we read:

> In that day the Lord with his sore and great and strong sword shall punish Leviathan the piercing serpent, even Leviathan that crooked serpent; and He shall slay the dragon that is in the sea[231].

Elsewhere we find:

> Art thou not it that hath cut Rahab, and wounded the dragon?[232].

In *Psalms* we hear of Rahab (evidently another name for one of the assailants) again: "Thou hast broken Rahab in pieces"[233], and: "...thou didst break the heads of the dragons on the waters"[234].

Traditionally, the destruction of these cosmic 'monsters' was almost always associated with water in one form or another. Thus, such phrases as 'in the sea' and 'on the waters' immediately remind us of Apollonius Rhodius's statement that, after being felled by Zeus's thunderbolts, Typhon lay beneath the Serbonian Lake; and the tremendous flood that allegedly issued from Satan's mouth after he had fallen to Earth; and the flood that reputedly gushed out of Ta-wats 'eyes' on coming to pieces after careering madly over the burning Earth. Despite their internal differences, these accounts clearly refer to the same original event.

The changing and varied visual appearances of these extraordinary visitors also provides further insights into the apparent nature of these bodies. Most often, they are described as writhing dragons or coiling serpents, and are sometimes said to have been multi-headed, to have displayed wide-gaping jaws, tusks, horns, sparkling crowns, or glowing manes and hair-like appendages, to have had speckled bodies and to have jetted great streams of fire from their imagined mouths. Other accounts mention the emission of pestilential clouds, poisonous blasts and rains of 'red milk' or 'blood'; while yet others refer to their production of

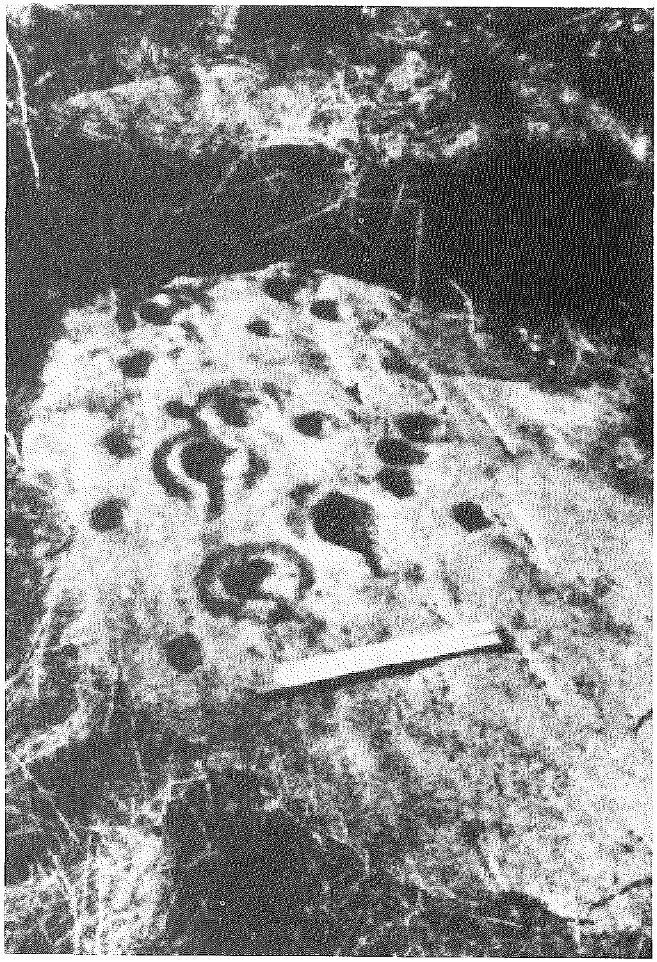


Fig 4.10a. Carved Neolithic 'cup-and-ring' motifs at Ardmarnoch, Scotland. *After R W B Morris, 1977, "The Pleistocene Rock Art of Argyll", by permission of Blandford Press and Bodleian Library, Oxford.*

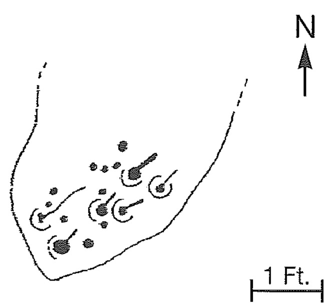


Fig 4.10b. Scale diagram showing the disposition of the Ardmarnoch rock motifs.

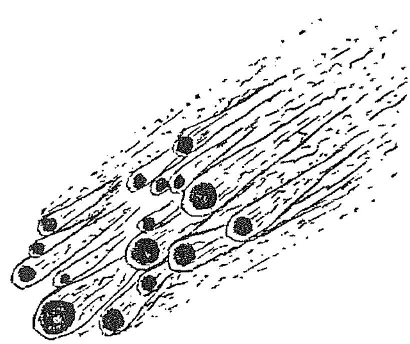


Fig 4.10c. The Ardmarnoch rock motifs redrawn to represent a similarly-arranged group of fiery celestial objects. This representation, although agreeing well with world tradition, is purely hypothetical.

hissing, roaring, thunderous or explosive sounds. It is also clear that each of these cosmic assailants possessed considerable bulk and mass. And since at least one of these objects (Phaeton) was reportedly only a little less brilliant than the Sun, the above descriptions, though diverse, collectively suggest that incandescent, electromagnetically excited bodies of matter were undergoing all manner of ever-changing images and trailing agitated trains of gases and debris.

That such images and descriptions closely mirror those forecastable for a 'stellar' visitor which, making a hypothetically close approach to Earth, was wrapped in igniting and exploding methane clouds productive of great jets of fiery hydrocarbons and poisonous blasts, is yet another aspect of this topic which it would be irresponsible to ignore.

Unquestionably the bodies involved were *not* abnormally large comets, meteors or asteroids familiar to modern astronomers. They were entirely different cosmic visitors. In short, Phaeton and its alleged companions were exceptions to the rule.

To survivors of this catastrophe, the sight of these objects plunging as a group across the heavens – a scene no doubt repeatedly obscured by the chronically deranged terrestrial atmosphere – was a never-to-be-forgotten experience, and appears to have subsequently led people to commemorate them in stone carvings. A possible example of such a carving adorns a large flat rock at Ardmarnoch in western Scotland[235] – at least one scholar[236] likened the sinuous lines streaming out from apparently glowing nuclei of comets (figs 4.10ab). Accepting for the moment that this carving does represent this ancient celestial drama and that it is reasonably accurate, it is possible to reconstruct (fig 4.10c) how these objects *may* have looked all those millennia ago. Certainly, if interpreted in this manner, the carving transmits precisely the kind of picture or spectacle so often described in tradition and epic literature. Again we ask if this, too, can be mere coincidence?

It is noteworthy that astronomical subjects were seemingly recorded quite often in other European megalithic structures, themselves apparently coeval with the above Scottish example[237], that at least some had lunar and apparently calendrical significance[238], and that, when assessed collectively, such monuments betray a surprising degree of understanding of astronomical phenomena generally among Neolithic peoples who raised the megaliths[239]. In that respect it would therefore have been remarkable had they not attempted to portray Phaeton's visit in their rock carvings.

15
The Mesopotamian Connection

Like many other early nations, the ancient Mesopotamians possessed a full account of this celestial war preserved on tablets found in the library of the 7th century BC monarch Assurbanipal in the ruined city of Nineveh. These tablets name the principal antagonists as *Tiamat*, a 'dragon-monster', and *Marduk*, an effulgent hero considered to be the most radiant deity after *Apsu*, the supreme Sun-god.

A baked clay cylinder-seal made by the Akkadian civilisation of Mesopotamia, and preserved as specimen VA/243 at the Vorderasiatische Abteilung of the State Museum in eastern Berlin, depicts the solar system as known to the Sumerians in the third millennium BC. It shows eleven globes encircling a large rayed star representing the Sun (fig 4.11a). The globes are generally thought to be planets, and their disposition is seen more clearly in fig 4.11b. Other cylinder-seals showing deities (Sun-gods?) orbited by *eleven* planets are also known. The relevant portions of them are given here as figs 4.11c and 4.11d.

Discounting tiny Chiron, modern astronomy recognises only nine planets in the solar system – Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune and Pluto. If we elevate the Moon to planetary status, as the Sumerians appear to have done, then we have a total of ten planets orbiting the Sun today. On this basis one planet is currently still missing from the earlier Sumerian total. Why, therefore, do the modern and Sumerian totals differ? Is this difference real or imaginary? Did the original seal-makers err in showing eleven planets? Could there really have been another planet known to the Sumerians, as yet unknown to us or lost since their day? If so, when and how was this planet lost? Could its disappearance, if real, be connected in any way with the Phaeton event? Such questions demand answers.

It is especially noteworthy that the most accomplished astronomers of antiquity were the Sumerians and Chaldeans (early Babylonians) of the third and fourth centuries BC, from which it hardly seems likely that they would repeatedly depict one planet too many on their cylinder-seals. Once, just possibly; repeatedly no. The level of astronomical knowledge in the ancient Near East more than confirms the apparent accuracy of these cylinder-seals and that no error was committed.

That the ancients recognised the existence of at least six planets – Mercury, Venus, Luna (Moon), Mars, Jupiter and Saturn – in addition to the Sun, is well known, and some also knew that the Earth was a planet too. These bodies, of course, were known by different names among different nations, several of which we shall have occasion to mention.

It was not until 1781 that modern astronomy discovered Uranus, 1846 Neptune and 1930 Pluto. Many early astronomers, however, apparently knew that these planets existed and even had names for them.

While Nicolaus Copernicus is justly called the 'Father of Modern Astronomy', in reality he only *re*discovered (in 1543) the central position of the Sun in the solar system, for the same celestial arrangement was apparently known to Aristarchus of Samos in the third century BC, and to others before him. Two hundred years earlier, for instance, the Greeks had listed the planets in their correct order from the Sun, thereby acknowledging that the Sun, not Earth, was the centre of the solar system. In discussing the exactness and accuracy of Mesopotamian astronomy generally, Diodorus Siculus, who lived in the first century BC, noted:

> ...the Chaldeans named the planets. In the centre of their system was the Sun, the greatest light, of which the planets were 'offspring', reflecting the Sun's position and shine... Each of the planets according to them has its own particular course, and its velocities and periods of time are subject to change and variation... the Moon's light is reflected and her eclipses are due to the shadow of the Earth[240].

The orbital and velocity variations mentioned by Diodorus are strongly suggestive of the fact that Chaldean astronomers knew of the equivalent terrestrial variations highlighted earlier in IV:7 on *Stability*. Possession of such advanced knowledge at so early a date would not have been unlikely among a race also cognisant of the precession of the equinoxes and the Great Year. These same Chaldeans are also accredited by Geminus of Rhodes as having been the first to determine the exact motions of the Moon[241].

Hipparchus, during the second century BC, knew of and understood the precession of the equinoxes. These are inexplicable unless 'spherical astronomy' is subscribed to, and only after the arrival in a given zodiacal sign (constellation) of Spring in relation to the Sun's position (as seen from Earth). The slow shift of the equinox point from one zodiacal constellation to another requires 2,160 years to complete, a period far too long to permit any one astronomer to make the relevant observations himself. Hipparchus evidently inherited detailed information amassed in earlier times, and actually acknowledged that his mentors

Fig 4.11a. Akkadian cylinder-seal in the State Museum, Berlin.

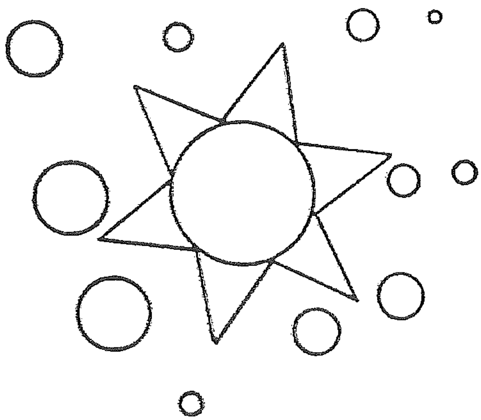


Fig 4.11b. Enlarged diagram of the planetary system shown on the Akkadian cylinder-seal.

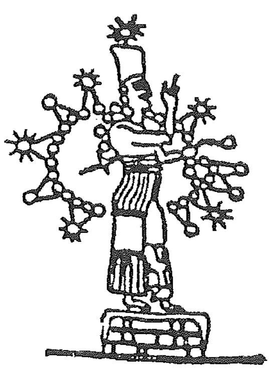


Fig 4.11c. Babylonian cylinder-seal showing planetary system.

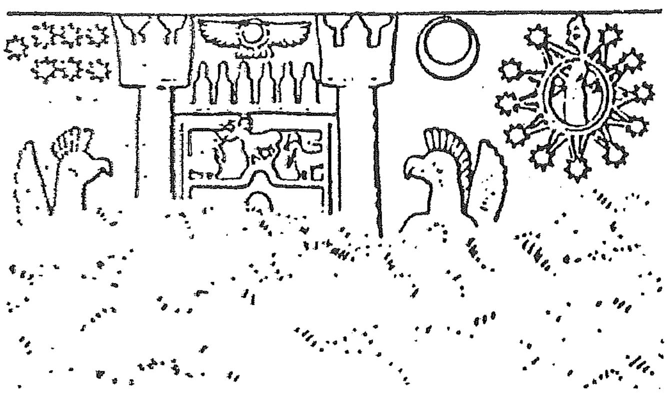


Fig 4.11d. Assyrian cylinder-seal with planetary system.

were "Babylonian astronomers of Erech, Borsippa and Babylon"[242].

The zodiacal signs themselves date from extreme antiquity, for Prof Alfred Jeremias found evidence that a Sumerian clay tablet in the Berlin Museum (VAT 7847) begins a list of named zodiacal constellations with the name Leo (the Lion), which projects us back to 11,000 BC or thereabouts – the time when the equinox point was in the constellation Leo[243]. This suggests that the zodiac had been devised even *before* the Phaeton disaster.

Professor Herman Hilprecht investigated the subject still further. After analysing thousands of baked clay tablets bearing mathematical tabulations he concluded that:

> ...all the multiplication and division tables from the temple libraries of Nippur and Sippar, and from the library of Assurbanipal are based upon 12960000[244].

Analysing the significance of this number, Hilprecht decided that it could relate only to the precession of the equinoxes and that the Sumerians knew of the Great Year of 25,920 years. This is sometimes called the Platonian Year, for apparently Plato, too, was aware of the phenomenon.

Assyrian, Chaldean and Sumerian astronomers accurately monitored the movements and positions of many celestial bodies relative to Earth and to one another, and kept precise ephemerides – tables that predicted and listed the future positions of the celestial bodies. These tables were examined by Prof George Sarton[245]. He found that they were computed by two methods which, as Prof Neugebauer subsequently discovered, were based not on observations by the astronomers who produced them but compiled "...from some fixed mathematical schemes... which were given and were not to be interfered with"[246].

These mathematical schemes were very old, for even the Assyrian astronomers did not fully comprehend them and were able to use them only with the aid of "procedure texts" which provided "the rules for computing ephemerides step by step" according to some "strict mathematical theory". This proved to be so advanced or obscure that, as Neugebauer admitted, its "...empirical and theoretical foundation" largely escapes modern scholars as well.

A clay tablet from Ur, dating from the third millennium BC, lists and describes a series of celestial bodies so carefully and accurately, that modern astronomers have had little hesitation in recognising the text as a classification of the constellations, which, in addition to the twelve zodiacal groupings, include the northern constellations of Draco, Ursa Major, Lyra, Cygnus, Cepheus and Triangulum, and the southern ones of Canis Major, Orion, Centaurus, Corvus and Hydra. This is interesting because, so far as is known, the Sumerian astronomers were the first to divide the heavens into three regions or 'ways'. Of these, the northern 'way' was named after *Enlil*, the southern after *Ea* and the central one (which contained the zodiacal constellations) after *Anu*. Rather soberingly we have to record here that it was not until 1925 that modern astronomers, after much discussion, decided to divide the heavens, as seen from Earth, into three regions. The modern and the ancient tripartite divisions are remarkably similar.

The names Ea, Anu and Enlil are especially interesting here for they provide further indications of the advanced levels attained by the early Mesopotamian astronomers and suggest that they knew a great deal about what actually happened at the time of Phaeton's visitation. Ea and Anu were the Sumerian names for the planets respectively known today as Neptune and Uranus. The existence of these planets *was* known to these astronomers and is presumably the reason why both appear on the aforementioned cylinder-seals.

Enlil is a particularly interesting name, for Sykes[247] has noted that: *Lil* meant 'demon' in several ancient Middle East dialects, whereby *Enlil* may have signified something like 'Demon Lord'; and that the Assyrians often referred to Enlil as *Bel*, who, in turn, was almost certainly identical with the heavenly-hero Marduk (alias Phaeton).

In Sumerian mythology Enlil was regarded as Anu's eldest son and the prince of the Sumerian pantheon, being second only in rank to the supreme Sun-god Apsu.

Later, Enlil appears to have transgressed divine laws, whereupon he was banished to the 'underworld'. Can it be coincidence that Lucifer (Satan), who was originally second only to God, was eventually thrown out of heaven and cast down into a 'bottomless pit', or that Phaeton, who was nearly as radiant as Helios (the Sun), was ultimately destroyed and his remains thrown down from the skies and buried under the Earth? The same theme recurs in Norse mythology about the primeval giant, *Ymir*, who, formed of fire and water, once waged war against the whole world and was only overcome by the gods Odin, Vili and Ve who flung his body into *Ginungagap*, a vast chasm which Ymir in his rage had caused to open in the Earth's crust[248]. The belief that a universal Deluge arose after *Athrajen*, hero of the North African Kabyles, had slain a marauding giant named *Ferraun* and hurled his carcass into a lake called *Thamgurth*[249], strongly suggests that he and Ymir were identical with the Deluge-inducing Lucifer or Phaeton.

Ginungagap is reminiscent of the great world crack or fissure discussed in Part One, an appropriate 'tomb' for anything consigned to it, and aptly described in later times as the 'underworld' or 'bottomless pit'.

Enlil, therefore, seems to be yet another title of Phaeton, while the 'way' of Enlil in the Sumerian tripartite division of the heavens appears to refer to the regions whence Enlil originated or which it traversed after entering the solar system. In that connection it is worth noting that the Phaeton legend refers to the Milky Way as the track taken by the fiery chariot of Helios, the stars being its scattered ashes; that the Brazilian Borros believe the Milky Way to be an ash trail left by a great conflagration (fiery object – Phaeton); that an early Indian name for the Milky Way was 'Path of the Serpent'[250]; and that the *Book of Job* asserts that Leviathan – a dragon-like attendant of the Phaeton-like Rahab – "maketh a path to shine after him"[251].

Interestingly, in considering cosmic causes for certain mass extinctions of terrestrial life in the past, Stothers concluded that: "...the most important perturbing objects must not only have a high mass density but must also be concentrated strongly towards the galactic plane"[252]. The Milky Way marks the galactic plane, as viewed from Earth! Did Phaeton, therefore, emanate from the direction of the galactic plane?

Astronomical knowledge in the ancient Near East was thus clearly far more advanced than is commonly supposed, but although much of it was apparently derived from yet earlier but unknown sources, considerable confidence can be placed in the veracity of even those records which depict additional worlds or planets in the solar system. Does some amazing truth lie behind these apparent discrepancies, a truth which involved large scale planetary disturbances like those suggested by our previous survey of the present solar system?

16
WAR IN HEAVEN

No names are given on the Mesopotamian cylinder-seals for the celestial bodies depicted on them, but the central rayed object is almost certainly the Sun and the remaining bodies are planets. The absence of distinguishing names, however, inevitably makes planetary identifications debatable, even though it would be reasonable to assume that the larger images represent the larger planets and the smaller images the smaller planets. We shall also shortly see that, on cylinder-seal VA/243, they have been placed around the rayed Sun in more or less correct orbital sequence (*not* distance). There is, however, one extra body, which, because it is not rayed, is presumably also planetary.

Various ancient Near Eastern cosmologies have come down to us, although often in rather fragmentary condition. Studies of them clearly show that all were based on some original prototype which evidently incorporated not only surprisingly advanced concepts but, in simplified form, the idea of the evolution of worlds in much the same general way as astrophysicists do today. Of these cosmologies, the version favoured by the early Mesopotamians is probably the best known and the most completely studied. It is a veritable epic, and, in its latter stages, describes the Marduk/Tiamat confrontation. It is thus directly concerned with the main theme of this book.

Three variants of this cosmological saga exist, in which the names of the principal characters often vary or are occasionally interchangeable. Oldest of the three is the version inscribed on clay tablets dating from about 650 BC, found in Assurbanipal's palace library at Nineveh. The next was written by Berosus about 280 BC, and the third, bequeathed us by Damascius, dates from the sixth Christian century. As Berosus' and Damascius' accounts are unhelpful here, we quickly turn to the oldest version.

The first studies made of the Nineveh tablets showed that they dealt with an Akkadian creation epic in many ways closely parallelling that given in *Genesis*. Accordingly, the first translation of it into English highlighted this similarity[253], later studies merely reinforcing this point[254]. Most scholars have come to regard the epic as a philosophical work emphasising the eternal struggle between good (light) and evil (darkness), or as an allegorical story of Nature's alternating summer and winter; yet, in view of current astronomical knowledge, it is comparatively easy to 'read between the lines', and reconstruct from the epic's text the outlines of what can only have been a monumental war in heaven. Indeed, in this connection, one cannot help but agree with Farnell who, in 1919, correctly observed:

> What is quite normal in nature and society rarely excites the myth-making imagination, which is more likely to be kindled by the abnormal, some startling catastrophe, some terrible violation of the social code.[255]

The Marduk/Tiamat confrontation combined all those deviations from the norm.

The epic, of which Prof Leonard King's translation is used here, and in which immense periods of time are truncated and telescoped, begins with a picture of the primeval universe. It then continues with an account of what may be regarded as the evolution of the planets (called 'gods' in the epic) and some of the satellites comprising the solar system. Together with the Sun, these bodies are awarded distinctive names in the Akkadian text, which, because we will repeatedly refer to them in the following paragraphs, are listed below with their modern counterparts.

Table 4B. Suggested identification of objects on Babylonian cylinder-seal

Akkadian Names	Modern Names
Apsu	The Sun
Mommu	Mercury
Lahamu	Venus
Lahmu	Mars
Tiamat	no equivalent now – perhaps *Electra* of Greek legend.
Kishar	Jupiter
Anshar	Saturn
Gaga	Chiron
Anu	Uranus
Nudimmud (or Ea)	Neptune
Gibil[256]	no equivalents known, but possibly
Nusuku[257]	Triton or Pluto.

The above list suggests the probable identities (Akkadian and modern) of the celestial objects featured on the aforementioned cylinder-seal in the East Berlin State Museum. The seal apparently shows the planets in more or less their correct order, in an anti-clockwise direction (that in which they naturally orbit the Sun) commencing with Mercury. The large relative size of the body identified as *Tiamat* is interesting. It suggests that Tiamat

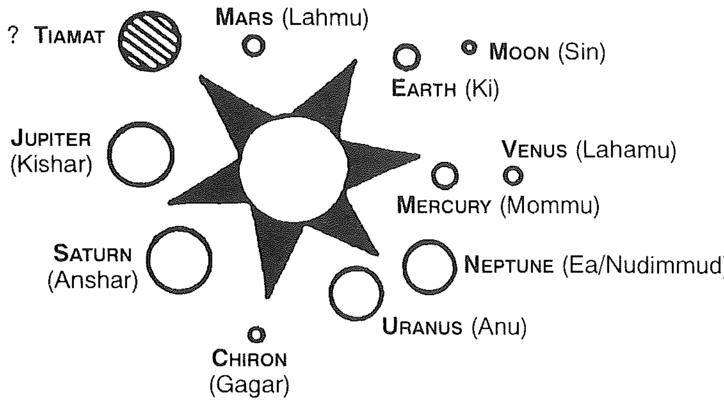


Fig 4.12. Suggested identification of objects on Babylonian cylinder-seal. Tiamat, the lost planet, is shown shaded.

physically resembled Jupiter and Saturn more than any of the inner planets. With that possibility in mind, it follows that Tiamat probably possessed a deep atmosphere not very dissimilar from those of the two giant planets just named, and in which methane, ammonia and various ices were comparatively prominent. We shall later find these to be particularly significant points. Ovenden has even suggested that its minimum configuration (distance from the Sun) relative to Earth (1.00) and Jupiter (5.20), was 2.79[258], and Van Flandern that its mass may have been 90 times that of Earth[259]. Opik has also speculated about this missing planet[260].

At this juncture we must note that the Akkadian epic makes no mention of Earth or the Moon, although Babylonian astronomers knew the planetary nature of these bodies, and apparently included them on the cylinder-seal diagram, calling them *Ki* and *Sin* respectively. Throughout most of this epic, Earth is thus conceived of, somewhat curiously, as a kind of unaffected off-stage vantage point from which the celestial dramas were merely observed and recorded.

No mention is made in the epic of how long peace reigned in the solar system before it was shattered by the arrival of a new 'god', Marduk, although we know from other evidence that Marduk (alias Phaeton) rampaged near Earth only some 11,500 years ago, when all the planets were still present in the solar system, orbiting the Sun on regular paths. But, as we shall now see, Marduk's arrival disrupted this order, and this remarkable epic, from this point onwards, traces the resultant havoc among the planets step by step.

The epic states:

In the Chamber of Fates, the place of Destinies,
A god was engendered, most able and wisest of gods;
In the heart of the Deep was Marduk created.

The 'heart of the deep' apparently signifies cosmic space beyond the confines of the solar system. Marduk originated there and was, therefore, alien to the solar system. As it neared the system, Marduk began to be attracted by the outermost sizable planet, Ea (Neptune), who could, therefore, be said to have 'begot him'. Marduk's origins are never made very clear, although several early sources provide a variety of scrappy and unhelpful hints that he was born in *Aruru*, *Dauce* or *El*[261]. Be that as it may, Marduk was a spectacular sight.

Alluring was his figure, sparkling the lift of his eyes;
Lordly was his gait, commanding as of olden times...
Greatly exalted was he above the gods, exceeding throughout...
His members were enormous, he was exceeding tall...
When he moved his lips fire blazed forth.

That Marduk was evidently visible from Earth during its initial 'adventures' among the furthest members of the Sun's family again indicates that it was not a comet. Even the brightest comets recorded in astronomical archives are not visible to the unaided eye when traversing the outer limits of the solar system. Yet Marduk is described unambiguously as a huge and radiant visitor from more distant (interstellar) regions, from time to time spewing great jets of fire. We may again emphasise that no comet observed in the outer confines of the solar system has yet been observed to eject great streams of fire like those just mentioned, since by their very nature comets are not actually fiery. Marduk was thus definitely some other kind of celestial visitor.

Of particular interest in the epic is a passage which relates how, after Marduk had entered the solar system, the planets "...heaped upon him their awesome flashes" making him shine with dazzling brilliance as he became "clothed with the halo of ten gods". In other words, Marduk grew markedly brighter, so bright that the ancients considered him second only to the Sun in heavenly brilliance, and, as amongst the Greeks, dubbed him the 'son' of the Sun (*Sol* or *Helios*). Clearly something happened to Marduk when far out at the edge of the solar system, something that has never been associated with even the largest known comets.

It would not be unreasonable to account for Marduk's increased effulgence and therefore apparent size by postulating that the planetary 'flashes' 'heaped upon him' were immense thermoelectric (and probably electromagnetic) discharges directed at him by the outer planets whose own electromagnetic fields were by then beginning to react to Marduk's arrival. Yet such effects may have been a part only of what perhaps really happened, and masked what may have been a still more startling scenario.

So far the evidence is inconclusive that the Kuiper Belt objects genuinely represent the assorted remnants of some sizable bygone planetary body. Nevertheless, these remnants *do* occur astronomically close to a geologically *very* young Aluminium-26 cloud said to be typical of those associated with supernova explosions. Instead of attributing Marduk's increased brilliancy solely to colossal exchanges of energy between Marduk and the outer planets, however, it should be borne in mind that virtually the same effect could have arisen if Marduk had catastrophically ruptured the remote plane now possibly represented by the Kuiper Belt objects. The resultant explosion would have been enormous and, even from distant Earth, spectacular but soundless. To terrestrial observers, who would scarcely have been able to have actually seen the planet involved, it would have seemed as though Marduk had simply grown in size and brilliance, to become in that respect an apparent rival to the Sun – something no comet has ever been credited with achieving.

The explosion itself, assuming that one really took place, must have resulted from either a physical collision between Marduk and the disrupted planet, or from a concomitant destruction of part of Marduk's 'stellar' substance. This, or some closely similar scenario, must have been the source of the Aluminium-26 cloud.

There is, of course, no question of any supernova event occurring on the outer edge of the solar system. Had one erupted – at *any* point in geological history – it would have totally incinerated the solar system, the Sun probably being the lone survivor of such an event. Instead, something infinitely smaller (though still huge by Earthly standards) occurred beyond Pluto to create the Aluminium-26 cloud, something which had to have partly involved 'stellar' matter.

The inherent violence of such an explosion naturally flung dismantled pieces of the destroyed planet in all directions, and it is possible to interpret the eccentrically orbiting object 1992 QB, possibly the unknown large body which believedly altered Uranus' speed in 1897 and, perhaps, Pholus and Pluto's satellite Charon as some of the larger relics of the now-lost planet. Such a concept would also account for Pluto's own highly eccentric orbit.

After entering the solar system, Marduk first encountered Ea (Neptune), the gravitational field of which was sufficient to determine Marduk's future course, "making it good for its purpose". Neptune's gravitational pull was also powerful enough to cause Marduk to grow a second 'head', an indication of Marduk's molten, plastic, condition.

As Marduk reaches Anu (Uranus), however, great pieces of him are torn off and form into four attendants which commence to circle around Marduk "swirling as a whirlwind". Again, no cometary body has been observed to produce revolving satellitic objects; only an object possessing appreciable mass could have established and maintained such a situation. As previously noted, conventional comets lack mass of any consequence.

Also of interest is Marduk's direction of flight. Its passing of first Neptune and then Uranus strongly suggests that Marduk's flight-path was *contrary* to that of the planets, a factor which, in the case of a large and apparently highly-charged visitor like Marduk, must have been very disruptive for smaller bodies encountered *en route*. Could this, for example, be the reason why the small planet Pluto and Neptune's two satellites (Triton and Nereid) orbit so strangely? It will be recalled from Part Three that Ovid stated that Phaeton flew among the planets the 'wrong way'.

Marduk then passes Anshar (Saturn), so perhaps it is no coincidence that this planet, together with Anu (Uranus) and Ea (Neptune), rotates at a surprisingly fast speed, that Saturn's satellite Phoebe has a retrograde orbit, and that Uranus (Anu), which was responsible for distorting Marduk and detaching four 'satellites' from it, now rotates on an axis uniquely tilted NNW-SSE.

Marduk apparently became trapped by the gravitational fields of the three large outer planets for some appreciable time. This also began to affect the orbit of Tiamat and its satellite *Kingu*, with the former adopting an erratic orbital path, and the latter being pulled free of Tiamat's gravitational attraction and acquiring a "Tablet of Destiny".

At this point, Kishar, Anshar, Anu, and Ea asked themselves by what right Tiamat had to elevate Kingu to the status of a god – one who orbited freely (the Tablet of Destiny). Anshar (Saturn) asked first Ea (Neptune) and then Anu (Uranus) to slay Kingu, but neither could do so, whereupon Anshar conceived the idea that this could be achieved by the approaching Marduk, an idea eagerly agreed to by the other gods. Thus we find Marduk, approaching close to Saturn ("kissed the lips of Anshar"), agreeing to undertake this task. Anshar then instructed his emissary, Gaga (Chiron), to:

Be on thy way Gaga,
Take the stand before the gods,

seemingly a clear reference to Marduk pulling Chiron free of the gravitational field of Saturn and causing it henceforth to move in free orbit. The presence of such a small planet orbiting among the giant outer planets is one of the anomalies of the solar system, and could well be accounted for by the scenario unfolding before us.

Marduk plunged on and began to approach Tiamat and the inner planets:

He produced streams, disturbed Tiamat;
The gods were not at rest, carried as in a stream.

Tiamat is described as having "paced about distraught" as Marduk also affected the inner planets and "diluted their vitals... pinched their eyes". Such phrases convey a scene in which the powerfully-charged Marduk, a molten fiery object, emitted vast electromagnetic charges that, as well as causing Tiamat to orbit erratically, affected the equivalent fields of Tiamat and the inner planets. In this connection, could it be significant that for some while before the onset of the Phaeton disaster, increased heat and a terrible drought was allegedly experienced on Earth?

Encouraged by Marduk's willingness to destroy Kingu, the gods then exhort Marduk to go a step further and "cut off the life of Tiamat" as well. In the epic, Marduk agrees to do this on one condition, with the words:

If I, as your Avenger
Am to vanquish Tiamat, save your lives –

Convene an Assembly to proclaim my Destiny supreme.

This passage seemingly relates to the stage when Marduk, having apparently already approached near enough to Tiamat to derange its orbit and detach its satellite ('first-born') Kingu, found itself still struggling in the grip of the combined gravitational fields of the outer planets which, in the guise of gods, were anxious to be rid of him. Eventually they ejected Marduk from their sphere of gravitational influence straight towards Tiamat with 'destiny supreme'.

The epic then tells how, deranged by Marduk, Tiamat began to break-up; from her midst, there emerged eleven "monsters", styled elsewhere as "eleven mighty helpers", which "separated themselves" from her body and "growling, raging... marched at the side of Tiamat". Tiamat is said to have "crowned them with halos". According to Babylonian texts, these "helpers" were armed with thunderbolts and included Lakhmu the shining snake, the Great Lion, the Viper, the Ravening Dog, the Scorpion Man, the Storm Winds, the Goat Fish, the Fish Man and Kingu[262] – Tiamat's "first-born" (satellite) – who commanded them. Among these names we quickly recognise the Midgård Serpent and the Fenris-Wolf of the Norse *Eddas*.

The epic then describes how Marduk filled himself with "blazing flame" – increased in radiance — "constructed a bow... attached thereto an arrow", "set lightning" in front of him, and made "a net to enfold Tiamat therein". These phrases can only signify that Marduk developed a coma ('bow'), emitted flashes ('lightning') and gave off electrical discharges all round ('net') as it coursed across the heavens. It must have been an awesome and terrifying spectacle. The four whirling satellites ('winds') detached from him by Anu (Uranus) fly by Marduk's side, and to these he adds three more (pieces which break-off from him) called *Evil Wind*, *Whirlwind* and *Matchless Wind*. All head straight for Tiamat and "her host".

The Lord went forth, followed his course;
Towards the raging Tiamat he set his face...
The Lord approached to scan the innerside of Tiamat –
The scheme of Kingu, her consort, to perceive.
As he looks on, his course becomes upset,
His direction is distracted, his doings are confused.
When the gods, his helpers,
Who were marching at his side,
Saw the valiant Kingu, blurred became their vision.

Marduk and his satellites were clearly deranged in flight as they neared Tiamat and Kingu, while the blurring of the satellites' 'vision' may refer to the blinding flashes of the electrical discharges that almost certainly must have occurred between all three bodies then. We have already noted how the electrical fields of closely approaching large bodies would try to equalise through repeated discharges of this kind.

Celestial battle, however, was now joined.

Tiamat and Marduk, the wisest of the gods,
Advanced against one another;
They pressed on to single combat,
They approached for battle.

Marduk "raised the flooding storm, his mighty weapon" (an electromagnetic storm of unimaginable violence?). "Tiamat emitted a roar" and, as her "fury" grew, "the roots of her legs shook back and forth" (Tiamat's magnetic poles repeatedly reversed with – surprisingly for earthly viewers – thunderous acoustics as the planet's structure endured appalling strain). Marduk then:

...spread out his net to enfold her;
The Evil Wind, the rearmost, he unleashed at her face.
As she opened her mouth, Tiamat, to devour him -
He drove the Evil Wind so that she closed not her lips.
The fierce storm Winds then charged her belly;
Her body became distended; her mouth had opened wide.

He shot there through an arrow, it tore her belly;
It cut through her insides, tore into her womb.
Having thus subdued her, her life-breath he extinguished.

In this remarkable passage, we literally read of the terrible destruction of a planet. At this point we must assume from the foregoing passage and from its alleged position in the solar system that Tiamat was a fairly large planet possessing a lithosphere like that of Earth. After unleashing his 'flooding storm', Marduk then enveloped Tiamat in constant electrical discharges ('net') which so disrupted the planet's electrical mechanism that Tiamat's rotation was retarded or braked to a halt. This resulted in the planet's outer shell or crust splitting open ("opened her mouth"). While this crack was still open ("closed not her lips"), Marduk poured further electromagnetic charges ("fierce... winds") into it ("charged her belly"), so that "her body became distended" (internal magmatic material continued to rotate, causing the remaining portions of Tiamat's crust to bulge and/or sag locally). This, in turn, caused the crack to gape ever more widely ("her mouth had opened wide"), and it faced directly at Marduk as Tiamat "opened her mouth... to devour him".

Some bolt ("arrow") of electricity or similar matter was then shot by Marduk into this crustal aperture which "tore her belly... cut through her insides" (magmatic interior) and "tore into her womb" (penetrated to the planet's core). This was tantamount to a gigantic electrical 'short-out' between the two internal dynamos of the respective antagonists, and must have resulted in one of two things: either Tiamat's entire natural electromagnetic field was neutralised, this being drawn off and absorbed by Marduk, or Tiamat broke-up. That Tiamat seemingly suffered the latter fate is suggested by the following passage, in which Marduk:

To divide the monster he then artfully planned.
Then, as a mussel, he split her into two parts.
The Lord trod upon Tiamat's hinder part;
With his weapon the connected skull he cut loose;
He severed the channels of her blood;
And caused the North Wind to bear it
To places that have been unknown.
The half of her he set up as a screen for the skies;
Locking them together, as watchmen he stationed them...
He bent Tiamat's tail to form the Great Band as a bracelet.

Tiamat's split crust still hung partially connected, any surviving remnants of the stricken planet's atmosphere, liquids, ices and gases, no doubt smoking and steaming as a result of the immense heat generated throughout Tiamat's structure by Marduk's onslaught. With his weapon (electromagnetic), Marduk then dismembered the planet completely, one half of which, presumably the upper, being termed Tiamat's skull. The "channels of her blood" were severed (Tiamat's polar axis no longer existed), whereby the "skull" portion of the planet – which may have carried an ice-cap – floated freely apart from the rest of the savaged world.

Marduk then appears to have demolished one of these halves, which, because Marduk was still moving sunwards and dragging the remains of Tiamat along with it, formed a "tail" of debris which streamed out behind it. The epic tells how Marduk placed these fragments in the heavens as a "screen", a "bracelet", a "Great Band" (a circling swarm?). Today, these may represent the asteroid belt, some members of which, as previously noted, orbit in families or groups as though all had formerly been parts of one or more larger bodies. The scholarly Jewish translation of the Holy Scriptures according to masoretic texts, *The Torah*, also refers to this, alluding to Marduk simply as 'the Lord':

The Heavens bespeak the glory of the Lord,
The Hammered Bracelet proclaims his handiwork...[263].

and very significantly adds: *"From the end of heaven he emanates"*[264]. We have already noted that the Babylonian epic states that Marduk came from the 'Great Deep' ('end of heaven').

Meanwhile, the apparently undemolished portion of Tiamat was carried by Marduk towards the Sun and the inner planets. But what of Tiamat's 'helpers'? The epic relates how, after the destruction of Tiamat:

> ***Her band was shattered, her host broken up.***
> ***The gods, her helpers who marched at her side,***
> ***Trembling with fear,***
> ***Turned their backs about so as to save and preserve their lives.***

Marduk, however, caused them to be "thrown into a net" (to be captured gravitationally – the combined gravitational fields of Marduk and the remaining part of Tiamat must have been appreciable):

> ***...They found themselves ensnared...***
> ***The whole band of demons that had marched on her side***
> ***He cast into fetters, their hands he bound...***
> ***Tightly circled, they could not escape.***

Furthermore, Marduk removed the "Tablet of Destiny" from Kingu's breast and attached it to his own – another reference to Kingu being reduced to a satellite, this time of Marduk. The gravitational field of Marduk thus continued to be enhanced.

Tiamat was no more. If early humanity had ever gazed at Tiamat as a distant planet circling the heavens (as the Babylonian epic clearly implies that they did), they could no longer locate it. It had disappeared. Interestingly, the ancient Greeks also speak of a time of celestial strife between the gods *Ares* (Mars) and *Athene* (Venus) when a planet, *Electra* by name and one of seven sisters, all sired by Atlas – and no longer able to watch the conflict – departed from the heavens never to be seen again[265].

In Part Three we found Plato's account of the loss of the legendary continent of Atlantis (the empire of Atlas) to be but one recollection of the occurrence of radical worldwide topographical changes some 11,500 years ago initiated by powerful and violent celestial agents.

So were *Electra* and *Tiamat* simply different titles of the same lost (destroyed) planet? Did Tiamat, like Electra, perish at a time when the planets Ares (Mars) and Athene (Venus) were also disturbed? Indeed, was their derangement merely part and parcel of the same cosmic drama which, in causing a vast conflagration, a tremendous flood, and major tectonic upheavals here on Earth, affected the entire solar system?

17
PHAETON'S WRATH

So far as our theme is concerned, the Babylonian epic finishes with the subjugation of Tiamat's attendants by the fiery Marduk. The epic has outlined an extraordinary celestial event in which the solar system was visited by a dangerous assailant from more distant cosmic regions, which thereupon wandered erratically among the planets in a sunwards direction, generating havoc as it did so. None of the described planetary reactions basically infringe known astronomical laws, although the account of the destruction of

Tiamat is certainly startling. In 1950, however, Velikovsky – who hardly did more than acknowledge the existence of the Tiamat/Marduk epic – argued that the planet Venus was originally a comet which had been ejected from the giant planet Jupiter during the second millennium BC, and that, after erratic wanderings among the inner planets Mars and Earth, it eventually settled down as a candescent 'hot' object into its present near-circular orbit round the Sun[266]. Unlike the Babylonian epic, Velikovsky's hypothesis – at which most astronomers voiced incredulity – required Mars to leave its previous stable orbit and to approach closely both Earth and the then still errant Venus on several occasions during the eighth century BC, a requirement necessitating a violation of the accepted laws concerning the motions of large celestial bodies[267].

Recent studies of Venus, however, show the planet to possess a bulk and composition very unlike that of Jupiter, so much so that there is absolutely no likelihood of it ever having issued from the giant planet[268]. For example, in table 4A (Planetary Statistics), we saw that Jupiter's density is only 1.3g/cm^{-3} and that Venus' is 5.1g/cm^{-3}, or similar to that of Earth.

Jupiter's atmosphere is dominated chemically by hydrogen and its most abundant simple compounds – methane and ammonia, as well as water. Recently, some higher hydrocarbons have also been detected in it[269]. In contrast, the Venusian atmosphere is oxidised[270]. Direct sampling by the Venera series of atmospheric probes disclosed that Venus' atmosphere consists almost entirely of carbon dioxide, with small quantities of nitrogen, argon, water and hydrochloric and hydrofluoric acids[271]; while analyses of infrared reflection spectra of Venusian clouds showed beyond all reasonable doubt that the visible clouds in the upper atmosphere of Venus are composed of sulphuric acid droplets[272]. Earlier announcements that the Mariner 2 space probe had detected hydrocarbons in the Venusian atmosphere were spurious and should be ignored[273]. Measurements taken by the Mariner 10 flyby of Venus highlighted another reason why the planet cannot have emanated from Jupiter, for they showed that:

> ...the total energy radiated by Venus is equivalent to that from a black body of about 230°K, or just what one would expect in the absence of any internal source. Thus there is no evidence that Venus radiates more energy than it receives from the Sun[274].

The possibility that Venus may have cooled from a candescent (1,100°C) state to its present much lower temperature during the thirty-five centuries or so since, according to Velikovsky, it ceased to be a marauding comet, has been ably investigated by Morrison[275] and others, who found that there exist *no* scientific grounds for supposing this to have occurred. In conclusion, therefore, no demonstrable evidence exists that it was ever a comet or has ever seriously departed from its present orbit.

Nevertheless, numerous references occur in the ancient writings of the Hindus, Persians, Babylonians, Chinese, Mexicans and others averting to a time when Venus apparently battled in the sky against Mars. Much of Velikovsky's argument respecting the alleged former derangement of the Martian and Venusian orbits relied on these references. Thus, if modern astronomy conclusively demonstrates that Venus cannot have been a comet, then either these ancient assertions *are* somehow factually correct or they really allude to one or more other celestial objects which, in later days, were erroneously confused by scribes, redactors and commentators with Mars and Venus.

In view of all the foregoing, it is exceedingly difficult to see how these ancient, and in many cases quite independent writings *can* be factually correct, and everything points to the second alternative as being the most likely. Indeed, we shall shortly find this to have almost certainly been the case. Firstly, however, we must take a closer look at Mars.

Table 4A shows that Mars takes slightly over 24 hours to rotate. Ideally it should take only 8 hours. This comparatively slow rotation is somehow connected with a past change in the planet's rotational equilibrium figure. In turn, this appears to have caused extensive fracturing of the Martian crust, and a reduction of the theoretical norm of the Martian magnetic field. We have also noted that Mars follows a decidedly eccentric orbit. Astronomers have admitted that the known observational data fails to satisfactorily explain these anomalies and that something quite profound has happened to Mars in the not so distant past.

This Martian fracture complex is especially noteworthy for resembling the equivalent lineament system characterising the terrestrial crust. This latter, which some have categorically stated was producible only by external rather than local agencies, resulted from massive crustal dislocations seemingly coincident with magnetic reversals, widespread orogeny, vulcanism, flooding and biological extinctions approximately 11,500 years ago, and for all of which a celestial initiation has been repeatedly advocated.

Can it be coincidence, therefore, that: the Babylonian epic describes how Marduk similarly split Tiamat's outer shell; that the Martian crustal fractures resemble Earth's; that a planet (Electra) allegedly disappeared at a time when Mars and Venus are said to have fought in heaven; and that when, on Earth, immense changes engendered by Phaeton (alias Marduk) occurred to topographical features ever associated with Electra's mythological father Atlas (*eg*, Atlas mountains, Straits of Gibraltar, and Atlantis)? Surely these similarities are too close to be products of totally separate events, for all are seemingly united by the insistent underlying theme of a powerful and destructive cosmic assailant.

If, therefore, neither Mars nor Venus can have strayed sufficiently far from their usual orbits to have engaged in 'celestial combat' early Man, who watched but misidentified the contestants, must have observed some *other* sizable object become embroiled in 'heavenly strife' with Mars. In one account from the third century BC, Mars is pursued and attacked while apparently still on its normal orbit:

> ...the star of Mars... was pursued by the star Venus; then Venus took hold of him and inflamed him with ardent passion.[276]

Something bright and star-like caught up with Mars as it travelled along its solar orbit and, having done so, began to heat it up ('inflamed him') just as Tiamat had been previously. Was this star-like body Marduk wending its way sunwards? We submit that it was. So, if any significance can be attached to the old Persian description of the "bright and glorious Tistrya" as the "star that attacks planets"[277], we see that the Venus which allegedly inflamed Mars' 'passions' was none other than Marduk (alias Phaeton). Enhanced radiance due to thermal energy (heat) may well have made Mars appear starlike (flashing) or sun-like (fiery) to Earthbound observers. Much of significance may underlie the following statement in a Chinese chronicle describing an abnormal celestial event said to have occurred in the reign of Emperor Kwei (Koei-Kie):

> At this time the two suns were seen to battle in the sky. The five planets were agitated by unusual movements. A part of Mount T'ai-chan fell down[278].

In the Indo-Iranian *Zend-Avesta*, these planets: "...ran against the sky and created confusion"[279], and: "...The celestial sphere was in revolution... The planets, with many demons, dashed against the celestial sphere and mixed the constellations.."[280]. These 'demons' were presumably the debris of Tiamat and her 'helpers' still accompanying Marduk at that time.

The ancient Chinese expressly associated these cosmic dramas with vast terrestrial floods, for they believed that "...if the five planets err on their routes", the land will be engulfed by a great flood[281]. This belief is unquestionably a memory of the Deluge occurring at the time of Phaeton's visit.

The Aztecs of pre-Columbian Mexico referred to Mars, which they called *Huitzilopochtli*[282], as being "...like live-fire, greatly feared by his enemies..."[283]. They also revered a hero-god called *Quetzalcoatl*, "the feathered serpent", the priest of whose cult, in one of the Aztec ceremonies, shot an arrow into an effigy of Huitzilopochtli, who was then considered to be dead[284]. Does this not recall Marduk firing the fatal 'arrow' (discharge) into Tiamat? And is it not a little curi-

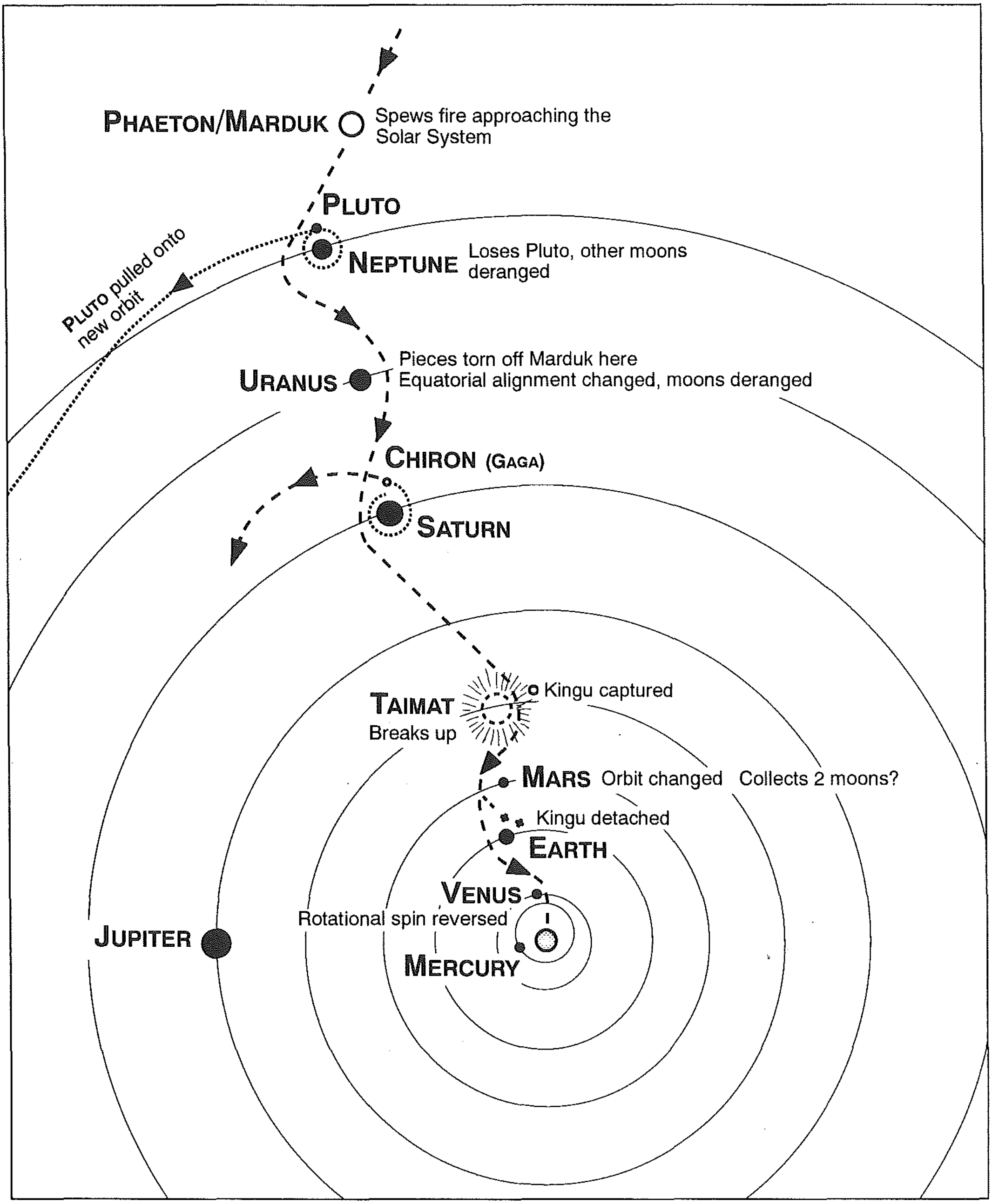


Fig 4.13. Schematic diagram of the path apparently taken by Phaeton/Marduk through the solar system. Not to scale. Based on the Sumerian texts and recent astronomical data discussed on preceding pages, and on the main effects attributable to its passage. Orbital positions of the planets approximately correct only at the times when Phaeton/Marduk reached their individual vicinities.

ous that the Aztecs always conceived Quetzalcoatl as a *serpent*, albeit a feathered one? Could it be that Marduk (alias Quetzalcoatl) discharged a similar 'arrow' at Mars when those two bodies neared one another? Classical Greek texts indicate that this almost certainly occurred.

Homer's famous *Iliad*[285], though primarily concerned with the equally famous Trojan war, contains a lengthy account of a celestial battle between the deities Ares and Pallas-Athene, and in which Aphrodite (goddess of the Moon) and Hera (goddess of the Earth) also become involved. Ares, of course, is Mars, and Pallas-Athene (Velikovsky's Venus) is Marduk. Homer makes Ares patron of the Trojans and Pallas-Athene protectress of the Greeks; but this was clearly a literary device. The confrontation between these two entities was originally a separate and much older interplanetary event.

That this is the correct interpretation is seemingly confirmed by the fact that, in the so-called Homeric hymns[286], Ares is called a planet, whereas Pallas-Athene is not, even though various earlier commentators have assumed that it must have been. The somewhat nebulous but nevertheless discernible distinction in the Homeric hymns is actually consistent with the description of *Ishtar* – the Babylonian name for Pallas-Athene – as 'the fearful dragon' inscribed on tablets retrieved from Assurbanipal's ruined library at Nineveh[287].

Paraphrasing Homer's account we find that Pallas-Athene first of all removes Ares from the field of battle (perturbs Mars' orbit), only for both entities to meet again – this time "furious Ares abiding on the left of the battle" (Marduk evidently passes round behind Mars and crosses inside Mars' orbit). This is consistent with the aforementioned 'pursuit' in Eratosthenes' account. At this stage, Aphrodite (the Moon) tries to enter the fray (the Moon affected gravitationally?). Ares then darkens the battlefield (the Martian atmosphere becomes disturbed?) and Pallas-Athene is seen to retreat (Marduk moves away from Mars). Hera, the goddess of Earth then complains at this celestial turmoil (Earth is affected electromagnetically?).

Pallas-Athene then turns on Ares and hurls a "spear" (discharge) "mightily against his nethermost belly" (this instantly reminds us of the "fierce storm winds" Marduk discharged at Tiamat's "belly"). Ares emits a "loud bellow" (thunderous roar) and Pallas-Athene a great cry (another roar) as "over against her spouted Ares, dread as a dark whirlwind" (innumerable lightning bolts discharged by Mars makes the planet appear to spout), and "together then they clashed with a mighty din...". At this juncture, Hera spread a thick mist about herself (though yet millions of miles distant, various physical effects of the conflict begin to be felt on Earth).

Ares strikes Pallas-Athene with his long "spear" (more electrical discharges), but although the latter "gave ground" (retreated), it retaliates by heaving a gigantic stone, "black and jagged and great" (the remaining portion of the dead Tiamat?), at Ares and thereby "loosed his limbs" (caused Mars to become unsteady – to oscillate). Simultaneously "round about Great Heaven pealed as with a trumpet". Aphrodite then came to Ares' assistance, whose "hand" she took and "sought to lead away" (lunar gravitational pull caused Mars to move further away from Marduk); but Pallas-Athene "sped in pursuit and smote Aphrodite on the breast... and her heart melted" (Marduk discharged an electromagnetic bolt at the Moon, which had the effect of causing the Moon to either move back towards the Earth or of nullifying its gravitational influence, or both).

As the battle, in which Marduk appears to have failed to overcome Mars, seems to have effectively come to an end at this juncture, it may be surmised that, in pursuing Aphrodite and smiting her on the breast, Marduk was now clear of Mars' immediate gravitational pull and was ominously heading towards the Earth/Moon system.

Several questions arise at this point. For example, did the remnant of Tiamat hurled by Marduk at Mars (if that is what the "black and jagged and great" stone really was) disintegrate amid tremendous din in Mars' Roche Limit? In its dismembered condition, this remnant would have been structurally weak with no controllable gravitational or magnetic field of its own, yet would still have possessed inherently destructive mass. It is, perhaps, highly significant that Mars is orbited today by two irregularly shaped ("jagged") satellites which, by common consensus, are peculiar objects from every point of view. Are they fragments of Tiamat acquired from Marduk? Tolson has already suggested this with regard to Phobos[288].

The two irregularly-shaped Martian moons, therefore, could indeed be captured fragments of the unfortunate Tiamat, while the aforementioned slow rotation of Mars, its unaccountably reduced magnetic field, its distorted orbit, the inferred past changes to its rotational equilibrium figure, and its crustal fracture complex, could well have resulted from its alleged encounter with Pallas-Athene (Marduk/Phaeton) and from an actual or near collision with the "black and jagged and great" stone (a remnant of Tiamat?). Roche's Limit would have ensured the inevitable break-up of that object.

Briefly, the Roche Limit is the zone which surrounds any large object of appreciable mass possessing a gravitational field, at a distance of 2 to 3 radii of the object concerned. In effect it is a danger-zone, and any object with a smaller mass or weaker gravitational field entering it will be either swiftly expelled from it electromagnetically, or, more commonly, be subjected to intolerable tidal stress and disintegrated. Disintegration is practically guaranteed if the smaller object remains within the zone indefinitely, but less so if it rapidly passes through only a limited area of the zone at high speed.

It is also more than probable that the disintegration of a large body (say, one the size of the Moon) would involve an explosion at some relatively early stage, with consequent high-velocity dispersal in literally all directions of the resultant debris. The blast occasioned by a sufficiently large explosion would, no doubt, extensively modify any atmosphere enveloping the larger host object, could alter its composition, and might even lead to permanent dissipation and attenuation of a sizable percentage of it. This, in turn, could alter the planet's thermal balance, and induce new climatic regimes. These, or closely similar effects, appear to have been experienced by Mars.

Discussing the Velikovskian notion of former celestial confrontations between Earth, Mars, and Venus, relative to the problem of disposal of planetary energy, Rose and Vaughan concluded that:

> The participation of at least one other body besides Venus, Earth and Mars in the encounters that have occurred since Venus' final departure from the vicinity of Jupiter could provide a easy solution to this energy-disposal problem.[289]

This is a most interesting statement, for, although we do not accept that Venus was ever ejected from Jupiter (as Rose and Vaughan believed), the object that they, and Velikovsky, called Venus appears to have indeed been present in the celestial encounters they discuss. It was Phaeton. Very pertinently, Rose and Vaughan added:

> ...if we permit this 'other body' to interact with Mars... then the problem of (orbital) eccentricity-damping will evaporate as well.[290]

As the probable sequence of the physical changes sustained by Earth during the Phaeton disaster are discussed in Part Five of this book, those details can be temporarily side-stepped here, and we pick up the saga of this 'war in heaven' at the point where Phaeton vacates the environs of Earth.

Upon leaving the vicinity of Earth, Phaeton apparently headed sunwards once more, for vague human memories have come down to us of a great 'dragon' or fiery 'monster' coursing across the heavens towards the Sun just after the Deluge. Evidently brief glimpses of it were afforded isolated Deluge survivors through occasional gaps in the deranged and rapidly thickening atmosphere (the 'collapsed sky'). Thereafter, the gloom persisting for decades afterwards, the collapsed sky undoubtedly curtailed observations of this celestial spectacle. Very little was seen of what happened to Phaeton as it neared Venus or crossed its orbit on its sunward journey.

Nevertheless, various post-diluvian beliefs and ancient astronomical texts suggest the outlines of what apparently occurred. Accordingly, we now examine these.

The worship of Venus as either the Morning Star or the Evening Star was extremely widespread in post-diluvian times, and many propitiary cults to Venus existed among numerous classical and pre-classical civilisations in both hemispheres. Clearly some deep significance underlay these beliefs and was seemingly due to the fact that, when Venus becomes the Morning or Evening Star, it can become the brightest object after the Sun. As a result of its increasing brilliance at those times, it may have instantly reminded catastrophe survivors of the steadily increasing brilliance of the fiery Phaeton in the weeks when it approached ever nearer to Earth.

If so, this suggests that, before the Phaeton disaster, Venus shone less brilliantly and was seasonally a less conspicuous object. This, in turn, might indicate that the albedo (reflectivity) of the Venusian atmosphere had been enhanced during the intervening period and that its orbital motion may have changed.

That something rather unusual has indeed happened to Venus may be inferred from the relevant statistics noted in table 4A. Compared with nearly all those for other planets in the solar system, these reflect decidedly aberrant motions. Could a near-collision with a sizable celestial object, such as Phaeton, have produced such anomalies? Theoretically at least, the answer is yes. It is, of course, unscientific to assert categorically that Phaeton caused these anomalies. Nevertheless, it is germane that ancient Persian texts declare that *Mievish-Muspar*, a fiery object, "provided with tails" and which had assaulted Earth long ago, had been "attached" by the Sun: "...to its own radiance by mutual agreement, so that he (Muspar) may be less able to do harm"[291].

In other words, Muspar – alias Phaeton – had eventually plunged into and been absorbed by the Sun. Its journey towards the Sun must, therefore, have carried it past Venus or across its orbit, whereby the likelihood of Venus acquiring anomalous motions then is a distinct possibility. Any such encounter, however, would have been largely invisible to Deluge survivors who for months could see nothing through the impenetrable gloom of the 'collapsed sky'.

It was only with the dissipation of this thick cloud cover that Venus, now perhaps on a newly-inclined orbit and possibly still trailing wisps or portions of its own disturbed atmosphere (likened in ancient texts to 'hair', 'tails', 'horns', *etc*), became conspicuous in the clearing terrestrial heavens. Its surprising brilliance and unexpected appearance at the time perhaps naturally led confused and terrified Deluge survivors to suppose that Venus was the vanished Phaeton, and that its possible return was something to be avoided at all costs. The Venus cults of antiquity probably arose then.

18
PHAETON'S SIGNIFICANCE

We have repeatedly seen that, during its devastating progress through the solar system, Phaeton was apparently attracted to nearly all the planets in turn. Jupiter and Mercury seem to have been the exceptions. Conceivably these were in the 'wrong part' of the solar system at the time, that is, they were orbiting the far side of the Sun relative to Phaeton's course. Phaeton's predilection for planets strongly suggests that it possessed an abnormally intense electromagnetic field which was naturally attracted to the equivalent fields of the planets it encountered and disturbed.

Eventually, the overwhelmingly greater electromagnetic and gravitational fields of the Sun pulled it unerringly to a fiery grave in the solar furnace. Phaeton's impact upon the enormously larger Sun would, of course, have been negligible.

It is possible, therefore, to conceive of Phaeton pursuing a meandering course through the solar system as it moved sunwards from planet to planet, resulting in a pin-ball effect. Phaeton also apparently entered the solar system from a direction opposite to that in which all the planets orbit the Sun. As mentioned before, old Persian texts expressly state that Tistrya, the "leader of the stars against the planets", proceeded "along his *winding* course"[292] (our italics), a point mentioned in several ancient texts and traditions. Fig 4.13 conveys this concept diagrammatically.

With the demise of Phaeton, the 'war in heaven' was effectively over, although innumerable examples of the wreckage it produced throughout the solar system are yet traceable and many legacies of the phase which involved Earth are still being experienced today.

Despite its awesome destructive powers, however, the disaster was essentially a solitary event punctuating the uniformitarian normality of the solar system and which, among other effects, terminated a long and idyllic terrestrial regime anciently remembered as a 'Golden Age'. This had been an excellent expression of Lyellian uniformity on Earth. Now it was shattered and gone. Long aeons would and are to pass before such conditions become general once more.

Incomplete, dim and scattered though they now are, the aforementioned legends and traditions and the abundant geophysical and biological evidences relating to the Phaeton disaster represent, of course, mere highlights of that appalling event – and essentially localised ones at that. They scarcely convey the full enormity of the overall catastrophe and seldom the actual order in which the constituent calamities occurred. Insofar as this is possible, an attempt will therefore now be made to trace the probable sequence of these, their consequences at the time, and their subsequent longer-term effects.

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Part Five

ANATOMY OF A DISASTER

1
The Antediluvian World

As demonstrated in Part One, the geological youthfulness of much of Earth's present land and submarine topography, together with the late existence of now-vanished landmasses and migratory routes, points unmistakably to the fact that, before the onset of the Phaeton cataclysm, world geography differed markedly from that now familiar to us.

Previously reviewed biological evidence also suggests that before that event Earth's climate was almost certainly more genial than at present, and was conducive to remarkable proliferation of plant and animal life – even in latitudes now decidedly polar. Luxuriant vegetation, clothing extensive tracts in all hemispheres, was home to a fauna infinitely richer and more abundant than that of today.

Also noted was the fact that such a regime could have existed only if Earth rotated more perpendicularly and, as emphasised in Part Five:4 on *Earth Fracture*, appreciably slower than today. Days must have been correspondingly longer virtually all the year round, and the seasons mainly undifferentiated climatically, especially in tropical and subtropical latitudes. Theoretically at least, the result would have been 'uniformitarian' conditions like those traditionally ascribed to the legendary 'Golden Age' alluded to earlier.

But the evolution and maintenance of such conditions necessarily involved several other important factors which, although individually the outcome of the regime itself, also collectively ensured its continued existence. We may infer with reasonable confidence that:

- Earth must have been a stable planet and had been so for a long span of geological time;
- The relative disposition of land and sea must have differed considerably from that of today;
- Mountains were lower and deserts, where they existed, were less extensive than their modern counterparts, while seas were generally shallower;
- Polar ice-caps, if they existed, must *a priori* have been of modest dimensions.

Momentarily assuming the validity of these inferences we can further deduce therefrom that drainage systems were generally sluggish and largely silt-free; that sedimentary surface deposits predominated; that such uplands as existed were ancient and eroded vestiges of once much higher features; that from long continuing natural dissolution caves and subterranean rivers were common wherever limestone strata existed. From this it may also be inferred that the atmosphere possessed more carbon dioxide and oxygen (one of the by-products of vigorous plant-cover) and more helium (see Part Five:3 on *Collapsed Sky*); that storms were comparatively infrequent; that a high humidity prevailed over much of the globe; that both night-time and day-time skies were relatively cloudless, high-altitude thin clouds being the norm; and that precipitation over most land areas must have consisted chiefly of heavy nightly dews.

Under such conditions vegetation inevitably proliferated vigorously, while the inferentially high volume of fertilising excrement deposited daily on land by huge coeval animal populations also undoubtedly played a major role in promoting this botanical luxuriance.

It was against this topographically and climatically different background that the Phaeton disaster commenced, and the collective experience of the human survivors of that event accumulated. Later, we shall see that this latter factor had a profound bearing on the ability of individual survivors to adjust to the drastically remodelled world into which they had been so roughly catapulted.

A mere handful of traditions exist which allude to what may be termed antediluvian geography. Interestingly these are essentially consistent not only with each other but also with the general world picture inferred above. Thus, the Lushai people of Assam state that before the Deluge their homeland had been level or plain-like, a physical condition also mentioned by such widely-sundered tribes as the Bununs of Formosa (Taiwan) and the Tsimshian tribe of British Columbia[1].

Other traditions, however, refer to a great 'world mountain' called Meru, so upland regions and various peaks evidently existed then as well. The Atlas mountains of north-west Africa, for instance, may be such a pre-cataclysmic chain – with its south-western extremity and a sizable portion of the former adjacent African mainland now partially submerged below the eastern North Atlantic. Classical Greek references to antediluvian times contain vague references to an as yet unidentified antediluvian range known as the Riphaean Mountains. The possible location of these will be considered more fully shortly.

Again, if we admit the emotive cycle of Atlantis legends as valid but distorted memories of some bygone reality, a large island existed somewhere characterised by both lofty mountains and a wide plain. Furthermore, numerous Deluge legends refer specifically to mountains as sanctuaries for animal and human survivors, while as many others mention caves *in* or *under* mountains as places of refuge.

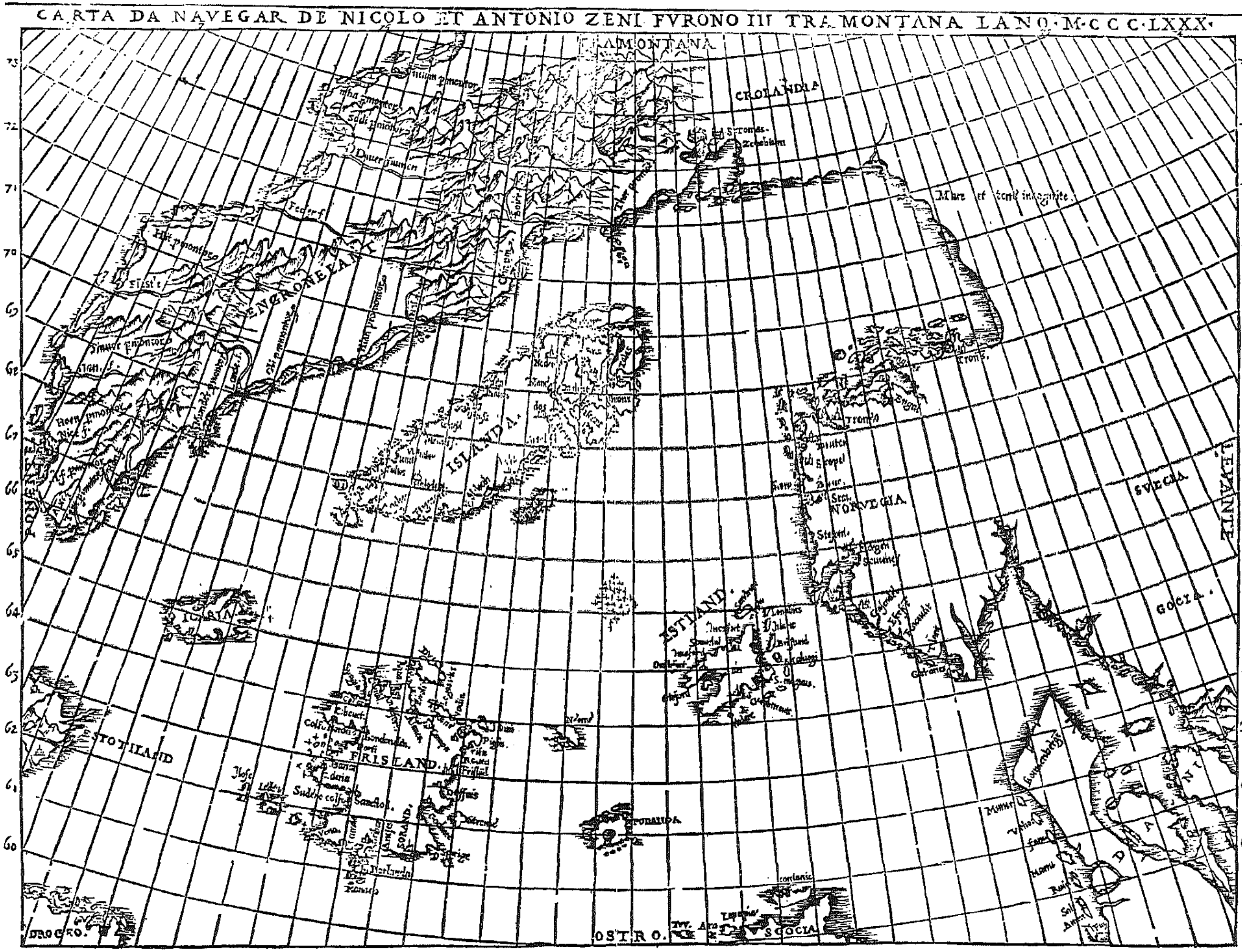
The survival in inland Borneo (Kalimantan) of certain topographical names which. according to the names assigned them, were anciently coastal features (capes, promontories *etc*), suggests that they also are fragmentary reminders of some long-vanished *antediluvian* coastline[2].

Thus, while some antediluvian coastlines were up-heaved and now lie far inland from present shores, others, together with their hinterland, were deeply submerged by the Phaeton calamity. Before that event, however, all marked the outlines of landmasses of very unfamiliar configuration.

The Mediterranean region generally and extensive areas of the North Atlantic were also apparently very different topographically before Phaeton's visit. Numerous living and recently extinct biota recorded from those regions testify strongly to this. The geographical distribution of the freshwater sponge (*Heteromeyenia ryderi*), presently confined to opposite sides of the North Atlantic and incapable of spreading except via freshwater habitats[3], is a case in point. Continuous land, having freshwater lakes and rivers, *must* have united these now widely-separated habitats until geologically recent times. In Part Two we instanced many further similar biological examples, which do not need detailing again here. Their collective testimony, however, is most eloquent.

From these and the many additional details cited earlier we may reasonably deduce that, under essentially genial climatic conditions, antediluvian land surfaces were generally rather flat or undulatory, and that cave-perforated uplands and eroded mountain systems existed in various districts. Certainly lakes and marshes existed in areas now devoid of those features, and the long axes of the oceans apparently ran in an east-west direction rather than the north-south direction that they do today.

But other evidence indicative of this vanished earlier geography also exists. It consists of some very unusual maps depicting unexpected information of special interest to us here. Space precludes our consideration of more than one of them – a truly remarkable map showing, among other things, an ice-free Greenland and what appears to be the now-sunken landmass of Fennoscandia. This map (map 5A), which along with many others of generally similar import is considered by us in another book, is generally



Map 5A. Zeno map of the North. *Map 29, "Nordenskiöld Facsimile Atlas", 1973, by permission of Dover Publishers Inc, New York.*

known to scholars as the Zeno map, since it was compiled in 1380 AD from observations allegedly made by the Zeno brothers during a northern voyage they are reputed to have undertaken earlier that century.

The map's history is interesting. The original compilation lay unpublished until, in the 16th century, G Ruscelli, a descendant of the Zenos, discovered it among old family papers and printed it in 1558. This was followed by a revised copper-engraved version (1561–1558) which appeared in a Venetian edition of Ptolemy's celebrated 'world' atlas.

Although active around 150 AD, Ptolemy, an Egyptian whose main studies had been made at Alexandria, was still regarded by 16th century geographers as the foremost geographer of all time, and whose maps – updated sporadically by later scholars with the then-latest geographical discoveries and information – formed the basis of the atlas of the world (as then known) at the time in common use. The Venetian printing incorporating the Zeno map was one such edition. The map also appeared in other editions, but, as far as is known, was not seen by Ptolemy and probably never existed in his day in the version familiar to us, since this latter is itself a compilation of several older and quite separate cartographic documents. For that and other reasons several later cartographic authorities have regarded the map as entirely fictitious[4]. Others, however, have concluded that the map reveals the Zeno brothers to have been "honest and reliable observers"[5].

Notwithstanding such conflicting opinions, *all* published versions of the Zeno map depict Greenland, Iceland, Scandinavia and northern Scotland (Scotia) very clearly, yet simultaneously show several supposedly imaginary islands (Frisland, Icaria, Droggo *etc*) in the North Atlantic absent from modern maps of the same area, and portray Greenland united to Scandinavia by an extensive *northern* landmass.

Babcock suggested that the outline of Greenland on the published versions of this map may have been taken from an early map of the region by Claudius Clavus (1427) or from another by Donnus Germanus (1466), and that Frisland was meant to represent the Faeroes, Icaria the Shetlands, and Estotiland eastern Labrador[6]. Be that as it may, the Zenos showed Greenland unambiguously and provide it with an island-girt coastline virtually devoid of the fiords now so characteristic of it, and with *named* mountain ranges and rivers.

Today, Greenland has practically no rivers of any consequence – the courses of those which do exist are very short – and its mountains are all but buried under an enormous ice-cap which, in places, reaches a thickness of 6,000ft (1,850m).

At this juncture two problems confront us: firstly, in view of the possibly imaginary status of some of the islands on the Zeno map, can we accept as genuine the unexpected topographical details depicted on Greenland?; and secondly, how could surface features – rivers and mountain ranges – now deeply buried under huge accumulations of ice, have been mapped at all if, according to conventional hypothesis, Greenland has been ice-mantled for scores of millennia ever since the inception of the assumed 'Ice Age'? Apart from recalling our previous conclusion that no 'Ice Age' of the kind envisaged by orthodox glacialists apparently ever existed, it should be mentioned that the cartographic accuracy of the Zeno map has been investigated on several past occasions largely in connection with the original projections employed by the map's compilers.

Various cartographic authorities have drawn attention to the apparent lack of accuracy in the positioning of certain topographical features, for example Cape Farewell, which on the original map is at 65°N. (whereas it should be at 60°N.), and suggested that the whole of the coastline had simply been skirted by ancient mariners and mapped by using only the very primitive sailors' compass of that period[7]. This conclusion, of course, completely ignored the detailed hinterland of Greenland exhibited by the Zeno map.

It was, in fact, completely demolished when Hapgood, who undertook a detailed analysis of this and other early maps, found that when the polar projection and the reconstructed grid were applied to the Zeno map and oriented to the correct north, Cape Farewell was actually located at 59°N, 44°W (its true co-ordinates being 60°N, 44°W)[8]. This remarkable accuracy was repeated for four other geographical features on both the east and west coasts of Greenland and for others on the coasts of Iceland, Norway and western Europe, where bearings seldom deviated from the true by more than one degree, and often by less. Hapgood's investigations also revealed that the Zeno map was actually a compilation of four separate distinct maps drawn at different scales and oriented to different norths which had later been combined to make a larger map[9].

When placed on a reconstructed Polar projection (figs 5.2abcd), the relative longitudinal and latitudinal positions of identifiable features on the Zeno map turn out to be extraordinarily accurate, and show that

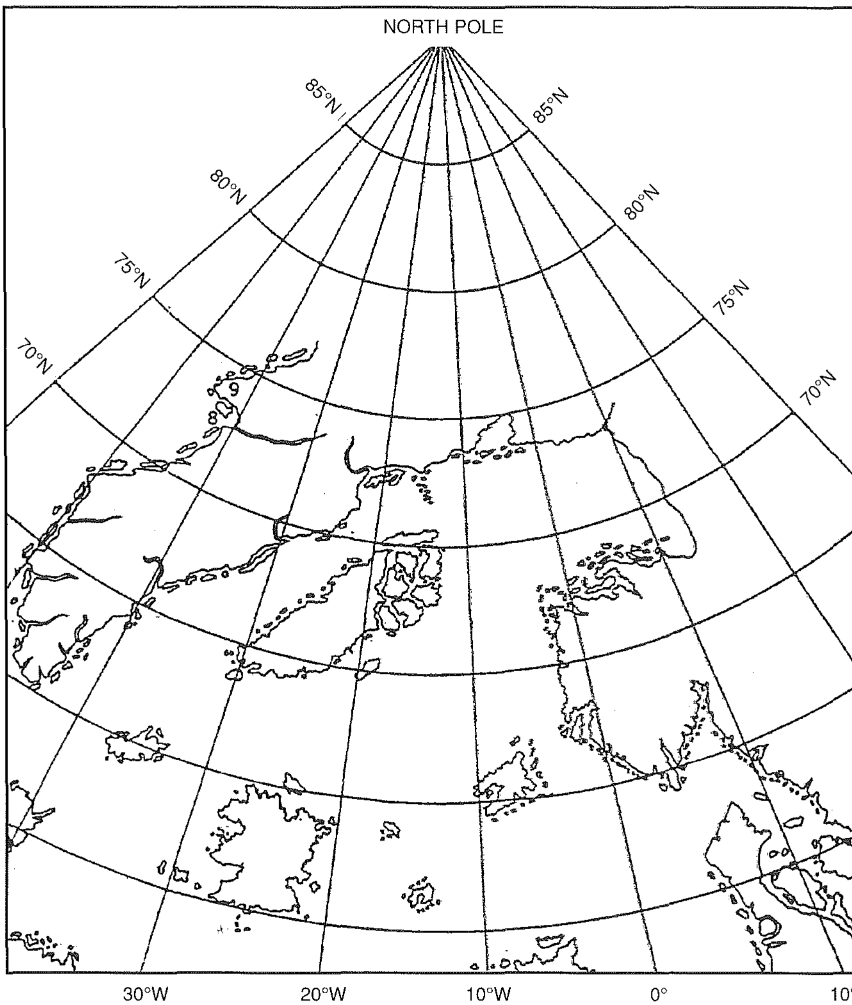


Fig 5.1. The Zeno map of AD 1390 plotted on a reconstructed polar projection. The latitudes of southern Greenland have been corrected but not the longitudes of its western coastline (see also fig 5.2).

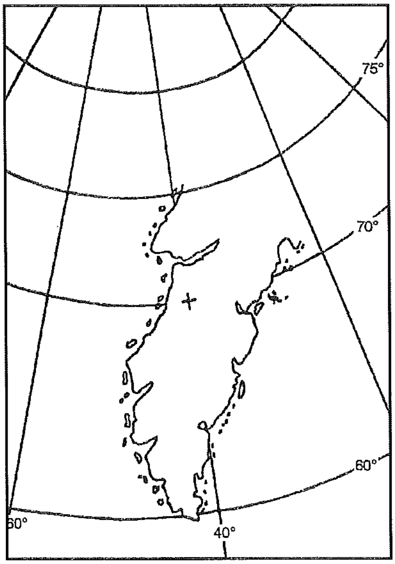


Fig 5.2a. Uncorrected western coastline of Greenland on the Zeno map.

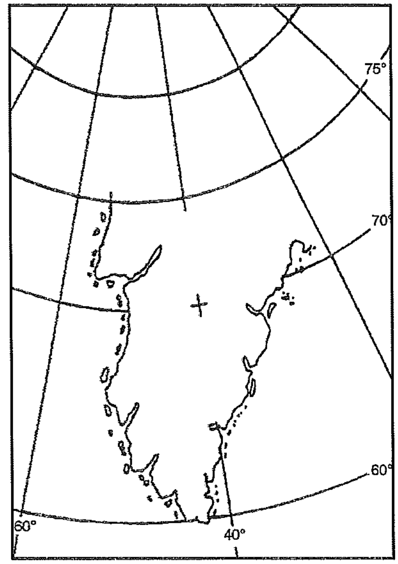


Fig 5.2b. Western coastline of Greenland on the Zeno map replotted to the correct degrees of longitude.

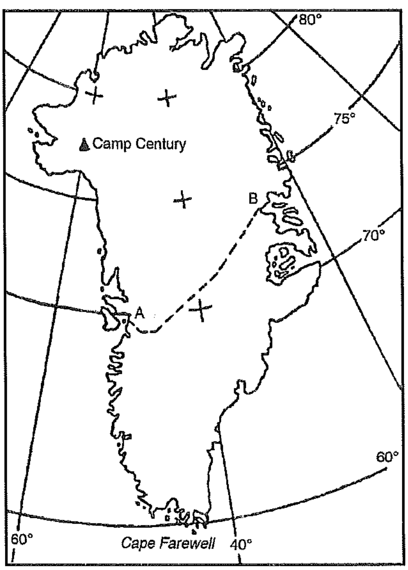


Fig 5.2c. Modern map of Greenland showing Camp Century, and the line (A-B) of the seismic profile of the sub-ice topography (see fig 5.2e).

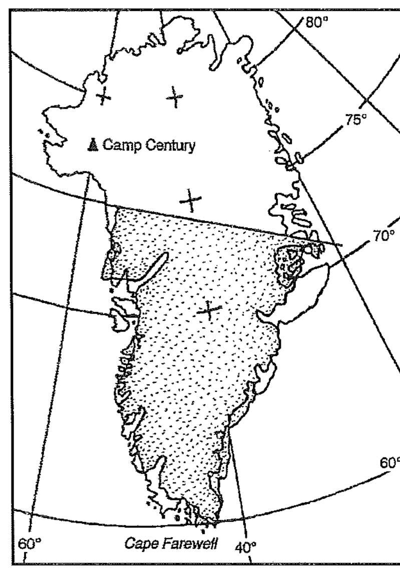


Fig 5.2d. Corrected version of the Zeno map of Greenland superimposed on a modern map of Greenland.

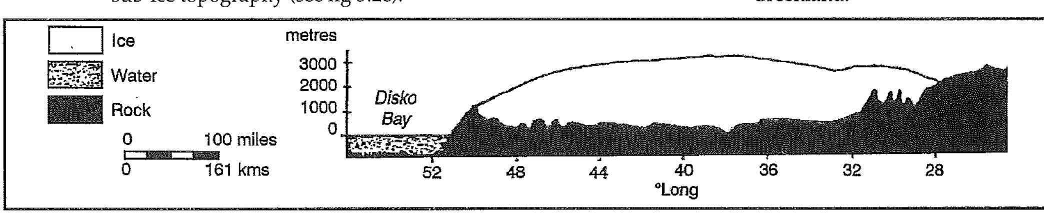


Fig 5.2e. Seismic profile across central Greenland (see fig 5.2c).

neither the Zeno map nor the four earlier maps from which it was compiled could have been drawn in the 14th century, when this type of projection was not used. Consequently, these maps and the information portrayed on them must date from much earlier times.

Compared with modern maps, however, the western coast (only) of Greenland on the Zeno map, even when placed on a reconstructed Polar projection, is found to be located 18.5° of longitude too far to the east. We have replotted the Zeno version of this coastline in its correct modern position (map 5.B) – that is, 18.5° further west – the resultant configuration of which (map 5.D) proves to be amazingly close to that of western Greenland today (map 5.C). Such close resemblances suggest that the rivers and mountains shown by the Zenos in the interior of Greenland are not, as some have speculated, purely imaginary features invented by medieval map makers. Closer examination of these details highlights some very significant facts.

The whole of Greenland slopes from east to west, with a belt of folded mountains having an average height of 7,000ft (2,150m) lying along the eastern seaboard. Greenland is also tilted from south to north, so that strata in the extreme south reach elevations of several thousand feet before abruptly plunging into the sea. The Zeno map appears to suggest precisely this topography.

The large central plain shown on the Zeno map is known to actually exist beneath the present ice-cap in the region indicated, and is apparently a portion of the crust now depressed below sea level by the enormous weight of the superincumbent ice[10].

In order to determine the age of the Greenland ice-cap, a borehole was sunk at Camp Century (77°N, 61°W), which reached bedrock at a depth of 4,705ft (1,387m). The contents of the extracted core was analysed using the theoretical age-depth scale from the 'glacier-flow' theory. This scale estimated that ice bored 3,705ft (1,140m) below the surface was probably 10,000 years old, while that at the very bottom of the core must be about 120,000 years old. This latter date is commonly accepted as the age of the Greenland ice-cap generally. From these details it was concluded that ice moving from the centre of Greenland would take 20,000 years to reach the west coast[11].

There are, however, reasons for doubting the validity of these estimated dates and of the methods used for interpreting the Camp Century core sample, for it has been established that ice streams off Greenland at the rate of some 100ft (30m) per day, that even over a broad shallow front of 21 miles (4km) the daily speed is still 9ft (3m), and that the ice-discharge from the huge Humboldt Glacier, with its 60 mile (96km) wide front, is 31ft (9.5m) a day[12]. This rate of flow is attributable to the fact that on floating away seawards a lack of friction between detached and still-descending ice-masses enables the speed of discharge to be higher than that of a mountain glacier, where such friction persists. Thus, the Mer de Glace on Mt Blanc only proceeds at 1.6ft (0.5m) a day. Furthermore, experiments conducted to establish the age of ice-layers which had moved from the centre to the coast of Greenland showed that the ice accomplished this in only 3,100 years[13]. Everything now points to the Greenland ice-cap being *much* younger than the 120,000 years estimated above.

The fact that northern Greenland was apparently *never* glaciated has already been emphasised. This is further confirmed by the dating of ground features found there and interpreted as being end moraines. These assumed moraines, which are associated with uplifted marine terraces 200ft (62m) above sea level, have proved to be only 8,000–6,000 years old. Indeed:

> No marginal moraines that are definitely older than Holocene have been found in northern Greenland[14].

The late age of these moraines reappears on the east Greenland coast, where examples are only between 11,000 and 9,500 years old; and then, on the west coast, both to the north and south of Disko Bay, upraised terraces show that the area was ice-free even before Holocene times. Other moraines at Taserqat date from some 10,000 years BP, at Avatdleq from 8,700 years BP, and those at Mt Keglen between 7,200 and 6,500 years BP[15].

It is certainly relevant that it was at Atanekerdluk, near Disko Bay, that, last century, an ancient tree, with a trunk "thicker than a man's body"[16], was found still standing erect on a hill at an elevation of 1,080ft (332m) by Capt Inglefield. Had this region ever been glaciated in the manner commonly supposed by orthodox glacialists, this tree could never have flourished, while if it was the remnants of a 'pre-glacial' tree, it would have been demolished and completely removed by the advancing ice of the supposed 'Ice Age'.

This is the conclusion already reached for so much of the present North Polar region – no significant quantities of ice existed there until *after* the Phaeton disaster. Thriving vegetation, including sizable trees, could reasonably be inferred as normal land-cover for territory featuring prominent rivers and mountains like those on the ice-free Greenland shown on the Zeno map.

Interestingly, expeditions made in the late 1940s to study the sub-glacial topography of Greenland produced seismic profiles showing not only the thickness of the ice but also the contours of the underlying land. This also confirmed the existence of the central flat plain depicted on the Zeno map[17].

The unexpected modernity of the moraines of northern Greenland – clearly accumulated by bygone glaciers -, the 'short' apparent period (3,100 years) needed by ice to move naturally from central Greenland to the coast, and Capt Inglefield's remarkable discovery of a long-dead erect tree in alleged 'glaciated' country at Atanekerdluk, are all details which, with several others mentioned earlier, suggest strongly that Greenland's present ice cover is an exceedingly youthful geographical feature – no more, perhaps, than 10,000–11,000 years old. If true, this means that the *original* field surveys embodied in the Zeno map may not, after all, be impossible. Man's ability to map ground features so early, and in such detail and with such accuracy is not as yet an achievement accorded him in orthodox history books – despite the stunningly advanced astronomical and mathematical knowledge obviously known to several of the *oldest of all known* civilisations (see especially section IV:15 on *The Mesopotamian Connection*. All these aspects are discussed in our forthcoming book *The Maps which Leapfrogged History*).

But a 'young' age for Greenland's ice-cover contrasts sharply with the 120,000 years estimated as the general age of ice at the bottom of the aforementioned Camp Century ice core. So also do the dates calculated for some of the lowest (oldest) ice cored recently at inland Greenland localities code-named Dye (1981), Renland (1987), GRIP and GSIP2 (1991–2)[18]. Collectively these indicate that the oldest ice averages around 100,000 years BP, while their general consistency with one another suggests that they cannot all be erroneous. A contradiction respecting the age of the Greenland ice-cover seemingly arises here. It would be reasonable to assume that one or other of these two sets of 'young' and 'old' dates is wrong, for surely they cannot both be right. Or can they?

Plotting of the geographical coordinates of the sites of the Camp Century, Dye, Renland, GRIP and GSIP2 cores on the 'corrected' Zeno Greenland (map 5.B) shows each positioned over or upon the flanks of mountainous terrain; and because these ranges are given specific names on the Zeno map, they must have been regarded as real ranges by someone at some distant time in the past. Today they are smothered under thick snow and ice.

Even in supposedly genial pre-cataclysmic times these lofty mountains must have naturally attracted some rainfall which, if the peaks were sufficiently high, would have fallen as sleet or snow (as on equatorial Mt Kilimanjaro today) and turned to ice on reaching actual land surfaces. The local development of glaciers – perhaps not of great size but certainly of great longevity, given the general stability of meteorological regimes then – even in such a benign era, would have been far from unnatural, and it may well be that 'old' ice studied at the bases of the above-mentioned cores is actually ancient glacier ice rather than ice indicative of a general glaciation at least 100,000 years old. The apparently incompatible ice dates and associated data from Greenland may thus not be contradictory after all, both these 'old' and 'young' sets being equally valid. Interestingly, if interpreted along these lines, neither jeopardises the main thesis advanced in this book, or the essential validity of the Zeno map's portrayal of Greenland.

Just conceivably these ice-blanketed mountains of Greenland are the aforementioned Riphaean Mountains of early Greek writers. Though possibly replete with glaciers, such once-accessible far distant ranges known via traditions from times so ancient that even the classical Greeks regarded them as legendary and no longer reachable, bespeaks of some now all but lost geographical knowledge first accumulated by an early forgotten race capable of land mapping ice-free (but now glaciated) regions to standards epitomised by the so-called Zeno map – the originals of which apparently *antedate* Greenland's present glacial regime.

While it might perhaps be imprudent here to pursue these lines of enquiry further, certain other aspects of the Zeno map also merit attention.

A further detail of the Zeno map concerns the absence of fiords presently characteristic of both the east and west coasts of Greenland. Although the map shows a heavily-indented Norwegian coastline and apparently emphasises an intricate archipelago along the northern Norwegian seaboard, neither the depicted bays and inlets nor the islands readily conform to Norway's present coastal topography. Additionally, the map fails to include the Scandinavian plateau which, in southern Norway, contains peaks as high as 8,000ft (2,450m) or more. This omission conceivably reflects a lack of data available to the Zeno brothers – or the map's Scandinavian sector is possibly unfinished. It is difficult to imagine that such topographical features would have been deliberately ignored or omitted had information about them been available.

Notwithstanding such possibilities, however, we have previously seen that the origin of the Greenland and Norwegian fiords apparently lies more with orogenic upheavals than with massive ice-sculpturing, and that it is unnecessary to ascribe great lengths of time to their formation by ice action. This conclusion accords well, of course, with what we have just learnt about the geologically youthful nature of the present Greenland ice-cap, and its inferred absence before Phaeton's lithospherically-disruptive visit.

It is interesting, therefore, that several authorities have recognised the geological modernity of the Scandinavian mountains, some even advocating a post-'glacial' (*ie*, early Holocene) uplift[19]. Forrest suggested that during the so-called 'Ice Age' they were less than 3,000ft (923m) high[20]. The fact that the Scandinavian uplands tilt downwards into the North Atlantic[21] also correlates with the previously discussed data respecting the geologically recent collapse of the old northern land of Fennoscandia which united North America and northern Europe. The Zeno map appears to show such a northern land-connection, not very dissimilar from that suggested from biological evidence by Scharff[22] and others over ninety years ago.

There are, therefore, apparently no genuine arguments for regarding the Zeno map – curious though it may seem to modern eyes – as portraying anything but that which actually once existed on Greenland in the not so very remote past. All in all, the Zeno map strongly suggests that it constitutes a precious record of a portion of antediluvian geography – a geography which initially formed the terrestrial backdrop to the celestial drama dominated by Phaeton, and which was largely destroyed and remodelled by that event.

It is upon the *modus operandi* and actual sequence of the events, which wrought such changes on Earth, that we must now focus attention.

2
Confrontation

In Part Four we left Phaeton (Marduk) and its attendants departing from the vicinity of Mars and heading for Earth, with Phaeton beginning to discharge electromagnetic bolts ('lightning') at the Moon. The subsequent interactions between Phaeton's entourage and the Earth and Moon amounted to a confrontation of epic proportions. The gigantic physical changes sustained by Earth were both startling and sobering, and the accompanying annihilations not less so. At this juncture, however, we confine ourselves to merely outlining the main phases of this confrontation, reserving for later pages more detailed examination of the *modus operandi* of the calamity and the sequence of the different phases comprising it.

The enormous scale of this catastrophe and the relative positions of the participants as it unfolded are probably most simply conveyed by a series of schematic diagrams (fig 5.3ab, cd, ef). Primarily these show the changing relative positions of the principal antagonists at given phases of the drama, while almost certainly the participants moved, at least initially, on different orbital planes. In order to better comprehend the suggested sequence of events and the relevant interactions involved, each diagram has been provided with a brief commentary tracing the most likely developments or those which can be inferred as having almost certainly occurred. Generally speaking, these formed an identifiable chain reaction.

We have previously noted that the Moon appears to have formerly circled Earth more closely than it does today – probably at no very remote time either. Fig 5.3a shows the Moon moving along this nearer orbit round an Earth spinning from west to east on a nearly vertical axis. Phaeton and the smaller Kingu approach the Earth/Moon system from the direction of Mars on their disruptive journey. For the sake of clarity, the minor but still dangerous lesser objects accompanying Phaeton and Kingu are omitted from this and the following diagrams.

Special note should also be taken of the Roche zone shown enveloping Earth. In due course, we shall see how the zone played a very important part towards the later stages of the Phaeton disaster.

Fig 5.3b, which represents a temporal interval of several days, shows a still largely unchanged Earth circled by the Moon on its pre-catastrophic orbit, but with Phaeton and Kingu now nearing Earth as they attempt to fly past the Earth/Moon system on their sunwards journey. Electromagnetic exchanges between all these bodies would have steadily increased from this point, resulting in an electrically enhanced terrestrial atmosphere, an intensification of magnetic storms, and a general rise in the temperatures of both Earth's atmosphere and hydrosphere.

Ancient Persian traditions are especially noteworthy in mentioning that Phaeton (Tistrya or Tistar) repeatedly changed shape as it approached Earth. Thus, for ten nights Tistrya moved "with light in the shape of a man", that for the next ten nights it assumed the shape of a "golden horned bull", and that for a further ten nights it appeared as a "white horse with golden ears"[23].

From these descriptions – which interestingly span an entire month – one might reasonably conclude that such shape changes were largely caused by the electromagnetic activity occurring within Phaeton's entourage, that several radiant bodies streaming lengthy tails were heading earthwards in comparatively tight formation, and that from time to time these either altered position relative to one another or, as the

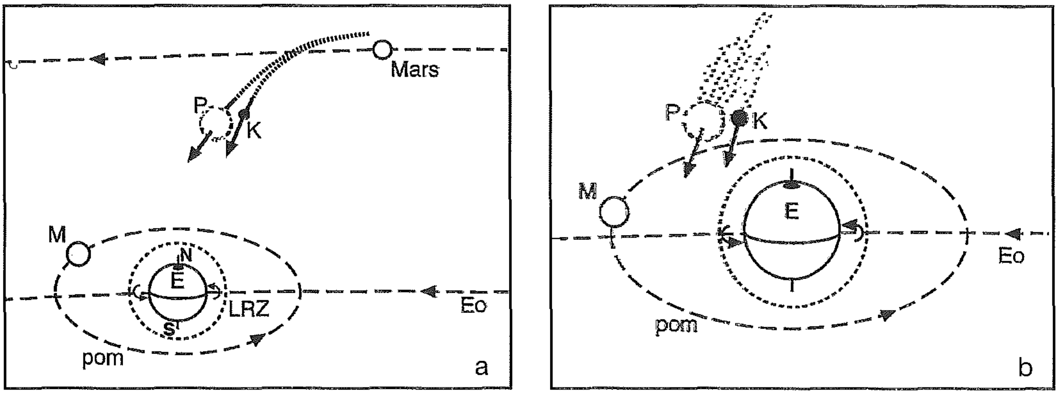


Fig 5.3ab. Phaeton's path close to the Earth.

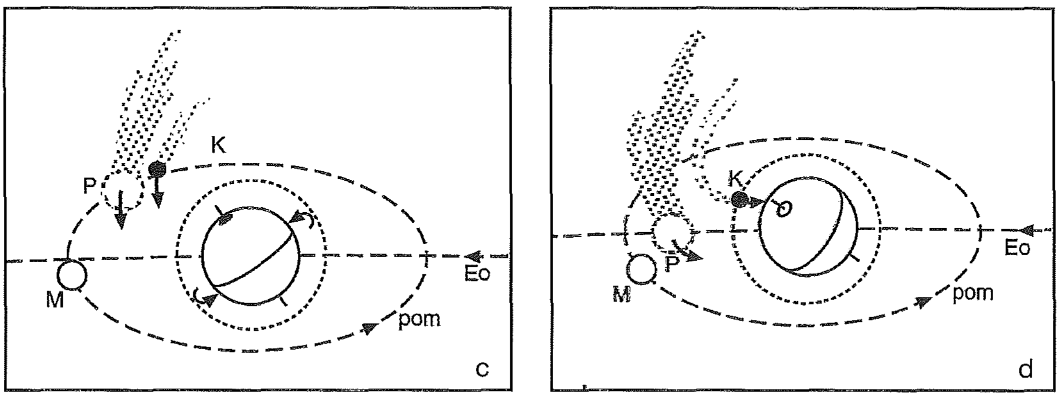


Fig 5.3cd.

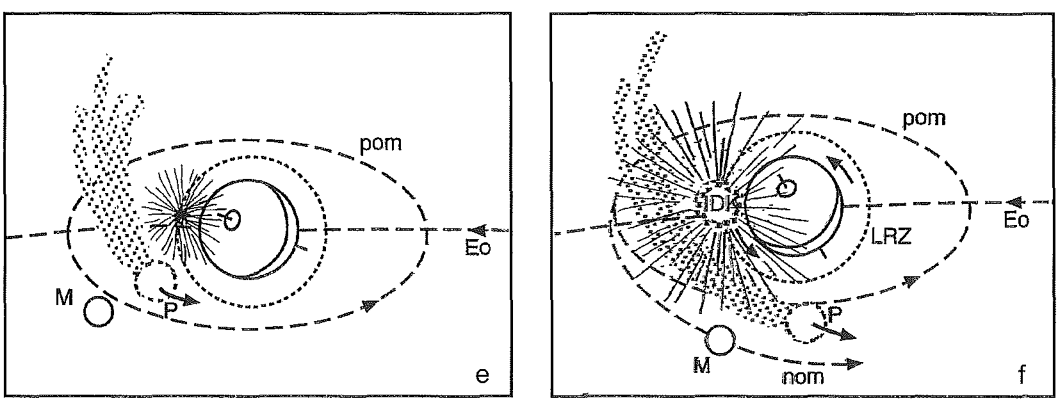


Fig 5.3ef.

E	Earth	Eo	Earth's orbit round the Sun	LRZ	Limited of Roche Zone of Earth
K	KIngu	pom	pre-catastrophic orbit of Moon	IDK	Ionized debris of Kingu
M	Moon (Lunar)				
P	Phaeton (Marduk)				

objects proceeded across the heavens, the overall perspective of the group repeatedly changed for terrestrial viewers. The Persian account strongly suggests this scenario. Certainly, shape changes like these are not novel. In just twenty-four hours, the configuration of some cometary heads has been observed to alter markedly. Fig 5.4 shows an example observed in 1862.

Ancient descriptions which likened Phaeton to a serpent, a wolf, a horned bull, a horse, a lion's head, a boar, a giant bird, or to some mythological creature like a dragon, the behemoth, or the leviathan; or which refer to dusky tongues, manes, bristles, and gleaming eyes are obviously allusions to the ever-changing fantastic image of Phaeton during its awesome progress across the firmament, a progress that in its later stages appeared to swing alternately towards the zenith or low to, or even below, the horizon, as Earth yawed unstably.

As Hindu traditions correctly affirm, Phaeton was "a dreadful spectacle". Multifarious changes could, of course, be expected in an object like Phaeton. Traditional references to them, far from being fanciful, are almost certainly genuine if poetic accounts of what was actually seen. The following conjectural interpretations (figs 5.3c and 5.3d) graphically outline what may have been observed in Earth's skies then.

Fig 5.3c, which represents the probable situation after a further interval of a day or two, shows Phaeton and Kingu set on a path that will take them inside the Moon's orbit and to one side of the Earth's northern zenith. To Earthbound observers their course was running contrary to Earth's rotation – as specifically mentioned in Ovid's account of the disaster. Earth/Moon gravitation now begins to affect the course of the intruders, while Earth, tilting axially from the vertical, starts to align itself towards Phaeton and Kingu.

Terrestrial wobble and axial shift will also have been exacerbated by the alarmingly fast increase in seismic activity occasioned by the steadily nearing Phaeton and its entourage – activity which, dislocating the lithosphere

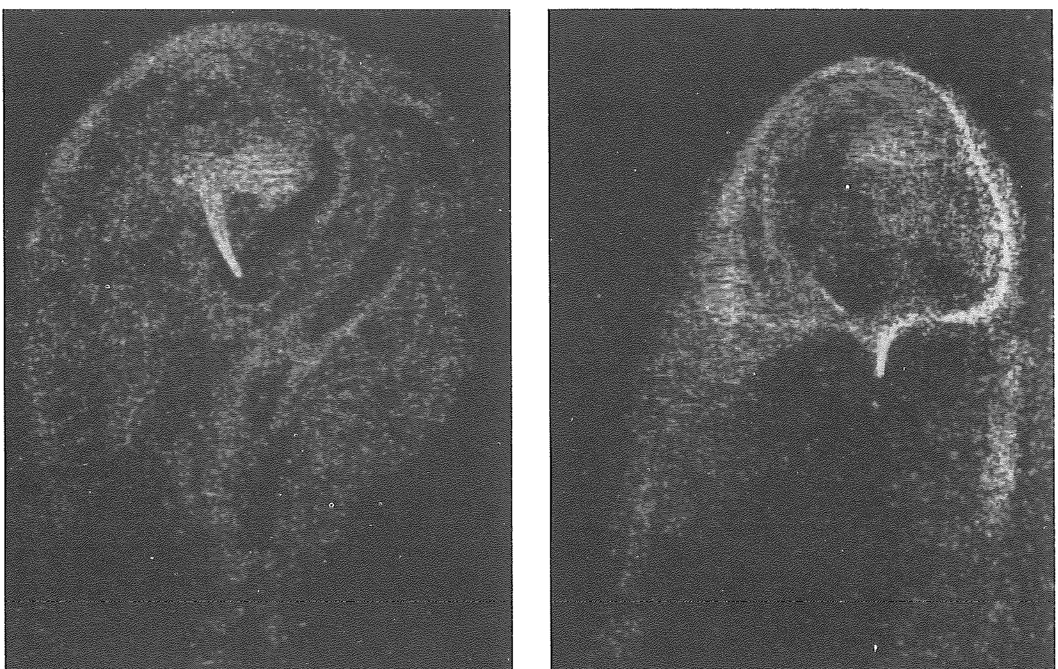


Fig 5.4. The head of a comet observed in August 1862. On the left, its aspect at 9pm on August 23rd, and on the right its aspect exactly 24 hours later. *After A Guillemin.*

worldwide, has been authoritatively described as being of "...indescribable and overpowering violence"[24]. Its magnitude far transcended the 7.5 shown by Heirtzler's researches as the minimum for generating not only axial wobble and polar shift but also for causing a geomagnetic reversal[25]. Magnetic charges imparted to igneous rocks during this reversal are, as previously noted, known to have been from ten to *one hundred times stronger* than any suppliable by unaided internal terrestrial mechanisms – Phaeton was the only co-existing close source capable of furnishing such massive charges!

Fig 5.3d indicates the probable position after a similar interval of time. The Moon is shown still moving along its pre-catastrophic orbit as Earth's rotation either ceases or is severely retarded by Phaeton and its attendants – now even closer to Earth. At this point, the combined gravitational pull of Earth and the Moon apparently began to prize Kingu away from Phaeton's embrace

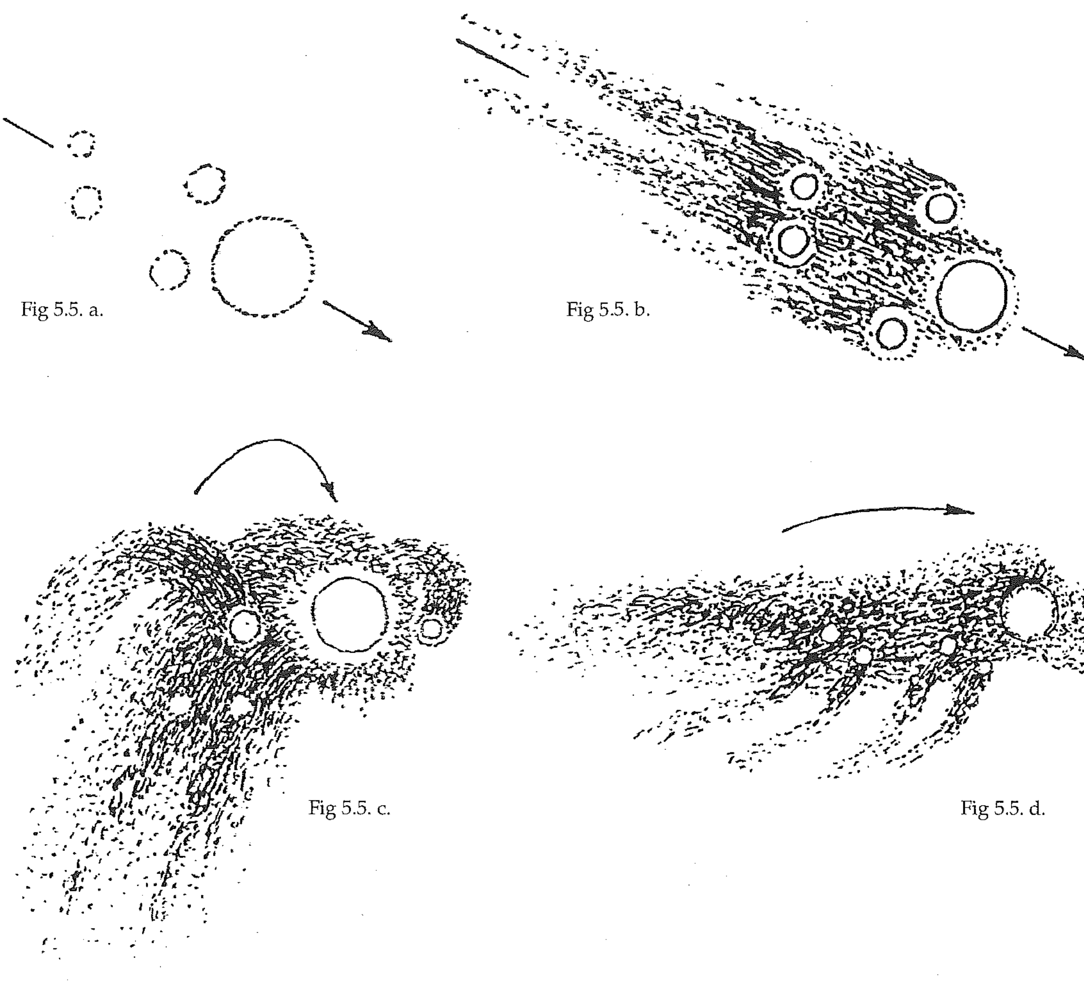


Fig 5.5. a. Fig 5.5. b. Fig 5.5. c. Fig 5.5. d.

Fig 5.5. a. Schematic diagram of the probable early disposition of Tistrya (Phaeton) – the largest object – and its four largest satellittes.
b. The same group shown in probable flight formation, broadly resembling a human shape.
c. The same group at a later stage seen three-quarters head-on, broadly resmbling a 'golden horned bull'.
d. the same group seen later still when broadly resembling a 'horse'.

and drag it inexorably towards Earth's Roche zone and ultimate destruction. Colossal electromagnetic exchanges must have continued unabated between Phaeton, Kingu, Earth and the Moon during this phase of the drama, as each object sought to stabilise its own electromagnetic potential.

The combined separation of Kingu from Phaeton and the stopping or slowing of Earth's axial spin caused terrible havoc on Earth. The waters of the world's rivers, lakes and oceans were drained from their original basins and drawn gravitationally to the point on Earth nearest (opposite) Kingu and Phaeton. Worldwide traditions remember this awesome effect.

The retarding of Earth's rotation also resulted in the world's winds blowing with a ferocity and intensity never experienced by modern people – winds which flattened whole forests, whipped ocean billows to mountainous heights, moved giant rocks and removed incalculable volumes of loose surface materials to very great distances. It was, in fact, remembered as a veritable *diluvium venti*.

Meanwhile, the internal magma tides continued to flow below the tormented terrestrial crust. Through the united gravitational influence of Kingu and Phaeton, they will have been slowly pulled towards that aspect of Earth nearest those celestial bodies. This inevitably resulted in geoidal deformation, huge portions of the lithosphere buckling, fracturing, subducting, collapsing or overriding one another as simultaneously numerous mountain ranges were up-heaved. Rivers of molten lava, rains of red-hot ash, and vast clouds of volcanic dust and gas swirled over enormous regions. Elsewhere rampant fires will have consumed all living things in their path.

At some localities volcanic gas clouds – *nuées ardentes* – transported large boulders many miles, scored rock surfaces with striae closely resembling those often ascribed elsewhere to glacial action, and, in company with high pressure grit-charged steam, polished and carved rock surfaces and excavated entire valleys. Concomitantly, avalanches of boiling mud ejected from volcanic vents and fissures poured down hillsides and along valleys transporting more boulders and producing further rock striations.

Numberless burrowing creatures sought sanctuary from these scourges in their underground dens – refuges which, though temporarily successful, proved to be fatal traps. Indeed, the mortality rate at that time among animals and plants of all kinds was frighteningly high.

Proceeding now to fig 5.3e, which represents a few hours later, we find Phaeton, unable to break the combined Earth/Moon gravitational field and so unable to 'capture' the Moon, displacing it to a new (its present) orbit. Slav traditions mention a 'star' or 'planet' named *Gokihar* ('Wolf-progeny') as the special "disturber of the Moon" at a time of great changes on Earth long ago[26]. Gokihar was presumably Phaeton.

Kingu, however, now trapped in Earth's Roche zone, had begun to disintegrate. Such frozen liquids and atmosphere as Kingu may originally have possessed will have become detached first, plummeting to Earth as blocks of ice, hail and gigantic masses of water (the pre-Deluge rain?). This process must have accelerated progressively, culminating in a mighty explosion, which hurled burning debris literally in all directions at high velocity and produced a blast which, among other things, caused the 'sky' or 'heavens' (actually the thick clouds of the 'collapsed sky') to open or part like a 'scroll'. Through this opening some of the largest fragments of Kingu – the Norse sagas called them the 'sons of Muspelheim' – plunged earthwards.

Accompanying these were immense masses of smaller fragments – the rains of gravel, showers of rocks and iron blocks, and falls of sand and dust of worldwide traditions. Fire (ignited gases?), burning fluids (hydrocarbons?), and sticky ferruginous fluids reportedly fell with them, adding to the prevailing chaos. Although the overwhelming majority of these fragments ignited on entering Earth's 'collapsed sky', either vaporising or exploding varying distances above ground level, the so-called Carolina 'bays' of the eastern United States, the smaller but otherwise closely similar 'bays' of Holland, and the aligned 'lakes' of north-eastern Siberia, Alaska, northern Yukon and north-eastern Bolivia were apparently produced then. The dominant NW/SE orientation of all of these structures strongly suggests a common origin, and that aerial agents formed them.

As Phaeton's influence began to wane, Earth's rotational speed started to increase again, although the planet generally still continued to suffer the calamities outlined in our explanation of fig 5.3d.

Fig 5.3f depicts the final phase of this terrible confrontation. The Moon is shown setting out on its new orbit. Earth has received Phaeton's legacy of an altered axial tilt and obscuring 'collapsed sky' conditions worldwide. Numerous fragments of the disintegrated Kingu continue to bombard Earth as concurrently, another of Phaeton's legacies, the Deluge, wreaks further havoc.

With the destruction of Kingu and the sunwards departure of Phaeton, the deranged atmosphere and the gravitationally heaped-up terrestrial waters strove to regain normality. Terrific gales continued to blow as Earth's atmosphere adjusted to changing topographical conditions, and both piled-up waters and the internal magma tides began to return to equatorial regions. Numerous surviving accounts describe the waters advancing like a colossal wave, or wall of stupendous height and irresistible power. The relatively abrupt release of the waters piled-up by Kingu's and Phaeton's combined gravitational influence will have inevitably produced a Deluge having precisely these characteristics. That the Deluge at many localities indeed assumed these proportions is confirmed not so much by the traditional descriptions but by the numberless physical evidences of its massive charge across the landscape.

The Deluge, careering headlong over hill and dale alike, charging up mountainsides and pouring down valleys, was checked only by the largest mountain ranges or deflected by the mightiest cliffs. With the force of ten thousand Niagaras it will have poured precipitously into those collapsed portions of the Earth's crust destined henceforth to be the present ocean basins. Amid prevailing gloom it roared across the open countryside obliterating or gathering up all organic matter in its path, carrying it long distances in battered and dismembered condition before depositing it along with incalculable volumes of sand, silt, gravel and stony debris in caves and rock-fissures on every continent, often in the wildest disorder, as densely-packed confused masses. Its waters extinguished innumerable fires and crushed or transported every movable object they encountered. They swamped caves, burrows and other underground refuges, drowning all creatures which had sought safety within them.

The magnitude of the biological extinction achieved by the Deluge almost transcends the imagination. It annihilated literally billions of biological units of both sexes and every age indiscriminately. Only incredibly powerful flood-waters operating worldwide could have achieved such results, and only a flood produced by the means previously suggested could have operated globally.

Finally, some thought should be given to the scale, rapidity and violence with which the successive phases of this confrontation took place, for not only are these factors consistently confirmed wherever physical traces of their former action are yet discernible, but they are implicit in their very *modus operandi*. Giant electromagnetic storms, lightning, earthquakes, volcanic eruptions, crustal dislocations, stupendous hurricanes, abruptly displaced bodies of water, celestial bombardments, rains of astonishing volume, and a mighty flood – *all* are quick-acting violent events.

Individually, each may have persisted for an appreciable time, although throughout its duration its actions are essentially rapid and impetuous. The elements of speed, great scale and violent power unquestionably rendered the character of each phase as phenomenal and terrible. So too were the extent and effects. In short, the catastrophe was eminently memorable. Nothing like it before or since was known to humanity.

With the draining away of the Deluge waters, Earth's confrontation with Phaeton was over to all intents and purposes, although its tribulations were not. Before considering these, however, we must examine more fully the various component phases of the confrontation itself to appreciate how each formed a logical and coherent link in a progressive chain of horrendous events totally unknown to modern Man.

3
COLLAPSED SKY

One of the earliest physical effects arising from Phaeton's visit was the phenomenon afterwards remembered traditionally as the *Age of Darkness*. Several accounts state that darkness enveloped the Earth before the onset of the Deluge, lasted throughout its duration, and endured for years after the flood waters had subsided. References to its persistence throughout early post-diluvial times usually associated it with great cold. Its density and longevity were decidedly exceptional, the former characteristic leading to at least one assertion that it was not of an "ordinary earthly kind"[27], and the latter to a general belief that the sky had 'fallen' or 'collapsed'.

It can hardly be coincidence that numerous traditions speak of this 'Collapsed Sky' as having fallen so low that people could not stand upright without touching it[28]; of the darkness being so intense and the atmosphere so thick that birds flew into one another and men and animals stumbled against each other[29]; and that it occurred at a time when the whole world was desolated[30] and a terrible heat enveloped the Earth and made its waters boil[31].

In Brazil, the Cashinaua Indians recall that deafening thunder and lightning accompanied the 'collapsed sky'[32], and many African tribes associated it with widespread biological destruction. Thus the Ovaherero tribesmen assert that when the sky "fell down" long ago "almost all the people were killed", a belief shared, too, by the Kanga people and Loanga tribe; and in Unyoro, the Wanyoro tribe likewise speak of ancient times when the god *Kagra* threw the firmament upon the earth to annihilate humanity[33].

The duration of the 'collapsed sky' varies considerably in the various surviving accounts of it. Some merely speak of Earth being plunged "in darkness for a long time"[34], or for so long that the period was later regarded as an age of "continuous darkness"[35]. Several imply that the darkness persisted for years, and a Mexican account (mentioned in Part Three) states that it actually lasted for twenty-five years. Certainly its persistence was everywhere traditionally held to have been abnormally long. We may never know its true duration, but this more than likely varied in different latitudes and was governed at different localities by local topography – the probable reason why differing estimates of its duration are given in different traditions. Moreover, if perpetual darkness prevented the distinction of day from night, the true duration of 'collapsed sky' conditions would have been very difficult if not impossible to determine.

The mechanism by which the natural terrestrial cloud cover could 'collapse' appears to necessitate: an initially massive and comparatively rapid evaporation of the Earth's surface waters; the subsequent condensation of those waters; and an equally massive and long-continuing pollution of the terrestrial atmosphere by suitable agencies. All such effects would, of course, result from other, still more fundamental, planetary activities involving among other things the production of great quantities of heat.

We have seen that the pre-catastrophic climate must have been generally warm and devoid of extremes over much of the globe. In such a climatic regime, widespread condensation in the guise of heavy dews must have occurred nightly, with water tables being relatively high. Several traditions independently aver that a terrible drought preceded the most dramatic expressions of the Phaeton disaster – the Conflagration and the Deluge. Fruit on trees shrivelled, crops failed and vegetation withered. Animals and birds migrated *en masse* from north to south[36]. Rivers and lakes began to dry up and sea temperatures rose. The evaporation of Earth's waters had begun. A blistering heat pervaded everything and a thickening haze formed high in the skies. It was presumably this haze which, according to the Amerindians of the Purus River region of Brazil, made the Sun and Moon turn red, blue and yellow.

Atmospheric distortion must have commenced then, as that part of Earth's atmosphere opposite or nearest the oncoming Phaeton and Kingu was slowly pulled gravitationally towards those bodies. This derangement probably assumed the form of a curved cone or plume which streamed outwards a considerable distance towards the celestial visitors, with the lightest gases (*eg* helium) being the most affected.

In other words, the terrestrial atmosphere was being held in a distorting pattern while Earth itself continued to rotate normally. Coupled with the intensifying electromagnetic conditions mentioned previously, winds must have been hot and dry in virtually all latitudes, contributing to a massive evaporation of superficial waters generally. Such evaporation inevitably resulted in the formation of a thickening cloud cover. Initially this was presumably the 'thick mist' alleged to have shrouded Hera (Earth) while Pallas-Athene (Phaeton) was still far distant (see Part Four); later it reached 'collapsed sky' proportions.

Even from the onset of the confrontation between Earth and Phaeton violent electromagnetic exchanges between these bodies would have been inevitable. Certainly at later stages of the cataclysm we are told that these exchanges became almost continuous – Pima Indian legends mentioning that even the advancing Deluge waters were cut by incessant lightning. Thus, early atmospheric effects must have included a heavy smell of burnt electricity. Surely significant, therefore, is the Samoan recollection that what we may take to have been just such a smell was noticed *before* the formation of huge clouds (relatively unfamiliar objects in antediluvian skies) which preceded the great Conflagration.

Unquestionably many of these initial electromagnetic exchanges reached ground level, igniting dehydrated forests or tearing up land surfaces. Numerous well documented modern instances are known of such disturbances, even though these obviously involve discharges infinitely smaller than those which must have passed between Earth and Phaeton. The following example shows how even a minor event of this kind can wreak appreciable damage. After a lengthy drought during August 1900, a thunderstorm arose in the forested Adirondack mountains and passed over Lake Champlain, USA. A lightning discharge occurred, striking the ground on the northern slope of Split Rock Mountain and setting fire to trees so that in under five minutes a "well-developed forest fire was under way". All around the point of impact dirt and rocks had been torn up with such force that rocks had been fractured and shattered, and fragments 110lbs (49.5kg) or more in weight were flung about[37].

V H Barnett has detailed similar cases in this category, which possibly have a bearing on the origin of *some* of the so-called 'glacial erratics'. He mentions a report of a great mass of rock being broken and thrown down the Llyn Teyrn in North Wales by lightning during a severe thunderstorm in August 1898, and Hibbert described the effects of lightning on the cliffs on the east side of Fetlar Island (Shetland) as follows:

> A rock 105ft long, 10ft broad and in some places more than 4ft thick, was in an instant torn from its bed, and broken into three large and several lesser fragments.

> One of these, 26ft long, 10ft broad and 4ft thick, simply turned over. The second, which was 28ft long, 17ft broad and 5ft in thickness, was hurled across a high point of a rock to the distance of 50 yards. Another broken mass, about 40ft long, was thrown still farther but in the same direction, quite into the sea. There were also many lesser fragments scattered up and down.[38]

If comparatively minor modern lightning discharges can cause damage on this scale, one is certainly left pondering the likely effects of the immeasurably greater examples exchanged between Earth and Phaeton.

Celestial electromagnetic exchanges of the size and frequency suggested must also have generated electrical currents not only on Earth's surface but also deeper, selecting metalliferous (better conducting) strata, following metallic veins – perhaps to great depths within the crust – and producing huge thermal increases worldwide. Repeated discharges on this scale would quickly generate sufficient heat to cause: almost instantaneous expansion of the water naturally locked up in crustal strata, resulting in extensive fissuring and splitting of surface rocks; the upwards flow of magma from the deeper fissures; and the activation of volcanoes. Oceans and seas would have boiled and steamed. In combination, these disturbances would, through a general release of heat, smoke and dust, initiate atmospheric pollution that would last for decades.

On rising into the atmosphere, these pollutants would have begun to seriously impair visibility while their rapid formation as dust or gas would have induced further electrical activity, conditions thereby going from bad to worse.

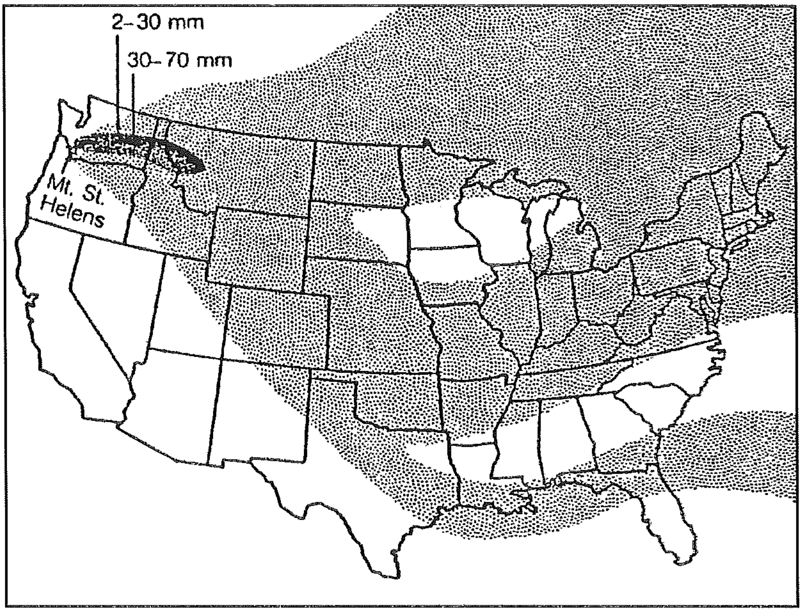
The now famous Mt St Helens volcanic eruption of May 1980 released an immense amount of ash and dust into the atmosphere, which ultimately affected at least two-thirds of North America (map 5B). In some areas it reached as much as 8 tonnes per acre, and *that* some 300 miles (480km) from the eruption itself[39]. The burial of Pompeii and Herculaneum under prodigious quantities of volcanic ash in AD 79 was a classic example, although only marginally worse than that occurring in 1914 when Sakurajima volcano in Japan all but buried innumerable buildings in its vicinity with similar ejecta (fig 5.6). The still more recent eruption of El Chicon in Mexico on April 4th 1982, hurled into the atmosphere more than five times the amount of material than the Mt St Helens explosion, and ranks as one of the largest of modern times.

Large volcanic eruptions can also seriously *lower* atmospheric temperatures. Thus, in 1783, Laki volcano erupted in Iceland and Asama volcano erupted in Japan. Though not exceptionally large, in combination they exerted a pronounced cooling effect on the world's atmosphere, not only in that year but also on the two that followed, which: "...were the coldest on record in the northern hemisphere"[40]. They created widespread dense fogs, whereby the Sun remained invisible until it had climbed 17° above the horizon – and that was in southern France in June!

In 1815, one of the most violent eruptions of all time occurred when Mt Tambora threw so much ejecta skywards that even 312 miles (500km) away the dust hung so thickly that: "...there was total darkness for three days – followed by lengthy twilight and brilliant sunsets elsewhere"[41]. Globally, temperatures fell 1.1°C below the annual norm, and 1816 was a year *without* a summer.

The role played by volcanic ash and dust released into the atmosphere is, even today, a significant one. For example, it has been determined that dust clouds erupted near the equator pollute the atmosphere and endure from 1 to 2 years, those erupted in middle latitudes from 3 to 5 years, and those in polar latitudes for up to 10 years[42].

Particularly intense vulcanism is known to have characterised 'late Pleistocene' times, truly enormous eruptions occurring in the areas embraced by the North Pacific[43], Antarctica and Iceland[44]. Literally thousands of volcanoes were active then (see table 5A). Their collective pollution of the atmosphere



Map 5B. General extent of ash-fall from Mt St Helens over North America, which erupted on May 18th 1980. *From G B Griggs & J A Gilchrist, "Geological Hazards, Resources and Environmental Planning", 2nd edn, 1983, reprinted by permission of Wadsworth Inc, Belmont, USA.*

must have been colossal. It has been suggested that this 'late Pleistocene' vulcanism may have seriously defiled Earth's atmosphere for up to 100 years[45].

The volume of volcanic dust poured skywards at any given time is also important. Large quantities initiate the development of sulphuric acid in the upper atmosphere, leading to the formation of thick cloud cover. Atmospheric pollution is worst and persists longest in high latitudes because, there, the dust veil causes the greatest depletion of the Sun's rays by screening both solar and terrestrial radiation through the formation of the cloud-cover. The resultant lower temperatures accordingly permit an increase in the build-up of snow and ice – the former producing a heat-reflective albedo effect, and the latter an entrenchment of continuously cool or cold conditions, and a weakened circulation[46].

As well as dust particles, volcanic eruptions also release sulphur compounds, potash, potassium, CO_2, and particles of glass[47]. In combination these could lower temperatures globally by up to 3°C, or perhaps even more.

Since it is well known that lightning often accompanies volcanic eruptions it would be reasonable to suppose an atmosphere heavily polluted with volcanic and fissure ejecta would tend to become increasingly electromagnetic. Electrical discharges must, therefore, have steadily increased between the thickening atmosphere and the tormented land surface, as concurrently larger ones generally continued to be exchanged between Earth, Phaeton, and the latter's entourage. The sheer weight of the polluted atmosphere would have forced the cloud base down to unprecedentedly low levels.

There is. therefore, a clear connection between the phenomenon of a 'collapsed sky', repeated electromagnetic exchanges between celestial bodies, and giant crustal dislocations generating both heat and atmospheric pollutants on a grand scale. A similar connection, considered more fully later, is equally discernible between a 'collapsed sky' situation and atmospheric defilement by vast burning forests and ignited petroleum.

It is also more than probable that most of Earth's helium was lost during this disaster.

Fig 5.6. Buildings partially buried by volcanic ash during the 1914 eruption of Sakurajima, Japan.

Table 5A

Some areas of major volcanic activity regarded by vulcanologists as being of 'late Pleistocene' or 'late Quaternary' age. Many areas, such as the Aleutians and Andes hosted scores, even hundreds, of simultaneously active volcanoes at that time.

Northern Hemisphere	Southern Hemisphere
Gt Khingan Shan Mts	Nigeria
Sikhote-Alin Mts	Kenya
Taiwan (Formosa)	Tanzania
Ryuku Islands	Great Rift Valley
Kuril Islands	Madagascar
Kamchatka Peninsula	Indian Ocean
Anadyr Bay	Burma
Bering Strait	Malaysia
Seward Peninsula	Indonesia
Gulf of Alaska	New Hebrides
Aleutian Islands	Australia:
Vancouver	N Queensland
Rocky Mountains	South-east New South Wales
Cascade Mountains	West Victoria
Grand Canyon	Tasmania
Sierra Nevada	Bismarck Sea
Columbia Plateau	New Guinea
Idaho	New Zealand
Oregon	Solander Islands
Arizona	Antarctica:
New Mexico	South Antarctic Peninsula
Mexico	Ellsworth Land
Nicarague	Marie Byrd Land
El Salvador	The Andes - Colombia to Chile
Guatemala	Brazil - Mato Grosso
Panama	Chile (800 recently active volcanoes)
Clarion Islands	
Hawaii	
Philippines	
Spitzbergen	
Novaya Zemlya	
Mid-Atlantic Ridge	
The Azores	
Canary Islands	
Atlas Mountains	
Hoggar	
Ethiopia	
Djibouti	
Gulf of Oman	
Iran	
Afghanistan/Pakistan border	

Helium is a light, inert gas normally found in the upper atmosphere. It is produced by the natural radioactive decay of uranium and thorium in the terrestrial crust. Investigations have shown that, at the present known rate of decay, and provided that uninterrupted decay has been going on since time immemorial, there ought to be a thousand times more helium in Earth's atmosphere than there actually is. Scientists at the US National Bureau of Standards who studied this enigma in 1964 concluded that the loss of so much helium could very well have been due to some geologically recent "catastrophic event", in which the gas was "boiled off"[48]. Theoretically at least, the Phaeton disaster provided all the conditions under which this could have occurred.

4
EARTH FRACTURE

The gigantic worldwide tectonic disturbances of 'late Pleistocene' times occurred almost simultaneously on a near-unimaginable scale – precisely what could be expected from a powerful external influence but not from the 'Ice Age' conditions conventionally believed to have existed then. The key factor underlying these tremendous changes was massive *crustal fracture.*

Interestingly the planetary scale and geological youthfulness of Earth's crustal fracture-complex has encouraged several high authorities to conclude that it resulted from an *external* rather than internal influence. We also previously noted that the Martian crust appears to have been similarly fractured, and that, in an ancient Babylonian epic, the planet Tiamat was fatally fractured and destroyed during a celestial encounter with a fiery sun-like object called Marduk. And since Marduk was seemingly identical with Phaeton, traditionally remembered as having anciently caused extensive topographical changes on Earth, could the terrestrial fracture-complex have resulted from the same dynamical process that destroyed Tiamat and fissured Mars?

If we examine this possibility further, it is noteworthy that Mars, like Earth, presently rotates once about every 24 hours, that the two innermost planets, Mercury and Venus, rotate much more *slowly*, but that the outer planets (Pluto excepted) rotate much more *rapidly* (see table 4A, Planetary Statistics). In the Babylonian epic Tiamat apparently orbited the Sun as an asteroidal planet somewhere between Mars and Jupiter.

We are not told Tiamat's size, however, although an apparent image of it on a Babylonian cylinder seal (fig 4.11c) indicates that it was larger than Earth, and modern estimates of a now-lost asteroidal planet suggest a mass approximately 90 times that of Earth[49]. Thus, as an astronomical body, Tiamat was sizable, although not really large. Due to its likely distance from the Sun, Tiamat could be envisaged as a planet having a solid rocky body not improbably ice- or water-covered, enveloped by an atmosphere more akin to those typical of Jupiter and the outer planets. Quite possibly, Tiamat may have rotated more quickly than Mars and Earth – perhaps in 18 or 20 hours – whereby its rate of spin at its equator (and hence that of any internal magma it may have possessed) was by any standard quick.

A fast-spinning sizable body like this, braked or stopped by a powerful external agent, would – largely because any internal magma would probably continue to rotate within the halted outer crust – literally come to pieces. Intolerable pressures and thermal increments would fracture and disrupt the latter. Faster-spinning larger bodies, such as the outer planets, could through sheer size and rotational speed override all but the very greatest external influences, and crustal and magmatic disruption would be minimal or non-existent. Similarly, a slow-spinning sizable body, externally retarded or braked to a halt, would also probably avoid fatal disruption, since, irrespective of the object's size or bulk, the braking process, while more easily accomplished, would obviously involve less crustal dislocation than if the rotation was speedier.

This seems to have been the case with Mars and Earth. Although the former evidently suffered orbital distortion and its rotation may have been slowed down, Earth, too, conceivably once rotated more slowly, a day consisting perhaps of about 30 hours.

We suggest, therefore, that at the onset of Phaeton's confrontation with Earth, the Earth's rate of spin was probably the single most important factor which determined its survival as a planet. Had its rotation been more rapid, it could well have shared Tiamat's fate. Combined with its powerful gravitational field occasioned by its essentially solid lithospheric construction, Earth's slower rotational rate prevented it from breaking up – although not, in our submission, by any great margin. Indeed, at the height of the catastrophe Earth's survival apparently came close to a situation best described as 'touch and go'.

As it was, Earth sustained fearful crustal damage during its encounter with Phaeton, and acquired an almost completely rearranged topography. The former disposition of land and sea was changed, a new world mountain system came into being, the number of active volcanoes was augmented enormously, a legacy of seismic activity was bequeathed which is far from over, a new land drainage pattern was instituted, and completely different oceanic and atmospheric circulatory regimes were established. While it is hardly necessary to reiterate the extreme youthfulness of these environmental components, we should stress that from what is known of geophysics and the theoretical interplay of two or more similar-sized confronting celestial bodies, all such planetary changes are *exactly* what could be expected to occur. Gold[50], Warlow[51] and Sagan[52], to mention just three, have all surmised as much.

A look now at some modern instances of horrendous crustal effects will enable us to better glimpse the sheer enormity and extent of the changes wrought during Phaeton's visit. Even these examples are necessarily pale echoes of those immeasurably greater and still more violent earlier analogies. Earthquakes, volcanic eruptions, tidal waves (tsunamis), mud-slides, avalanches, dust clouds, and various ejecta, will be among those examined. This evidence, when magnified to the probable scale and intensity of the equivalent events during the Phaeton disaster, is as sobering as it is awesome, and conjures up mental images from which, even today, thousands of years later, the mind recoils numbed and appalled.

Of the many terrible earthquakes that have occurred at intervals within living memory – among which those of San Francisco, Quetta, Agadir and several in Turkey instantly spring to mind – probably none was more severe than that which, just before noon on 1st September 1923, struck the twin Japanese cities of Tokyo and Yokohama. In the present context this was an unusually instructive event because it also involved a retreat of the sea, a gigantic tidal wave, a landslide, a tremendous rocky avalanche and a terrible fire. The full extent of the destruction meted out by these agencies did not become apparent until the completion some while later of official Japanese enquiries, which disclosed truly horrific details.

The following statistics suffice to convey the scale of that disaster. In Tokyo destruction was incredibly rapid everywhere. Four-storey concrete buildings disintegrated 'in the flash of an eye', tiles cascading with precipitous speed from roofs. Fires broke out all over the place – 252 in all, of which only 40 were contained or extinguished – and 71% of the city, or some 366,262 houses, was incinerated. Neighbouring Yokohama was eventually completely gutted by fire within twelve hours. No fewer than 38,015 human victims of the holocaust were finally counted, many of them having died of heat suffocation.

Around Sagami Bay, the final figures of casualties from fire, earthquake and tidal wave was 99,333 killed, 43,476 missing and 103,733 injured. Of buildings, 128,266 had totally collapsed, 126,233 had half-collapsed or suffered irreparable damage, 447,128 had burned down and 868 had been demolished or swept away by the tidal wave. The overall total of destroyed buildings was 576,262[53].

The avalanche, beginning on the 3,000ft (923m) high peak of Mt Hiziridake, just over 4 miles (6.4km) inland, consisted of a wall of dirt and rocks which roared across the country obliterating everything in its headlong rush towards the sea, at a speed subsequently calculated to have been approximately a mile-a-minute (95kph). The speed and volume was attested by the debris it deposited along the valley slopes forming its route, at heights exceeding several hundred feet as it rounded curves in its course[54].

From just this one terrifying event, 718 aftershocks occurred in September, 96 in October, 86 in November, 139 in December, and 167 in January 1924[55]. How much worse and globally more numerous must have been the aftershocks following the departure of Phaeton?

Probably the most notorious earthquake recorded since modern archives began was that which devastated Lisbon on November 1st 1755. It was so powerful that it was also clearly felt in Morocco and Algeria 1,000 miles (1,600km) or so to the south. Between eight and ten thousand people, together with their cattle, camels, horses and other animals, were swallowed up by abysses which closed over them again, the ground presenting the same surface appearance as it had before the dreadful event[56].

Often more destructive than earthquakes are the subsidiary catastrophes accompanying them. Those must have been *common* at the time of and immediately following the Phaeton disaster.

In the celebrated earthquake of 1811 at New Madrid in Missouri, for example, entire islands disappeared in the Mississippi River and local flooding caused great loss of life[57].

Certainly, the burial of some 25,000 people by the Huascaran avalanche, caused by seismic activity in the Yungay and Ranrahirca region of Peru on May 31st 1970[58] falls into this category. This avalanche poured down the valley at no less than 200mph (320kph)! Its motion resembled a great wave, and, in the words of one nearby observer: "The crest of the wave had a curl like a huge breaker coming in from the ocean. I estimated the wave to be at least 80m (160ft) high"[59]. At some places it buried the valley with debris to a depth of 260ft (80m), and transported huge boulders, some as large as 19.5 cubic yards (15 cubic metres), long distances before dumping them at all sorts of locations.

A comparable landslide of 1,300 million cubic yards (1,000 cubic metres) occurred at Mayunmarca, also in Peru, in 1974. In only 4 minutes it descended a vertical distance of 4,800ft (1,500m) at a speed of 75–87mph (120–140kph) and was completely irresistible[60].

The volume of material moved by landslides is sometimes awesomely great. At Frank, in Alberta, for example, one such slide involved approximately 39,650,000 cubic yards (30,500,000 cubic metres) of rock[61]. Last century, a land-slip at Gohna, in Himalayan India, involved the 4,000ft (1,230m) vertical descent of so much rock debris that it piled up *in moments to a height of 800ft* (246m) and completely blocked the local river. The force carried debris half way up – 2,000ft (615m) – the opposite side of the valley and hurled large boulders a mile or more away. So much dust rose into the air that the district remained darkened for several days[62].

Such instances graphically illustrate how giant rock-slides and avalanches occurring on a global scale during the Phaeton disaster could have obliterated and buried extensive areas of the pre-catastrophic landscape, and how much of this material – subsequently rearranged by the Deluge waters following closely upon its dislodgement – has been recorded as 'drift' filling up entire valleys.

Submarine earthquakes, such as must have undoubtedly occurred during Phaeton's visit, also often generate highly destructive subsidiary calamities. Tsunamis (tidal waves – a Japanese term) are among the worst and commonest of these, and can be up to 500 miles (800km) long. In the ocean itself, the waves may be only a few feet high, but on reaching coastal margins sometimes attain enormous heights. One recorded in 1737 at Cape Lopotka, Kamchatka, was as much as 210ft (65m) high. Still larger ones have been reported, and wave speeds of between 300 and 500mph (480–900kph) are known, with water pressures reaching 800lbs per square foot. The velocity of the falling crest of a wave combined with the speed of advance reaches 49 tonnes per square yard for a wave only 30ft (9m) high[63], so we can only imagine the pressure exerted by the largest modern waves or by those occurring during the Phaeton disaster.

Their capacity to devastate must have been tremendous when we consider that a tsunami caused by a submarine earthquake near the Tuscarora Deep south of Japan in June 1896 roared in from the sea as a 75–100ft (23–31m) high wave which engulfed whole villages and left no trace either of them or their inhabitants. In moments, 27,122 people were annihilated, thousands more injured, and 10,617 dwellings swept away[64].

Additional hazards accompanying earthquakes include emissions of natural gases, sulphurous odours and seepages of petroleum and bituminous substances[65]. Did we not read in Part Three of poisonous blasts and rivers and lakes of fire, as having been among the traumas which reportedly beset early humanity at the time of the Phaeton disaster? Gases and petroleum seepages would have afforded precisely these effects.

But earthquakes even of the magnitude just mentioned are hopelessly inadequate explanations for the collapse of ocean basins, the formation of rift valleys and fracture complexes of global extent. These are clearly the outcome of the more fundamental process of plate tectonics, which alone appears to be capable of dislocating the lithosphere. Infinitely larger and more dramatic than any produced by even the severest known earthquake, the results usually manifest themselves as enormous faults. They are the true lines of Earth fracture.

Arguably the most famous example is the San Andreas fault in California (fig 5.7), but others equally representative are known from every continent. All usually occur as scarp faces separating faulted blocks of land (tectonic plates), the scarps often rising, sometimes vertically, high above the surrounding countryside. A splendid instance is the nearly straight fault bordering Lake Mobutu Sese Seko (Albert) in Uganda, the scarp face towering to a height of almost 975ft (300m) and evincing every sign of being geologically very youthful (fig 5.8).

As previously noted, these rock faults accompanied the widespread orogeny of 'late Pleistocene' times. The San Andreas fault, for example, is associated with the latest uprise of the Sierra Nevada range, while another of still greater dimensions (the Indo-Gangetic trough), has long been associated with the elevation of the Himalayas[66]. This latter is actually a gigantic crack, now largely in-filled with alluvial deposits, stretching more or less uninterruptedly from Sumatra, round the Arrakan coast, across northern India and through the Persian Gulf to the Mediterranean[67].

It is parallelled further north by another crack marking the centre line of a succession of mountains running from south Asia, through Asia Minor and the Balkans to the Alps[68]. It is now filled with serpentine, a rare deep-seated rock, which must have welled up from immense depths. Both cracks are connected with the latest uprise of the Alps and with the formation of the Mediterranean basin occasioned by the collapse of the old Tyrrhenian continent.

Interestingly, Burrard, a former surveyor-general of India, concluded that the uprise of the Himalayas and the associated crustal fractures resulted from a deceleration of Earth's rotation, and that:

> It looks as if our Earth had in the distant past received a tremendous blow from outside...[69]

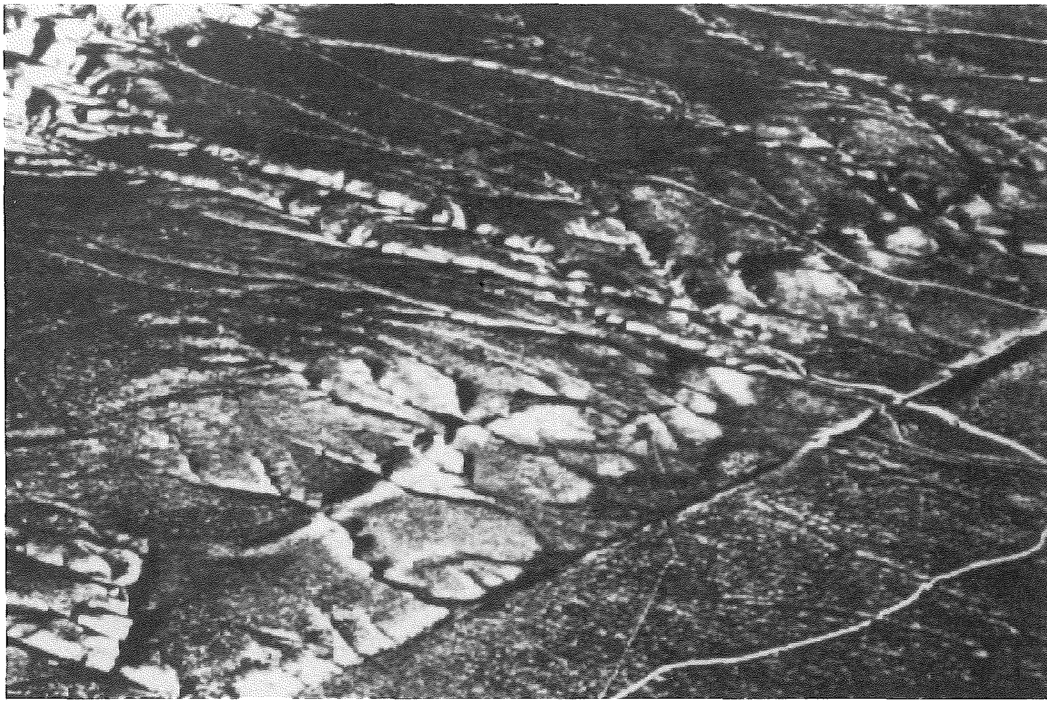


Fig 5.7. The San Andreas crustal fault in California. *Photo: W A Garnett, California.*

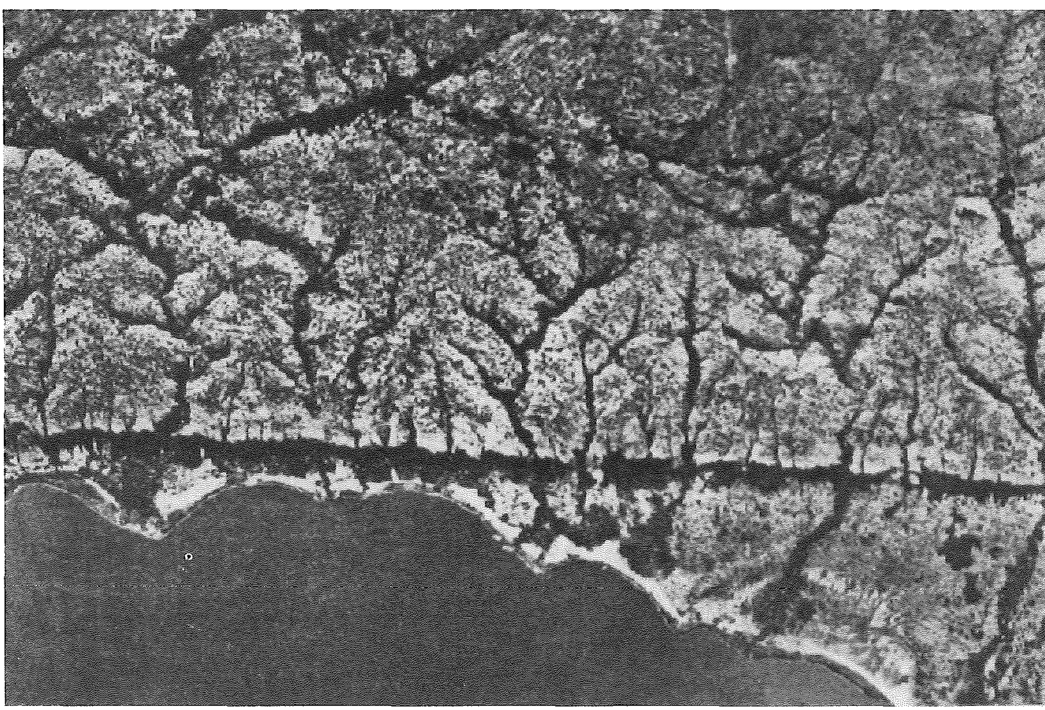


Fig 5.8. The fault bordering on Lake Mobutu Sese Seko, Uganda. *By permission of David & Charles, Newton Abbot.*

Obviously Burrard envisaged a celestial force, although he failed to specify its identity. In our submission, Burrard's 'blow' was administered by Phaeton, although we do not consider that actual physical contact occurred between that object and Earth. The electromagnetic, thermal and gravitational interplay between the two bodies sufficed at the time to fracture the terrestrial crust in the manner now discernible.

Using varied material, Mantura[70] and others have recently questioned the validity of the currently-fashionable theory of continental drift. Others, like Oppenheim, have concluded that, as presently advocated, the concept is grossly oversimplified and that the key to its understanding lies in the pattern of global crustal fracture zones. As Oppenheim said:

> This pattern... would suggest that expansion of the Earth's crust has taken place[71].

Vast amounts of thermal energy could achieve such expansion. As the great majority of these fractures are demonstrably young features and an exceptionally powerful geomagnetic reversal (over 100 times stronger than terrestrial mechanisms could produce) occurred approximately 11,500 years BP, when the Phaeton disaster took place, so much thermal energy was seemingly generated that expansion of the underlying magma resulted in Earth's crust literally *cracking apart* like the shell of an overheated egg.

If true, this may even have distorted the geoidal shape. Very significantly, Taira[72] has suggested that such a geoidal distortion accompanied severe vulcanism in eastern Asia coincidentally with the onset of cold (glacial) conditions at the beginning of Holocene times (*ie*, immediately after the Phaeton event). In all probability the difference between 'during' and 'immediately after' is illusory.

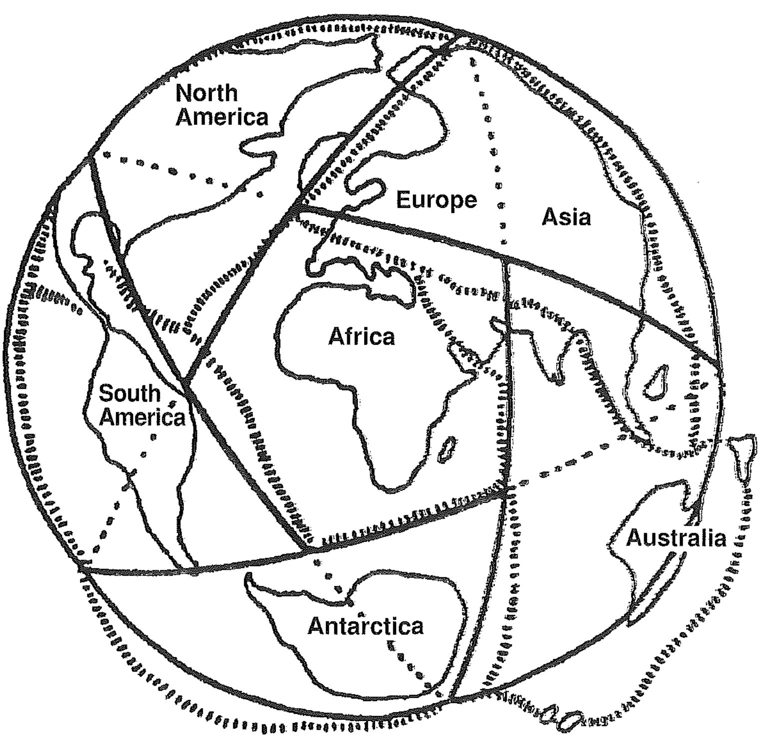


Fig 5.9. Major tectonic plates of the Earth (broken lines) compared with a projection of a regular icosahedron (solid lines) on an azimuthal equidistant projection *(after Spilhaus)*.

Mantura, moreover, has argued that the curious shapes of the major tectonic plates – produced by crustal fracturing – show the theory of continental drift to be false, while Spilhaus has demonstrated that the shapes of the plates and the triple points formed where the plates naturally meet coincide very closely with the vertices of an icosahedron (fig 5.9). He added:

> Triple points are important, such as the cracks in Pangaea [the original tectonic plate which split into present continental plates], which typify what happens in a *homogeneous material that is uniformly stressed.*[73] (Our italics)

Recent explorations in Arizona have highlighted puzzling seismic data from levels deep in the continental crust. These concern the *homogeneity* of miles-thick sheets of crystalline rock, which have been *forcibly pushed* hundreds of miles over *younger* sedimentary deposits. Similar homogeneous sheets, up to 61 miles (10km) thick, have also been noted in the southern Appalachians, where they have been moved bodily westward by as much as 140 miles (225km), while in Utah another almost identical example has apparently been *pulled down* a vast inclined fault[74]. In every case, the sheets appear to have slid while molten over the strata now underlying them – yet, in doing so, they remained intact, a seemingly impossible but nevertheless real effect.

A *uniformly exerted stress* would be one method by which this remarkable result could be achieved. Certainly the thermal energy unleashed by these events must have been appalling. These details, coupled with Spilhaus' observation on what happens to uniformly stressed homogeneous rocks, provide sobering insights into both the linear and vertical extent of the crustal disturbances characterising Phaeton's visit. The lateral displacement of enormous pieces of Earth's crust has been noted in Part One, where we saw that, like other major mountain ranges, the Rockies were pushed many miles *over* adjacent strata.

In Nigeria, sets of uniformly straight parallel crustal fractures, each hundreds of miles long and aligned almost due north-south, have resulted from the application of a massive compressive stress. Investigators of these huge cracks actually suggested that their near-meridional orientation was due to a change in the speed of Earth's rotation, and that this was probably induced by a near-miss or the oblique impact of a cosmic body![75]. Although that proposed event supposedly occurred millions of years ago, considerable field evidence exists that these Nigerian fissures may really be geologically very recent. If so, the unspecified cosmic body just postulated could very well have been Phaeton.

Gigantic east-west crustal derangements reach great visual prominence in the Central American-Caribbean region and in eastern Indonesia. In the former region, these displacements occurred during late Quaternary times when colossal portions of the lithosphere slid past one another or *subducted*[76]. Directly associated with the Clarion fracture zone in the eastern Pacific[77], with the San Andreas fault in California and its southern extension in the Gulf of California[78], with the deep-sea trench off Guatemala and with the trans-Mexican volcanic belt[79], these upheavals were also connected further south with a similar belt of major tectonic collapse features which, in Guatemala and San Salvador, include the stunning Coatapepeque caldera and the Ilopango depression[80].

Indonesia virtually duplicates the Central American region just considered. There also an east-west crustal dislocation of surprising modernity and stupendous proportions is present. It profoundly affected the biology of the region as represented by Wallace's Line[81].

The sudden slowing of Earth's rotation, therefore, inevitably caused severe crustal fracturing worldwide. The continued rotation of the semi-fluid molten magma below Earth's halted or decelerated crust resulted in vastly increased thermal energy and, not improbably, in temporary geoidal deformation. In such circumstances the greatest stresses would mostly be experienced in tropical latitudes where both surface and subterranean magma speeds are naturally higher than in polar regions. The direction of such stresses would tend to override that of planetary rotation.

Lithospheric fracturing and the subduction and over-thrusting of crustal plates of the magnitude being contemplated would inevitably compress and buckle some portions of the terrestrial surface (causing the uprise of mountains and plateaux) while simultaneously stretching others to the point where massive crustal fracturing and collapse would occur. The African Rift Valley, the floor of the Atlantic either side of the mid-Atlantic ridge, the Mediterranean basin, the dropped ocean floor off Kamchatka, and the Turfan depression in central Asia, all appear to be examples of such crustal collapse, and geologically very recent ones at that.

5
FIRE-STORM

The ferocious magnetic storms in Earth's atmosphere coincident with the widespread drought and botanical desiccation which typified the terrible confrontation between Earth and Phaeton, allied to the furious winds generated by the braking of Earth's rotation and an attendant axial shift, quickly produced Fire-storm conditions.

Moreover, crustal sliding and disruption over magma intensely heated electromagnetically by a massive polarity reversal, together with concurrent volcanic eruptions and magmatic outpourings on a tremendous scale, increased global thermal levels catastrophically. Tinder-dry grasslands and forests (often of resinous timber) perished in frightful holocausts. Water temperatures rose, and rivers, lakes and even seas eventually began to steam and boil. As conditions progressively deteriorated, metalliferous veins in surface strata, often acting as natural lightning conductors, began to melt or fuse, with the softer ores (*eg*, lead, tin and gold) liquefying quickest and finding their way into rock fissures and other cavities. The presence of iron ore and other metals in several bone-fissures was noted in Part Two. Evidence for all these and the following effects of great heat and rampant fire at the close of so-called 'Pleistocene' times abounds on almost every continent.

Near-endless torrents of hot volcanic ejecta rained down upon huge areas; immense clouds of inflammable gases escaping from seismic fissures and volcanic vents rolled over the terrain, bursting into flame or, as *nuées ardentes*, buoying up enormous boulders and other debris for long distances before depositing them at all sorts of locations; exploding gases and other volcanic substances created blast effects of appalling severity, and high pressure jets of grit-charged steam and heated water carved out, striated or drastically altered local topography.

In other regions, avalanches of boiling mud, spewing out of vents and chasms, compounded the unbridled chaos. These overwhelmed whole forests, filled up entire valleys, buried rivers and small lakes, scored rock surfaces and transported sizable boulders many miles from their original sources. In short, the terrible world conflagration of universal tradition had begun.

The traditional recollections of this holocaust are frequently most graphic, and often contain interesting supplementary information about it. They show that nothing remotely resembling this conflagration has been experienced by present-day humanity. Even the severest modern volcanic outpourings or forest fires fall very short of what clearly took place then.

Nevertheless, as the following examples clearly indicate, even these disturbances furnish valuable insights into what must have happened on an immeasurably greater scale during Phaeton's visit.

Today, approximately 500 terrestrial volcanoes are considered to be active or dormant[82] (potentially active). The number of extinct cones, however, greatly exceeds this – and when one contemplates that many presently extinct volcanoes were active a mere thousand years ago, the rate of extinction, even if only approximately constant over the last 11,500 years, indicates that volcanic activity around that date was severe. Indeed, the volcanic record confirms this, for literally thousands of volcanoes were active during and immediately following Phaeton's visit (see table 5A). Little imagination is needed to visualise the colossal volume of 'hot' volcanic material – lava, mud, ashes, dust, gases, steam, smoke, *etc* – ejected then. The following modern reports and observations clearly reveal that it cannot have been otherwise.

Observations of geologically recent vulcanism encountered in Mato Grosso, Brazil, by Savage-Landor in 1912 concerned volcanic lapilli (stone fragments), ashes and cinders which had buried whole valleys. Large portions of sizable hills had blown up or collapsed. Huge subterranean volcanic cauldrons and gigantic wall-like volcanic dykes were encountered. Blue, black and red baked rocks abounded. Craters of every size were seen. Great expanses of pulverised and carbonated rock were traversed and observations made of extensive beds of cinders and ashes up to 40ft (12m) deep. Numerous large fissures and cracks, very significantly aligned north-west to south-east, had riven surface strata throughout the region[83]. Near the Capim Branco basin, gigantic solidified 'waves' of once molten lava were found. They had formerly been flowing across the landscape as a vast fiery avalanche like, but infinitely greater than, known modern equivalents. One of the 'waves' had been arrested in mid-motion, its upper portion hanging like a magnified crest of a breaking sea wave[84].

Although the heat emitted by such vulcanism must have been indescribable, it still pales alongside that which must have accompanied the stupendous basaltic outpourings in the Deccan, huge areas of the Pacific floor, and the Columbia Plateau during 'late Pleistocene' times. The temperature of a fire fountain (like that in fig 5.10) repeatedly measured on December 5th 1959 in Hawaii was consistently above 2050°F (1120°C), and actually reached 2200°F (1200°C) on one occasion[85]. The largest fire fountains, incidentally, have been known to spurt upwards by as much as 1,000ft (308m)[86]. Fire fountains having similar temperatures must have been common in these gigantic volcanic eruptions of the past.

Like many of their modern analogues, these outpourings almost certainly occurred with devastating violence and rapidity. Lava ejected by Mauna Loa on Hawaii in 1855, for instance, moved at over 40mph (64kph), while, during the eruption of the Japanese volcano Bandai in 1888, one of its four peaks was blown off and almost three billion tonnes of material were hurled skywards within just a few minutes. Many of the 'late Pleistocene' volcanoes must have acted with similar speed and violence.

Even in modern eruptions, the volume of ejected matter is frequently immense. In December 1959, for example, the volcano Kilauea Iki on Hawaii at first spewed out lava at the enormous rate of 470,000 cubic yards ($357{,}200m^2$) per hour, later increasing this to 1,400,000 cu yds ($1{,}064{,}000m^3$) per hour[87]. A still higher *hourly* rate – 5,000,000 cu yds ($3{,}800{,}000m^3$), or approximately 2,500,000 tonnes – was attained by the volcano Mauna Loa in 1887[88].

Most popular and general scientific surveys of vulcanism refer to the tremendous volcanic explosions of Krakatau in August 1883 and Mt Pelée in May 1902, while in our own day accounts of the huge eruption of Mt St Helens in May 1980 have been published at all levels. These three events – of which the first two are classics – have furnished abundant data about important subsidiary phenomena respecting rock striations and huge displaced boulders. Fuller consideration of these is therefore especially instructive.

Krakatau is a small volcanic island in the Sunda Strait separating Java and Sumatra which, on August 26th 1883, erupted so loudly that it was audible 150 miles (240km) away. The whole night long Krakatau belched thick black smoke which, rent by *continuous lightning flashes*, eventually soared to a height of 87,750ft (27,000m).

At approximately 10.00am the following day, however, there occurred the most violent natural disaster of modern times. Krakatau literally exploded with a thunderous roar which was heard in Ceylon (Sri Lanka), the Philippines and Japan, over 3,000 miles (4,000km) away. Masses of rock measuring 5,200ft (1,600m) were flung as far distant as 100 miles (160km), and its shock waves were registered by barographs all over the world. A tidal wave 32.5ft (10m) high rushed out from the island at the incredible speed of 350mph (560kph) in all directions, reaching a height of 120ft (36m). It swamped Javanese and Sumatran settlements, in a matter of minutes completely demolishing 295 towns and villages, and partially devastating 132 others. At least 5,000 ships and boats were wrecked, or carried, toy-like, far inland. Acting in unison, blast and tidal wave killed some 36,000 people and numberless animals and plants almost instantly, while many others were badly injured. The wave itself was distinctly felt at places as distant as Port Elizabeth in South Africa and, as an abnormal swell, in the English Channel[89].

Enormous quantities of ejected ash and dust were blown far and wide. Regions up to 275 miles (440km) away were plunged into *total* darkness: 130 miles (208km) away the darkness continued unnaturally for 24 hours, and 50 miles (80km) away for as long as 57 hours. In the immediate neighbourhood of Krakatau it persisted for three days and was so thick that nobody could see their hand before their face[90]. 'Collapsed Sky' conditions had been produced. Dust from the explosion actually fell on ships 1,600 miles (2,560km) away, and for years remained suspended in the upper atmosphere causing spectacular sunsets. Pumice (light bubbly volcanic rock) thickly covered the sea all round Krakatau, and ships visiting the area shortly afterwards reported how they had to plough their way

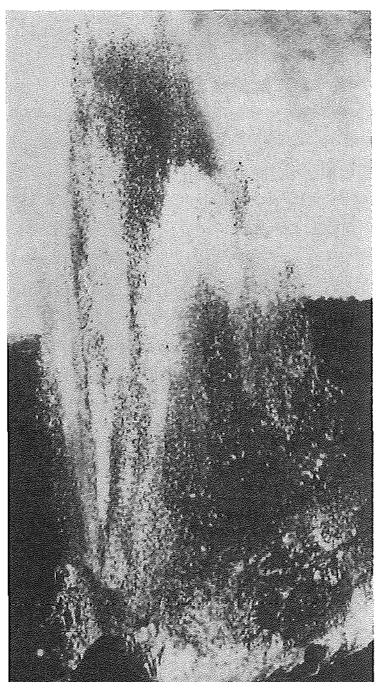


Fig 5.10. A fire-fountain.

through 10ft (3m) thick layers of it. Innumerable tree trunks and animal and human corpses were embedded in it – a dismal and sobering sight[91].

It has been estimated that the main Krakatau explosion released energy in the order of 7.2×10^{22} ergs (72 followed by 21 zeros), which is equivalent to that produced by an atom bomb of about 1.8 megatons[92].

Hardly less traumatic, and in some ways worse, was the appalling volcanic cataclysm involving Mt Pelée at the north tip of the island of Martinique, on Thursday 8th May 1902. Shortly before 8.00am that day, when 28,000 inhabitants of Saint Pierre nestling at the foot of Mt Pelée's southern slope were just starting another day, and the harbour of this coastal town was full of shipping, Mt Pelée erupted with incredible violence. Initially, only minor explosions shook the volcano, which threw mud and rocks about and rained heavy ash falls over the surrounding countryside[93]. Later repeated blasts of gas and superheated steam shot with frightful intensity through fissures in the volcano's flanks:

> ...carrying with them vast quantities of glowing ash and blocks. So voluminous were these ejecta that they fell at once on the adjacent slopes, then raced down the mountain sides at hurricane speeds. Some of these glowing avalanches were observed to move at rates of more than 100 miles an hour. One overwhelmed the town of Saint Pierre *in an instant*, killing all but one of its 28,000 inhabitants.[94] (Our italics).

The lone survivor was a prisoner in a local jail! Almost everyone aboard the vessels in the harbour was similarly annihilated *in a flash*[95], a mere 25 (out of a crew of 68) surviving on the steamer *Roraima*. Their collected depositions revealed that Mt Pelée had blown to pieces soon after 7.45am. One side of the volcano had been ripped out completely, and a solid wall of flame had hurtled out at horrifying speed with a noise compared to thousands of simultaneously discharging cannon. A veritable fire-hurricane, it careered down the mountain and across Saint Pierre and its harbour. Saint Pierre was destroyed in an instant, leaving it singularly like the incinerated cities of Nagasaki and Hiroshima in World War II (fig 5.11). On reaching the harbour, the fire-wave caused the sea to boil and seethe and send up vast clouds of steam, as coincidentally it burnt off masts and funnels of anchored ships. Indeed, *Roraima*'s masts and smokestack looked as though they had been "cut by a knife"[96].

Other recorded effects included the ejection of huge blocks of andesitic lava – some 15ft (4.6m) long[97], and one 30x24x22ft (9x7x7m)[98] – flung as far as Sèche-Blanche plateau 3 miles (4.8km) distant. Elsewhere, a bluff near Mt Pelée exhibited surface striations caused by sand-blast action which were practically indistinguishable from so-called 'glacial' striae[99], while at Grande Rivière an extensive boulder-field formed by high speed mud-torrents was found. Alleged glacial boulder-fields are often very similar (figs 5.12, 5.13), while, as we have seen, mud-slides sometimes produce rock striations[100] as well as transporting large rocks appreciable distances[101].

Medical examination of the grotesque injuries on the dead were also instructive:

> In many instances the actual cause of death probably was the inhaling of the very hot gas. The bodies were intensely burned, as also were those of the survivors. Many were stripped of clothing by the force of the blast; but others remained clothed and the clothing was not ignited, even though the body beneath it was severely burned. Body tissue was distended, and in many instances skull sutures had been opened up. The injuries were such as would result from sudden heat intense enough to turn water in human tissue into steam, but not high enough or of long enough duration to raise fabrics to kindling temperature.[102].

Though grisly, these details instantly recall the state of some of the animal remains excavated from several of the aforementioned bone-caves, and the Zuni legend describing how, at the time of Phaeton's visit, searing blasts heated the blood of huddling animals to the point where it gushed out of their bodies. Coincidences?

Just one day earlier, La Soufrière on the island of St Vincent had also erupted. While not as devastating as the Martinique explosion, that of La Soufrière was nevertheless violent and cataclysmic. It included a tremendous volcanic blast which felled and debarked numberless trees, and a rain of ashes so immense that it filled a local gorge to a depth of 200ft (61.5m). Sand-blasted trees, resembling some found in 'drift' gravels elsewhere, were among its other victims[103].

When Mt Pelée erupted again between 1929 and 1932, geological teams rushed to Martinique to study how some of the scientifically unobserved 1902 effects had been achieved. Interesting discoveries resulted. Enormous lava boulders were found 3 miles (5km) from the main crater, not flung there by blast or transported by mud-torrents, but carried aerially by *nuées ardentes* – gas-charged vapour emitted explosively from the volcano. Perret described the process as follows:

> At the moment of explosion liquid masses of lava, instead of being hurled high into the air to form bombs, are converted more or less completely into ash by the rapid discharge of gas, and with the ash are carried along ejectamenta of all sizes: blocks, boulders... highly heated but not fused. Of such materials are the *nuées ardentes* composed, and no matter how heterogeneous in size they may be, all are derived from the same mass of lava... The vapour density about the separate particles is so great that blocks and boulders... are buoyed up and carried forward like corks.[104].

The force and velocity of these *nuées ardentes* were frequently so great that, not only did they carbonise trees, but underlying rock surfaces were scarified (incised or stripped) and striated very much in the manner of alleged glacial action. Such effects were noticed at several places, especially at the base of Morne Lénard near Mt Pelée. The close similarities between striations of volcanic and supposed glacial origin was noticed as long ago as 1909, when it was established that, given sufficient power and speed, grit-charged volcanic steam could

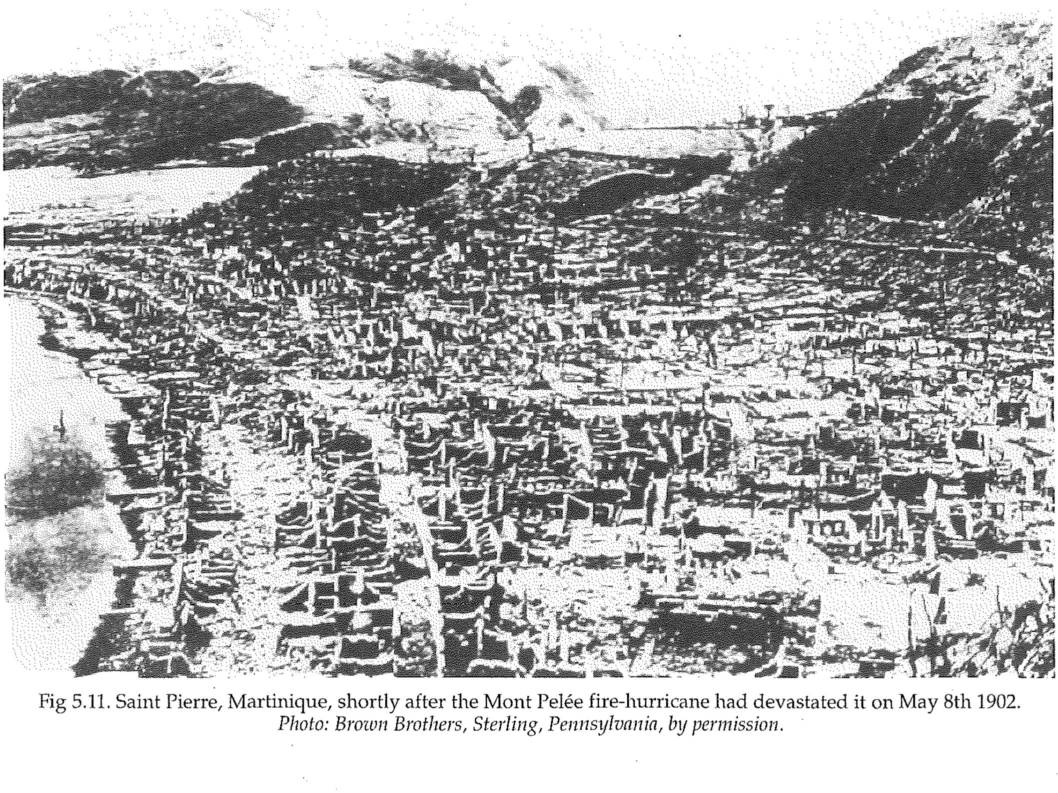


Fig 5.11. Saint Pierre, Martinique, shortly after the Mont Pelée fire-hurricane had devastated it on May 8th 1902.
Photo: Brown Brothers, Sterling, Pennsylvania, by permission.

quickly excavate U-shaped valleys in *solid* rock. One such valley was cut by this process during the 1902 eruption of Mt Pelée[105].

On December 4th 1951, Hibokhibok volcano in the Philippines duplicated Mt Pelée's 1902 performance on a somewhat smaller but still catastrophic scale. A mighty explosion released a gigantic avalanche of red-hot lava enveloped in "writhing clouds of stifling gas and hot dust" which:

> ...swept silently and lethally over the villages just north of Mambajao and, in a few moments, took the lives of 500 persons. Houses were burned and bodies of persons and animals were charred and mummified. The blast accompanying the avalanche knocked down trees and aligned them parallel to the direction of movement of the avalanche. Three miles from the summit of the mountain the force of the blast was sufficient to wrap the *trunk* of a coconut tree 5in in diameter in the form of a U around the trunk of a big mango tree.[106] (Our italics).

The extraordinary effects of directed volcanic blast have also been noticed in Russia, particularly in connection with the eruption of Mt Shiveluch[107].

The recent Mt St Helens eruption provided further evidence of the near-instant devastation possible by just one large volcanic outburst. Exhaustively published elsewhere[108], the details need not be repeated here, although reference should certainly be made to the vast number of trees felled by incredibly powerful fast-moving blast clouds, and to the huge pyroclastic ash and mud-torrents enveloping enormous log jams "...that resemble those deposited by water". The resultant deposits with their woody contents are reminiscent of the Alaskan 'muck' beds and the Siberian 'wood hills' which contain trees like those carbonised by Mt Pelée.

These modern examples of vulcanism demonstrate that many, if not all, of the agents capable of causing phenomena supposedly typical of the alleged 'Pleistocene' glaciations are to be found in them. Superheated high-pressure steam and sand blasts, *nuées ardentes*

Fig 5.12. Alleged moraine at Bear-den, Maine. The size of the boulders is indicated by the human figure in the middle distance. This boulder field is essentially identical to those formed by flash-floods and mud-torrents. *By permission of the Geological Society of America, Bulletin, vol 11, 1900, and R S L, Oxford.*

and mud-torrents causing rock striations; mud-slides forming extensive boulder-fields; *nuées ardentes* and mud-flows transporting giant rocks long distances; high-velocity grit-charged steam carving out whole valleys; and fire-waves incinerating and debarking numberless trees, as in Alaska and Arctic Siberia. This, of course, does not imply that vulcanism was exclusively responsible for all the alleged 'Pleistocene' glacial effects.

Unquestionably various other agents also contributed to their generation. Nonetheless, considering the extent and severity of vulcanism at the end of so-called 'Pleistocene' times, and the apparent absence then of large scale ice action globally, it is more than probable that at least some alleged 'glacial' effects were due to volcanic agencies.

Numerous independent tribal recollections of a frightful world holocaust traditionally attributed to one or more cosmic agents were marshalled in Part Three. Very significantly, these memories are entirely consistent with the type of scenario which the volcanic and Earth fracture evidence just reviewed unmistakably suggests. Many accounts provide exceptionably graphic descriptions of a raging inferno. In the North American Wintun legend, for example, the hero, *Olelbis*, allegedly:

> ...looked down into the burning world. He could see nothing but waves of flame; rocks were burning, the ground was burning, everything was burning. Great rolls and piles of smoke were rising; fire flew up towards the sky in flames, in great sparks and brands... The great fire was blazing, roaring all over the earth, burning rocks, trees, people, burning everything...[109].

The Mbocobi tribe of South America recall that when the Sun once fell down from the sky it set the world alight in a "deluge of fire"[110]. The Norse *Voluspa* recounts how the cosmic assailant *Surt*: "...comes from the south with ...fire". In the stanza which describes earth sinking into the sea, it is said that "steam rages... fire shoots high to heaven itself..."[111].

Surt, who, with the Midgård Serpent and the Fenris-Wolf, figures prominently in the *Ragnarök* epic:

> ...remains (in the sky) to the last, to fling fire over the whole world, so that the race of men perishes with the gods, and all are finally engulfed in the overwhelming sea; the Sun becomes dark, Earth sinks in the sea, the shining stars slip out of the sky. Vapour and fire rage fiercely together, till the leaping flame licks heaven itself.[112].

Ovid, in his account of Phaeton's flight close to Earth, tells how Phaeton "...beholds the world set on fire *on all sides*..."[113] (our italics) and how, at that time, all the great rivers of the world either dried up or were turned to steam. The Washo Indians of California recollect a tremendous terrestrial convulsion which up-heaved whole mountain ranges in blazing fire, the flames rising to such heights that "...the stars of heaven melted and fell upon the Earth. Then the sierras rose up from the plain..."[114].

Closely similar events are mentioned in the Old German Apocalypse, the *Muspilli*, in its account of the reputed conflict between Elijah and Satan (Phaeton):

> ...the mountains begin to belch forth fire, no tree remains unscathed upon the land, the waters dry up, the sea disappears, the heavens begin to burn in a dull flame, the Moon falls, the Earth is on fire, no stone remains upon another.[115].

These are not simply memories of unusually severe vulcanism, although volcanic eruptions are featured, but accounts of infinitely worse conditions: occasions when yawning chasms in a fractured and dislocated lithosphere permitted stupendous volumes of molten magma to well up and overspread adjacent landscapes; when great portions of the Earth's crust buckled and folded amid fountains of fire and superheated steam as new mountain ranges were up-heaved and existing ones elevated still higher; and when other portions collapsed and fell away into fiery cauldrons of prodigious size. Accompanying such hellish events, fire, lava, cinders, ashes and gases shot skywards to immense heights in repeated explosions of unimaginable ferocity, transcending even those of Krakatau and Tambora. Many eruptions would have given the impression of reaching 'heaven itself'.

These recollections also plainly state that the entire world, not just some particular region, caught fire: "everything was burning", "fire on all sides", "roaring all over the earth", and so on. A universal conflagration, however, is precisely what would have occurred if the terrestrial crust was extensively fractured and buckled by an irresistible force; and only an external force could have achieved such disruption.

Still closer consideration of the thermal aspect of this disaster indicates the operation of yet another highly destructive agent – wind of super hurricane force. It was a major element in this appalling Fire-storm, and must now claim our attention.

6
HURRICANE

Inevitably, tremendous winds generated by the various factors discussed previously blew with mind-boggling force and velocity over much of the world. Even the worst modern typhoons, cyclones, hurricanes and tornadoes pale alongside the winds that must have been unleashed then. Their destructive power almost surpasses comprehension, and today they have no direct parallels. It is not, however, difficult to appreciate their effect upon the worldwide fires we have just been considering.

Here, we survey some of the yet extant data – physical and traditional – apparently relating to the former reality of these winds, and attempt to assess their significance during the Phaeton disaster.

We begin by recalling the remarkable accumulation of diverse avian species (birds) entombed in 'late Pleistocene' deposits in California, and the equally heterogeneous mass of plant and animal remains in the similarly-aged lignite beds at Geiseltal in Germany. These assemblages can only have been congregated at these places by furious winds or wildly surging water, or by both those agents acting in unison.

The destructive capacity of continuous winds has long been known, those laden with dust or grit being especially acute. Concerning the effects of sand-charged winds, Dana once remarked:

> The sands carried by winds when passing over rocks sometimes *wear them smooth*, or cover them with *scratches and furrows*, as observed by W P Blake on granite rocks at the Pass of San Bernardino, in California... Limestone was so much worn as to *look as if* the surface had been *removed by solution*. Similar effects have been observed by Winchell in the Grand Traverse region of Michigan...[116] (Our italics).

Almost all observers of 'drift' – that singular formation considered at length in Part One – have commented on its generally unstratified and chaotic appearance. Geikie spoke of it as having a "confused and tumultuous" appearance[117], adding that the intercalated beds in it:

> ...are twisted, bent, crumpled and confused *often in the wildest manner*. Layers of clay, sand and gravel... are puckered into folds and sharply curved into vertical positions. The intercalated beds are everywhere cut through by the overlying 'till', and... in the mass of the 'till' itself fossils sometimes, but very rarely, occur, and fragments of wood have from time to time been discov-

> ered. They almost invariably afford marks of having been subjected to the same action as the stones and bowlders by which they are surrounded.[118] (Our italics).

Only an agency operating indiscriminately and universally, or a combination of such agents acting coincidentally, could have produced results of this kind. Indeed, it was, as Dana once stated, a process which deposited the 'drift' "pell-mell"[119]. Its distribution is also peculiar, for, speaking of that portion of it known as 'boulder clay', another authority described how:

> The true bowlder-clay is spread out over the region... as a somewhat widely extended but uniform sheet, yet it may be said to fill up small valleys and depressions, and to be thin or absent on ridges or rising ground.[120]

This singular distribution is comparable to snow accumulations driven by high winds.

Many have admitted that the 'drift' was deposited under violent conditions which affected vast areas simultaneously[121]. Others, like Figuier[122], have recognised that the event was sudden and somehow connected with a change in the inclination of the Earth's axis[123] – by now an all too familiar theme. This violence of deposition, and its apparent similarity of operation over huge regions, not only explains the unstratified and tumultuous appearance of much of the 'drift', but is in direct contrast to the slow, if inexorable, action of ice to which its origin is usually ascribed. All-embracing agents capable of acting violently and suddenly are required to account for the observable phenomena. Only water and wind possess those capacities.

The 'boulder clay' was almost certainly viscous when first deposited. Prior to attaining that consistency, however, it had existed on the original land surface as sand and soil particles which, from the earliest stages of the catastrophe onwards, were frequently disturbed by lightning strikes and heavily augmented by prodigious falls of volcanic ash and dust produced by the ever-increasing vulcanism. Super-cyclonic winds subsequently whirled up all this material from the pre-catastrophic landscape, depositing it as a great dusty mantle over hill and dale alike. Shortly afterwards it was converted into a great muddy paste by the Deluge waters which redistributed it tumultuously where we now find it. As we shall soon see, the Deluge was not long in materialising and apparently commenced its activities well before the super-winds were eventually dissipated. It was the combination of water and wind which bodily moved the 'drift' across the convulsed landscape. That much of the 'drift' was deposited in this manner is indicated by the presence in it, in many places, of upright tree stumps with their roots still firmly embedded in the original soils underlying the 'drift'. These stumps protrude upwards into the basal layers of the 'drift'. Had ice deposited the 'drift', then these stumps would have been obliterated. They were not.

Thus, terrible winds, whistling round the world, swept up masses of loose surface material and fanned the conflagration already in progress as the result of plate tectonics and rampant vulcanism engendered by the rotational and axial changes. The results were horrendous.

It is scarcely surprising, therefore, that descriptions of these stupendous winds feature in the ancient recollections of almost every nation of consequence. It was a wind without parallel – and, because it occurred at the time of the cosmic assailant Phaeton, was accorded a cosmic origin. This notion of a 'cosmic' wind is reiterated again and again in the Persian *Avesta*[124], in the Hindu *Vedas*, in the Babylonian *Talmud*, and by many authors of antiquity. It was also known as the *'diluvium venti'* – the deluge of wind[125] – and was expressly attributed by the ancient Mesopotamians to Marduk (Phaeton) which is said to have:

> ...created the evil wind, and the tempest, and the hurricane, and the fourfold wind, and the sevenfold wind, and the whirlwind, and the wind which has no equal.[126].

In the Gilgamesh epic the duration of the wind is given as : "...six days and a night... the hurricane, deluge and tempest continued sweeping the land"[127]. The wind is described as a whirlwind or cyclone of unimaginable ferocity. We are told that: "The whirlwind of *Adad* swept up to heaven"[128], and was so awesome that even "The gods were terrified at the cyclone"[129].

Rabbinical records provide essentially the same information. They assert that the wind endured unabated for seven days and that it was accompanied by a darkness so intense that people did not stir from their homes and refuges during that period[130].

The pre-Columbian Maya records describe how these frightful winds demolished all towns, swept away whole forests, moved great rocks, and blew away entire hills[131], the latter, no doubt, being sand-hills or earthy mounds. The winds were regarded as the wrath of the Mayan god *Hurakan*, whose name, later corrupted to 'hurricane', was ever afterwards associated with winds of exceptional force and prolonged violence.

The Mayan claim that this super-cyclone moved giant rocks is, somewhat surprisingly, consistent with fact. Fig 5.14 shows one such rock which was *thrown up* a cliff about 39ft (12m) high and *carried* inland a further 97ft (30m), before being *turned upside down* by a hurricane which recently visited the east coast of Barbados[132]. Many further similar modern instances are known. Certainly large rocks can be, and are, moved by exceptional winds. Those comprising the *'diluvium venti'* were more than exceptional.

Maori traditions connect this dreadful aeolian derangement with a gigantic cataclysm which permanently submerged an ancestral Pacific homeland. These describe them as: "...the mighty winds, the fierce squalls, the clouds, dense, dark, fiery, wildly drifting, wildly bursting"[133], which swept away vast forests and lashed the ocean waters into mountain-high waves.

It scarcely needs emphasising that this *'diluvium venti'* created a tremendous din. Many traditions expressly refer to the appalling racket accompanying the Con-

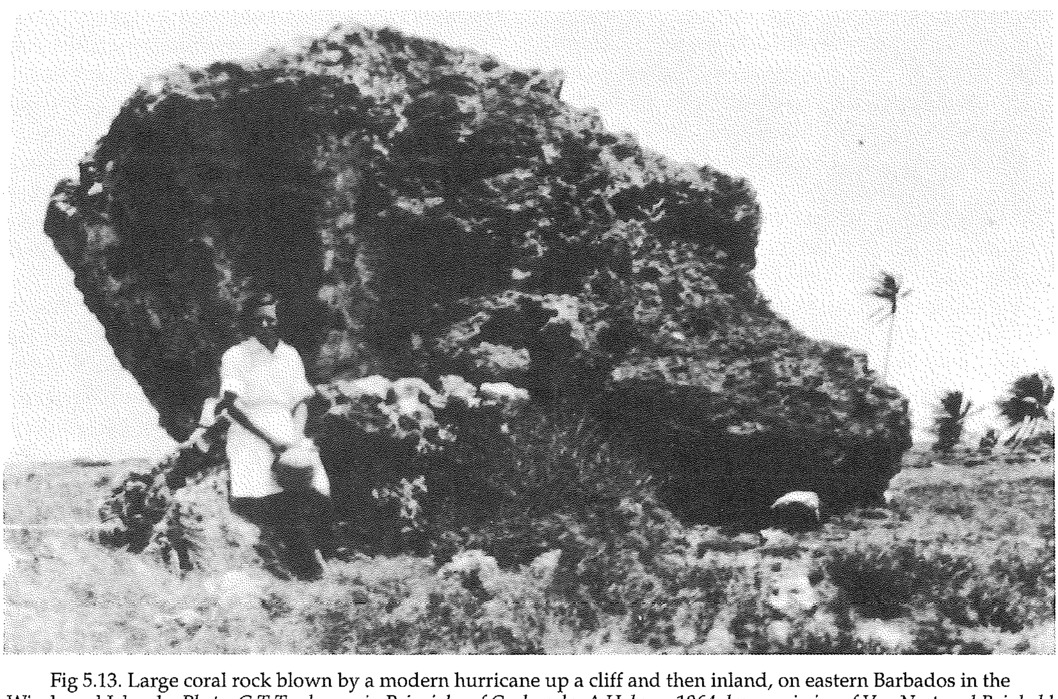


Fig 5.13. Large coral rock blown by a modern hurricane up a cliff and then inland, on eastern Barbados in the Windward Islands. *Photo: C T Trechman, in Principles of Geology by A Holmes, 1964, by permission of Van Nostrand Reinhold (UK) and R S L, Oxford.*

flagration and the Deluge. Much of it was caused by these winds. Interestingly, the native North Americans link the winds and the noise they made with a celestial monster (Phaeton) which passed across the heavens near Earth, with:

> ...a whistle in his mouth; as he moved forward he blew with all his might, and made a terrible noise... He came flowing and blowing; he looked like an enormous bat with wings spread.[134].

Marduk, which allegedly unleashed an 'evil wind' and 'fierce storm winds' to destroy Tiamat (see Part Four), evidently repeated the process when, in its guise as Phaeton, it confronted Earth at the time of the Noachian Deluge.

The absolute power of concentrated wind is often not sufficiently comprehended, especially in regions normally not experiencing it. It is, however, devastating. At Salt Creek, Iowa, for example, hurricane force winds on June 12th 1881 lifted cattle high into the air and flung them violently back onto the ground, killing them outright. Leaves on adjacent vegetation were withered as "by the heat of a fire". Simultaneously, stands of timber in Nevada were flattened and tree trunks hurled 500ft (153m) away, while a heavy goods train was blown off a nearby railroad track[135].

Regarding the unfortunate cattle of Salt Creek, one can appreciate how animals similarly exterminated during Phaeton's visit might be buried whole, their constituent bones broken or fractured internally but held in place by muscles, sinews and flesh externally; and how modern finds in 'drift' deposits of such bones with all the fragments still in relative position (but with the formerly surrounding flesh and soft tissues decayed away) perplex those still adhering to conventional 'Ice Age' concepts. In Part Two many such finds were noted, clearly indicating that whole animals had been interred coincidentally with the deposition of the 'drift'. Moreover, in view of the previously suggested aeolian involvement in the tumultuous deposition of the 'drift', it is not surprising that organic remains found in it were apparently subjected to the same action as the deposits enveloping them[136].

The Maori reference to 'fiery' winds seemingly alludes, at least in part, to airborne billows of ignited gases and a general fanning of the tremendous conflagration already raging then across much of the world. As we shall now see, it is a detail consistent with what must have happened at numerous localities.

Such huge fires – which at their height may have attained sub-continental extent – would themselves have created acute fire-storm conditions by sucking in air from surrounding regions on a retort basis. This is a well known aspect of particularly severe fires, and has been documented in connection with prairie fires, volcanic eruptions and giant fires in cities. A brief look at some of these provides telling glimpses of what occurred on Earth immediately before the onset of the Deluge.

Wind rushing in from all sides to fan 200ft (61.5m) high flames generated during a field fire at Stockbridge, Massachusetts, in 1783, were strong enough to lift large cut trees 50–60ft (15–18m) *above* the ground[137]. Other similar cases are known.

The bombing in World War II of Hamburg, Germany, on the night of July 27th 1943, led to an appalling fire-storm which raged on into the next day. Three years later exhaustive investigations pieced together the tragedy. Very dry weather conditions had preceded the bombing, and contributed greatly to the 'success' of the fire. The exceptional number of bombs dropped upon the city started so many fires simultaneously that a column of heated air, 11 miles (2.4km) in diameter and 21 miles (4km) high, formed above the centre of the fire[138]. Temperatures inside this fire area reached 800°C[139]. The water in the canals and port of Hamburg heated to the point where they were "hardly bearable"[140]. These details are strongly reminiscent of what occurred during Mt Pelée's 1902 destruction of Saint Pierre, when the fire-wave had melted glass (650–700°C) but not copper (1,058°C) and the harbour waters had boiled and steamed[141].

The Hamburg fires produced air turbulence fed by ground surface winds in-rushing from surrounding districts to replace those drawn up by the rising column of heated air. One and a half miles (2.4km) from the central fire area wind speeds varied from 11–33mph (18–53kph), whereas near the centre they reached typhoon strength, uprooted trees of all sizes and blew people off their feet. At first, the typhoon "...moved into the direction of the fires, later spreading in all directions"[142]. People perished not so much from exploding bombs or actual incineration but from the rapid loss or contamination of the atmosphere. Heat stroke, suffocation due to a lack of oxygen, carbon monoxide poisoning and inhalation of dust were among the causes established[143]. Unquestionably wind played the most critical role in this tragedy and, as the principal cause of atmospheric derangement and pollution, increased the final death toll far beyond that which could have been initially anticipated.

Almost precisely similar circumstances attended the even worse fire-storm that destroyed Chicago in 1871. Its horrors were carefully chronicled by Sheahan and Upton in their classic account of the event published within weeks of the calamity[144]. Although grim, their text sheds considerable light on the kind of fiery phenomena generated by Phaeton's visit. Tornado strength winds fanned the fire so fiercely that iron, granite, bricks and glass were melted and fused together in grotesque conglomerates, as if all had passed through a blast-furnace. Athens marble, which had been used to adorn certain city edifices, burned like common fuel[145]. The fire also doubled on its track at the Great Union Depot, and burned half a mile southward in the very teeth of the gale – a gale which blew a perfect tornado[146]. Another notable feature of this fire was its cleansing capacity:

> The most striking peculiarity of the fire was its intense heat. Nothing exposed to it escaped. Amid the hundreds of acres left bare there is not one to be found with a piece of wood of any description, and, unlike most fires, it left nothing half burned... The fire swept the streets of all the ordinary dust and rubbish, consuming it instantly.[147].

Sufficient data has been presented to show the devastating role of concentrated wind when combined with fire. On its own, fire is bad enough, and if winds are light or non-existent it can be contained. Accompanied by strong or gale force winds, however, fire becomes uncontrollable. It becomes rampant – wind exacerbates it. And when it attains the fury of a fire-storm, performs a remarkable cleansing role.

At this late date we can merely try to imagine what the great Conflagration of Phaeton's day must have been like. The mind almost refuses to accommodate all the interrelated relevant factors, while the sheer scale of it encourages the mind to recoil from a picture so terrifying as to be numbing. Frightful though they were, the Mt Pelée fire-wave, the Hamburg fire-storm, and the great Chicago fire were miniature events when compared with Phaeton's Conflagration. Whole continents were on fire with flames that we are told "reached to heaven". Certainly it was the worst holocaust ever experienced by humankind. And winds of staggering force and power were a part of it, just as they seem to have been during the Deluge which, following hard on the heels of the Conflagration, extinguished it.

7
BOMBARDMENT

It is surprising to discover on the gentle terrain of the Atlantic Coastal Plain, with no concealing cover or topography, one of the Earth's most immense, spectacular and intriguing topographical phenomena. Seen from the air the Carolina bays are an astounding, unforgettable revelation. But though hundreds of thousands lie clearly visible, scattered across the Atlantic Coastal Plain from Maryland into northern Florida, they are often all but unrecognisable to the uninitiated eyes of groundlings.[148].

So wrote Henry Savage jr in his recent study of these extraordinary ground features which, although most abundant near or along the Atlantic coast, also occur far inland[149]. They almost certainly occur, too, as submerged structures on the adjacent Atlantic continental shelf. The term 'Carolina Bays' is thus a misnomer: they are not bays and extend far beyond Carolina. First mentioned in 1847, when comparatively few were noted[150], the true distribution of these shallow crater-like depressions was not appreciated until the 1930s following the advent of aerial photography. Today about half a million 'bays', both complete and vestigial, have been recorded. Of these: "...140,000 are large-to-medium sized, having lengths of more than 500ft"[151]. Their shapes are also particularly intriguing, for:

> ...Although most bays approximate an elliptical shape, they vary greatly in ellipticity. Generally, the smaller the bay the more nearly round it becomes. Although there are numerous bays that are almost perfect ellipses, the variations from that geometrical perfection are many and diverse. Often bays are asymmetrical, their north-east sides being significantly more curved than their south-west sides... More frequent variations from elliptical perfection are the ovate bays. These egg-shaped bays likewise vary greatly among themselves, running the gamut from extremely elongated ones to some almost circular in shape. Among the ovate bays marked geographical correlations have been observed. As one moves south-westwardly from the South Carolina-North Carolina border bays tend to become increasingly ovate in shape. A similar tendency appears as one moves west across the coastal plain.[152]

Respecting their sizes and distribution:

> ...There are some immense bays such as Big Swamp Bay... in central South Carolina, nearly four miles long. In striking contrast some of its tiny neighbours are only three or four hundred feet long... Very large bays occur mostly in the area of bay concentration in south-east North Carolina and north-east South Carolina. They become markedly less frequent the farther they are from that region. So too does the rate of bay occurrence diminish, and when they do occur in the most distant areas they usually appear in groups widely separated from other groups.[153]

Although like several other authors Velikovsky boldly stated that: "...A remarkable feature of these depressions is their parallelism: the long axis of each of them extends from north-west to south-east..."[154]. This comment actually applies to comparatively few 'bays', since, overall, their alignment varies considerably and does so systematically on a geographical basis. For example:

> Bays in the area of the border between the Carolinas display a generally north-

> west/south-east orientation. However, as one moves up the coast there is a tendency for bays to become more and more easterly in orientation, until in Maryland they approach an east-west direction. Likewise, as one moves down the coastal plain the 'bays' long axes tend to rotate in a clockwise direction, until those found in south Georgia generally display an almost north-south orientation. A similar effect can be observed as one moves from east to west.[155].

The significance of this important fact, which clearly relates to the cause of the formation of the 'bays', will be discussed later. Various explanations for the formation of these curious structures have been proposed down the years. The earliest advocated a combination of artesian springs and wind action[156]. Another argued that the 'bays' possibly evolved from drowned valleys blocked by sandbars when the coastal plain hosting them emerged from the sea[157], while a third postulated that they possibly resulted from a process of natural solution of sandy sediments[158]. Studies of the 'bays' in the Carolinas suggested to Melton[159] and others[160] that they probably represented ancient meteor scars dating from 'late Pleistocene' ('Ice Age') times[161].

Other explanations involved supposed gyroscopic eddy effects[162], air shock waves generated by aerially-exploding meteors[163], giant prehistoric fish spawning-beds[164], the action of dust devils[165] and stranded icebergs[166].

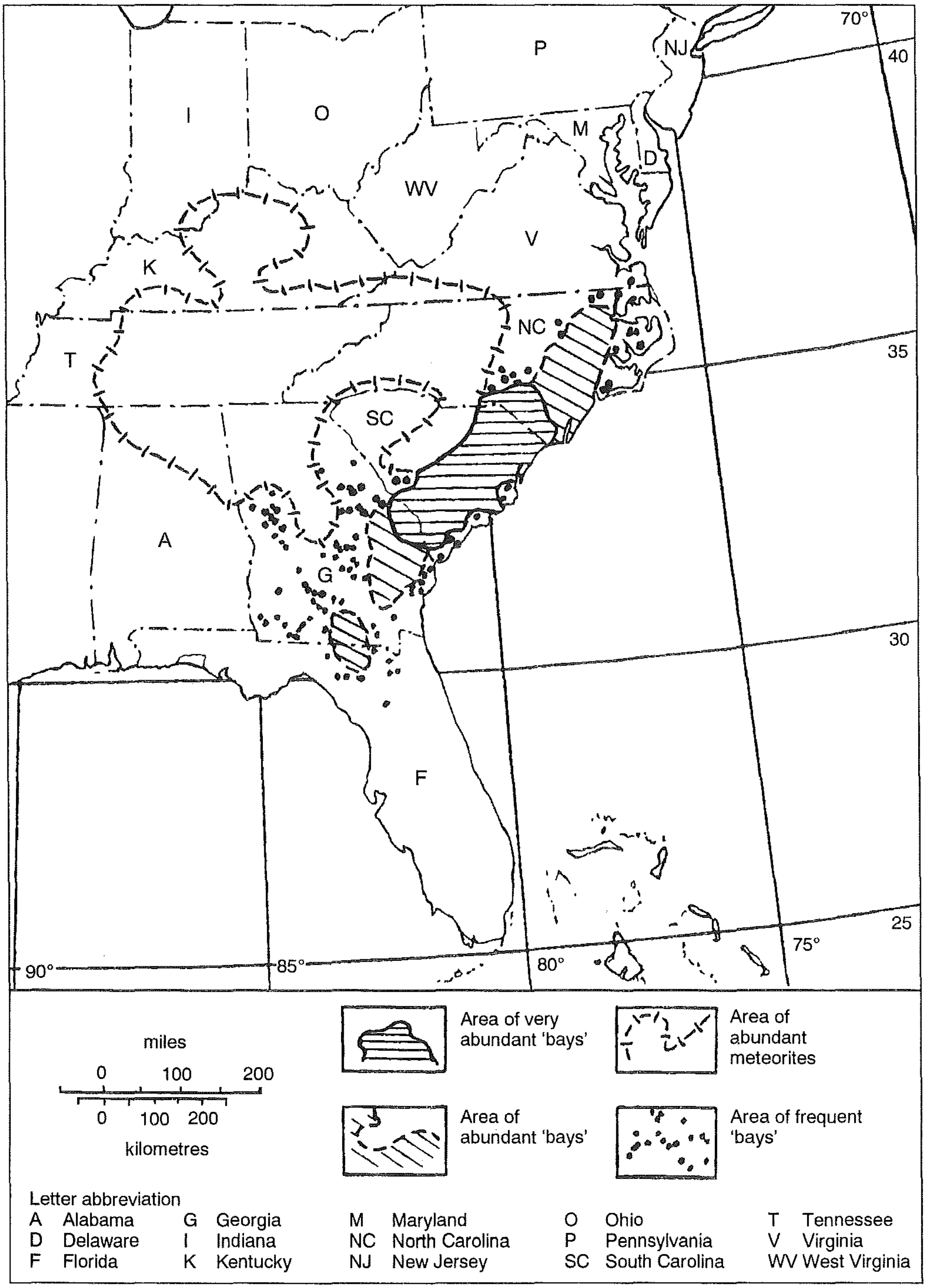
Another hypothesis[167] suggested that the 'bays' were made by a comet which crashed into the eastern United States long ago. We now know, of course, that even large comets apparently lack sufficient mass to cause crustal damage like that represented by the 'Carolina bays'. More feasible, however, was the suggestion that the 'bays' were of meteoric origin[168], especially as magnetometer studies of them in North Carolina hinted that buried meteoritic debris existed in association with those structures. Previously it had been noted that unusually high concentrations of meteorites existed inland from the main 'bays' area (map 5C), and in 1952 this was stressed as good evidence of such an origin[169].

Yet whatever the cause of the formation of the 'bays', it must have been extensive, sudden and violent. Not long ago, the high probability of this came to light in a lengthy farm drainage trench dug near Camden, South Carolina, which, at an average depth of 14ft (4.3m), exposed masses of prostrate trees at its base. Many were of large size and all indicated the former occurrence of a sudden "massive blow-down"[170]. If the 'bays' *are* low-level aerial blast effects, then, granted that the ancient landscape was well forested, the occurrence of calamitously-felled timber in their immediate vicinity could not only be expected but would be consistent with such an explanation.

Interestingly, Henry Savage jr, the latest investigator of these 'bays', has also advocated a celestial cause for their origin, placing that event at the *end* of the 'mammoth' age ('late Pleistocene' times in conventional chronology), an age which, we have already seen, terminated abruptly and violently everywhere during Phaeton's visit. If the conclusions of Savage and others like him are correct, then the Carolina 'bays' might very well represent yet further physical reminders of the Phaeton disaster.

The likelihood that numerous similar 'bays' lie submerged on the continental shelf east of the Carolinas has encouraged investigations of what may be an immense impact crater on the floor of the Atlantic near Bermuda. A collision between Earth and a gigantic meteor has been suggested as the origin of this drowned feature, described by Kelly and Dachaille as follows:

> This great undersea crater has a rim that stretches for hundreds of miles in a great circle beginning at a point north and east of Puerto Rico and curving past the Bahamas, the Carolina coast, and north and east along the Atlantic coast until it loses itself in the deep ocean off the New England coast. There is a very sudden break, almost a cliff, where the continental shelf (crater rim) breaks off into the deep ocean. The Bahama Islands form the south wall of this crater. They rise only a few feet above sea level but they form an undersea cliff that is nearly 700 miles long. Between the Great Bahama Bank and the islands of Cuba and



Map 5C. Areas of abundant meteorites and Carolina 'bays' in the eastern United States. *After Prouty, Johnson, Savage and other sources.*

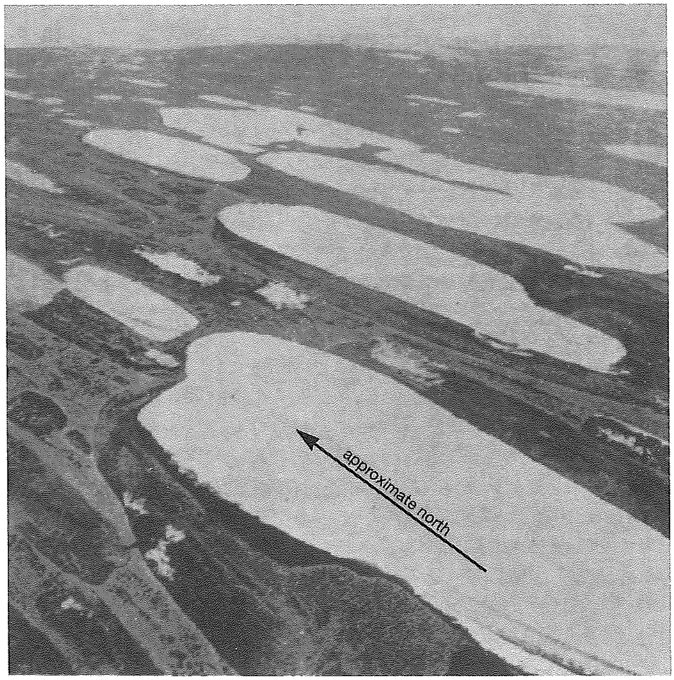


Fig 5.14. Aerial view of some of the oriented lakes near Point Barrow, Alaska. *With permission of the Univ of Chicago and R S L, Oxford.*

Haiti, there is a secondary channel that is nearly half as deep as the main crater basin. The islands of Cuba, Haiti and Puerto Rico are the mountains that form the remains of the outer crater rim, and the Brownson and Bartlett Deeps are the down-warped troughs that are common to many of the other great collision points that we shall mention later.

The floor of this great impact crater is also consistent with what might be expected. It slopes in every direction from the central peak (Bermuda) gradually growing deeper toward the rim, although it averages deeper on the south and south-west than it does on the north. It is somewhat ovoid in shape, being longer from north-east to south-west; the distance from Bermuda to Cape Hatteras being about 600 miles and from Bermuda to the Bahamas about 750 miles... The Bermuda central peak is surrounded on all sides by deep ocean, reaching a depth of 2,500 fathoms within a few miles from shore. From this point it gradually deepens outwardly in all directions for about 300 miles where it levels off and continues at about the same depth until it meets the sudden rise of the crater wall. This wall averages nearly 17,000ft and in places more than 18,000ft and this in a distance of no more than 15 or 20 miles. If one could remove the water and stand on the bottom of this crater one would look up at a mountain wall almost three times as high as the Grand Canyon is deep, and almost as steep. The deepest part of the crater lies at the end of the Bahama chain and athwart the Mona Passage between Haiti and Puerto Rico. This is the Brownson Deep which is 4,780 fathoms or 28,680ft. It is a comparatively narrow trench... and probably indicates a down-warping of the crust or an in-falling of molten magma at the time of the collision.[171].

As direct observations are inevitably limited, it is presently impossible to positively assert that the above structures do collectively represent an ancient impact crater. Nevertheless, the known physical evidence is decidedly thought-provoking, and it must be noteworthy that it is located eastward of the general area of the Carolina 'bays'. Furthermore, it would indeed be remarkable if entirely separate events, possibly spanning millions of years, contrived to place in such close geographical juxtaposition sets of major topographical features forming a seemingly natural west-to-east sequence – an area of prolific small meteorites progressing via abundant larger 'bays' to an immense crater-like structure – suggestive of one or more impacting cosmic bodies.

The Carolina 'bays', however, are not entirely unique. Similar concentrations of oriented shallow depressions ('lakes') exist on the Alaskan permafrost near Point Barrow – and, like their southern analogues, they are mostly aligned north-west to south-east. They also extend, or must have once extended, northwards across the floor of the Arctic Ocean.

Oval, elliptical, or greatly elongated in shape (no circular examples are known) they number many thousands and cover more than 25,000 sq miles (64,750km^2). In size, they range from 9 miles (14.4km) long and 3 miles (4.8km) wide to 1 mile (1.6km) or less long and 1 mile (0.8km) or less wide. Some are water-filled, but others are quite dry, the latter revealing that many depressions overlap upon one another and must have been created successively (see fig 5.15). Very interestingly, a 'late Pleistocene' or early Holocene date has been suggested for these features[172].

Early studies of these 'lakes' concluded that many, if not all of them, represented land surface 'cave-ins' resulting from the thawing of otherwise permanently frozen ground[173]. 'Caving', however, cannot produce extensive regional orientation or cause apparently newer 'lakes' to impinge on older (and presumably 'caved-in') 'lakes'. Only some aerial cause could produce such effects.

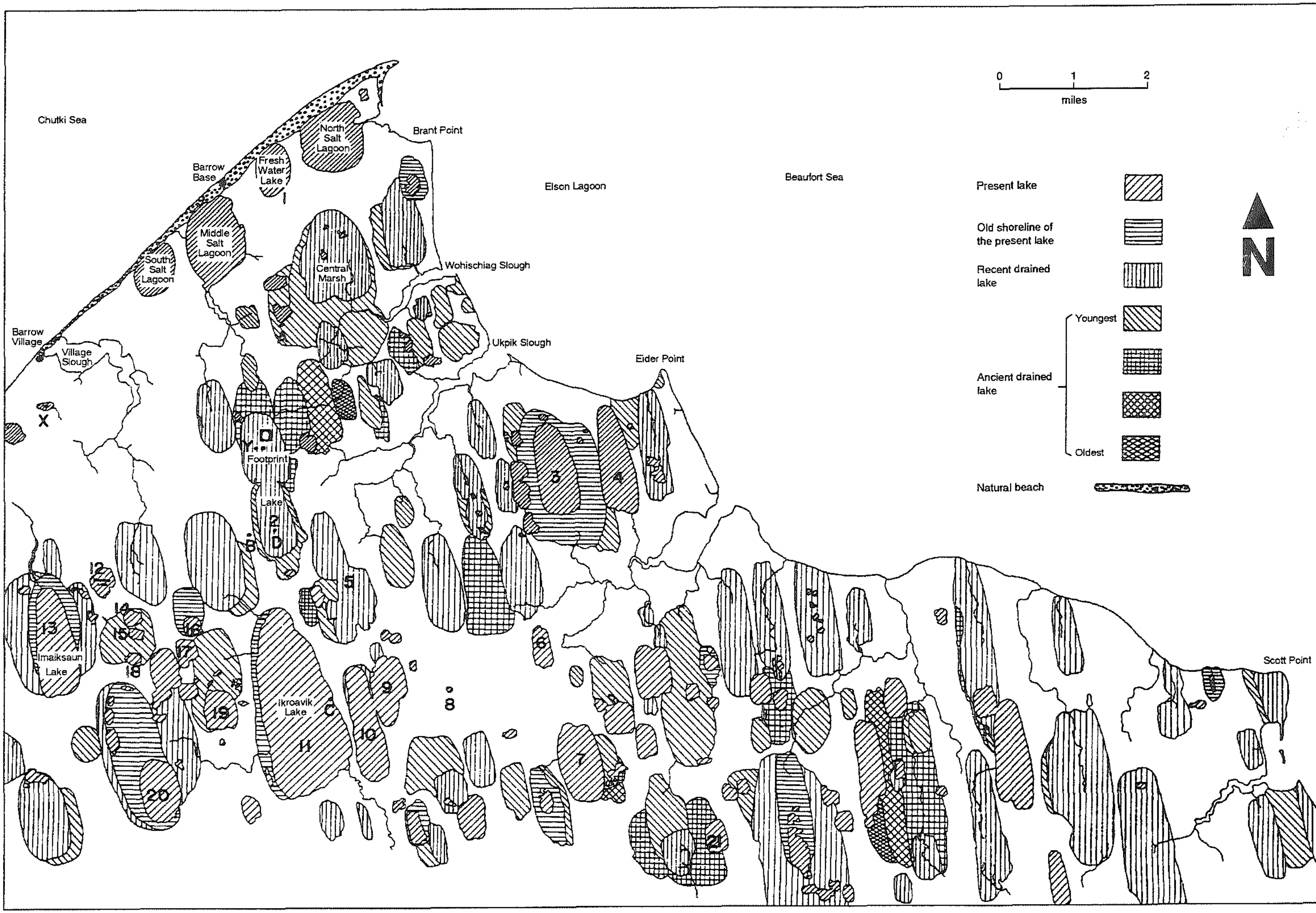
These 'lakes' bear close comparison not only with others in the Harrison Bay area of Alaska, where they are also aligned north-west to south-east[174], and on the Old Crow Plain (west of the Mackenzie Valley) in Yukon, Canada[175], but also with others believed to be of Quaternary age in the valleys of the Penzhina and Anadyr rivers in north-eastern Siberia[176]. These latter reportedly vary in diameter from several hundred feet to as much as 3 miles (5km), are generally oblong or elongated, and are remarkably shallow. Nor should we forget that, as previously remarked, shallow, swampy 'lakes' close to the north Siberian mammoth graveyards are stated to have been formed under exceptional circumstances.

Rather unexpectedly, a further group of over 200 shallow 'lakes', also generally aligned north-west to south-east, covers more than 45,000 sq miles (116,550km^2) of the Beni region of north-eastern Bolivia in South America. In size, they range from about 1,000ft square (307m^2) to 5.4 by 12.4 miles (8.6 x 20km). Again, some are water-filled, others are dry. Most exhibit rectilinear or oval shapes, although a few irregular shaped examples also exist. The oval 'lakes' are particularly noteworthy for having one rim more developed than the others, exactly as in many of the Carolina 'bays' and the Old Crow Plain 'lakes' (see table 5B), and, as with many of those structures, also lack stream inlets or outlets[177].

The arguments advanced to account for the Carolina 'bays', and the oriented 'lakes' of Canada, Alaska and Siberia, which call for ice, 'cave-ins', or the collapse of portions of ancient buried valleys, scarcely apply in tropical Bolivia, yet, the South American examples are seemingly explicable by a single event responsible for *all* these remarkable geographically scattered features.

Oval crater-like ground structures, closely resembling th Carolina 'bays' also exist in the Netherlands, where they are, however, far less obvious than their American counterparts through having been largely obscured by agricultural and constructional activities[178]. Significantly, many erratic boulders composed of rocks not now found closer than Finland and Scandinavia occur near these depressions, the long axes of which, moreover, are predominantly north-northwest to south-southeast.

At Tapanui, north of Invercargill at the south-eastern end of South Island, New Zealand, an extensive, largely triangular area is notable for yielding unusual quantities of small metallic fragments and stony objects known locally as 'China-stones'. The latter contain carbonised



Map 5D. Oriented lakes near Point Barrow on the north coast of Alaska.

Table 5B

Comparison of the Alaskan lakes, the Carolina 'bays' and the Beni Basin, Bolivia

(After Plafker G, Prouty W F, Johnson D)

	Northern Alaska	Old Crow Plain Yukon Territory	Carolina 'Bays'	Beni Basin
Area	More than 25,000 sq miles	About 3,000sq m	Between 25,000 and 40,000 sq m	Total area approx 45,000 sq m limited to Beni Basin
Number	Probably tens of thousands of lakes or lake basins	Several hundred oriented lakes	About 500, 000 'bays'	Roughly 2,000 oriented lakes and dry lakes
Axial orientation	North-west	North-west	North-west	Majority trend from N40ºE to N55ºE with average N48ºE. Subordinate trend from N50ºW to N30ºW with average N41ºW. Minor amount almost square
Size	Vary from 9m long and 3m wide to 1m long by ½m wide	From very small to 6½m long by 3½m wide	Vary from a few hundred ft in diameter to 3-7m long and 2+m wide	Several hundred ft in greatest diameter, to 12.4m long by 5.4m wide
Shape	Elliptical, cigar-shaped, ovoid rectangular, compound	Rectangular, elliptical, compound	Elliptical, ovoid	Square; rectangular; groups of adjacent rectangles; elliptical (many with one side more strongly curved than the other); irregular
Depth	From less than 10ft to 60-70ft below surrounding plain	Reportedly very shallow	From 1-2ft to 30-40ft below surrounding plain	Roughly 75ft maximum reported
Shorelines	Outline of many lakes smoothly curved	Appear smoothly curved on oblique air photo	Shorelines smoothly curved	Generally smooth outlines; in detail most are finely embayed or jagged
Relationship	Lakes parallel, intersect or overlap one another	Lakes parallel one another, rarely inter-secting or overlapping	Bays parallel, intersect or overlap one another. Some bays lie within others	Lakes parallel one another; rarely intersect or overlap
Linear arrangement	Rows of lakes present in some localities	Rows of lakes present in some localities	Rows of lakes present in some localities. Parallelism along axes of ovoid. Longest axes running NW-SE	Rows of lakes present in several localities
Cross-section shape	1. Shallow with concave profile; 2. Deep central portion surrounded by a shallow shelf	Described as shallow	Shallow, concave, deepest toward SE end with a higher rim	Pan-shaped with abrupt, steep sides and flat bottoms
Age	Probably 'Pleistocene' to recent	No data	'Pleistocene'	Probably recent

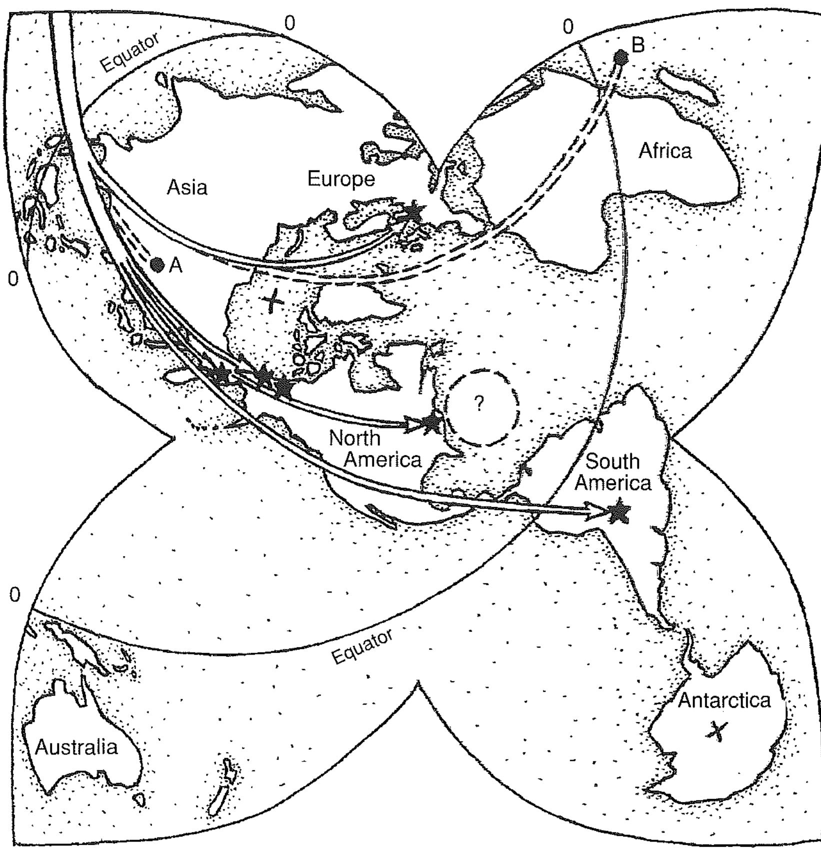
Note: m = miles.

fragments of 'late Pleistocene' plants and animals. Hand-held compasses also regularly behave wildly in this area.

In combination, these details raise the possibility that this is another area over which a large aerial explosion (like those suggested as the cause underlying the creation of the Carolina 'bays') occurred in 'late Pleistocene' times – a date agreeing remarkably well with the 11,500 years BP date advocated in this book for the Phaeton disaster. In this case, however, no shallow-rimmed craters were formed. Rather interestingly, however, Maori traditions refer to an immense aerial detonation occurring over South Island long ago, when a huge horned celestial object, "glowing like the Moon". split apart and crashed to Earth, causing widespread devastation.

In 1951, Kelly[179] suggested that the Carolina 'bays', the supposed Bermuda 'crater' and the oriented 'lakes' around Barrow Point all originated during 'late Pleistocene' times through Earth's collision with a giant meteor or series of meteors, which jolted the terrestrial pole from an older position centred on Apatak Island in Ungava Bay, Quebec, to its present location. While we do not necessarily agree with this theory, it is nevertheless a most interesting one.

All the aforementioned structures lie along a single curving course. If we add the Russian, Harrison Bay and Old Crow Plain



Map 5E. Possible polar flight-paths of disintegrating aerial objects theoretically responsible for oriented lakes, Carolina 'bays' and an alleged crater on the floor of the Atlantic Ocean at the time of the Phaeton disaster. The recently discovered 'craters' at Duolon (A) and the Amirantes area of the Indian Ocean are not necessarily any part of the events depicted on this map. Their locations, however, suggest that some association may exist. Accordingly, their suggested pre-impact flight-paths are shown dotted. *Partially based on Kelly and Dachaille.*

sets of oriented 'lakes' to Kelly's map we find that they too generally straddle the *same* curving course. Dare we accept this coincidence? The overall impression received is that of some large disintegrating body nearing the Earth on a curved trajectory over the northern hemisphere, and of pieces of it breaking off *en route* and striking the ground or exploding a short distance above ground-level at those places where the above-noted 'bays', 'lakes' and supposed 'crater' now occur.

Using the reported alignments of the Bolivian and Dutch structures, it is also possible to interpret them as analogous effects, created by related pieces of the same disintegrating object, ending their careers over Bolivia and the Netherlands respectively (see map 5E). Certainly the long list of similarities between all these topographical features (table 5B) strongly suggests that they shared a common origin. Indeed, how many coincidences are tolerable before definite causal connection between these topographical features becomes irrefutable?

Exciting though such an interpretation may seem, does it really reflect reality or even the sequence of events which can be inferred as having probably comprised that phase of the Phaeton catastrophe? The testimony of tradition, representing the only surviving eye-witness record of that terrible event, supplies several interesting clues partly answering this question.

8
HELL ON EARTH

No matter which account we study, the principal assailant in the great cosmic drama under discussion is almost always stated to have been accompanied by several lesser but highly destructive 'attendants'. The Babylonian account provides the assailant Marduk with four 'assistants' early in his wanderings amongst the outer planets. Later, after the battle with Tiamat, it reportedly acquired Tiamat's satellite Kingu as well as dismembered pieces of Tiamat too. By the time Marduk (Phaeton) neared Earth it did so in company with quite an entourage of lesser objects.

Likewise, the Midgård Serpent of Norse tradition was attended by the Fenris-Wolf, Garm, Surt and Loke; while in the Bundahish, Tistrya is accompanied by the Pairikas or 'worm-stars' and the 'angels' Vohuman, Hôm and Bûrg[180]. The solar horses, which in Greek legend pull Phaeton's fiery chariot, is a poetic way of saying that fiery and effulgent objects accompanied and preceded it through the heavens. Biblical texts mention an 'evil host' accompanying Satan or the dragon during the 'war in Heaven', while the Vedic hymns of ancient India describe Indra (Phaeton) as travelling across the firmament with a band of destructive entities known as Maruts, who are repeatedly described as 'blazing', 'brilliant with fire', 'shining like snakes' (with long trailing tails), the 'terrible ones' and the 'shakers of Heaven and Earth'[181].

Such traditions clearly record that *several* fiery or luminous objects arrived simultaneously in the neighbourhood of Earth at the time of the Phaeton disaster, and that these were largely subordinate to Phaeton irrespective of the name by which Phaeton was locally remembered.

As the following excerpts suggest, it was widely believed that several if not all of these unwelcome visitors crashed down upon

Earth to be buried deep below its surface in a vast chasm – which later came to be regarded as Hell itself. Describing this event, the *Book of Revelation* informs us:

> And there was a war in Heaven: Michael and his angels fought against the dragon, and the dragon fought with his angels. And prevailed not; neither was their place found any more in Heaven. And the dragon was cast out... he was cast into the Earth, and his angels were cast out with him.[182]

The same source provides further details about what can only have been a cosmic bombardment during the course of this 'war', and refers to various other effects considered previously. We are told that first there was "silence in Heaven about the pace of half an hour"[183]. This was succeeded by "thunderings and lightnings, and an earthquake"[184], after which the Earth was showered by "hail and fire mingled with blood"[185], which consumed trees and grass. Then a "great mountain burning with fire was cast into the sea: and the third part of the sea became blood", which, evidently poisoning the waters, occasioned widespread loss of marine life[186].

This event was followed by the falling of a "great star from Heaven, burning as (if) it were a lamp"[187]. This star was called Wormwood because it allegedly made "a third part of the waters" of the world bitter and undrinkable[188]. This heralded a general blotting out of the Sun, Moon and stars, after which another "star fell from Heaven unto Earth; and to him was given the key to the bottomless pit. And he opened the bottomless pit; and there arose a smoke out of the pit, as the smoke of a great furnace; and the Sun and the air were darkened by reason of the smoke of the pit"[189].

Finally there appeared "a great red dragon, having seven heads and ten horns, and seven crowns upon his head. And his tail drew the third part of the stars of Heaven, and did cast them to the Earth"[190]. This same red dragon was then "cast down" onto the Earth and a vast flood issued from its mouth[191], and it uttered "blasphemies" (awful sounds) from the mouths of its seven heads which continued to be emitted for "forty and two months"[192].

These extraordinary passages clearly state that, during a tremendous cosmic conflict, several of the participating bodies actually crashed to Earth. Although we are not told in which hemisphere these objects fell, they reportedly came down well apart – one in a chasm, one in the sea, another which rendered waters undrinkable, and one (a 'dragon'-like body) which inferentially fell on land. Very likely most of these objects vaporised or totally disintegrated before making physical contact with the terrestrial surface (excepting the supposed impact crater off the eastern coast of the United States), this occurring a short distance above ground level.

At the time, 'collapsed sky' conditions had already been established over many regions, the thick, particle-charged atmosphere contributing materially to the ultimate combustion of most of the falling bodies.

Widespread atmospheric derangements must also have occurred as prominent subsidiary effects in the vicinity of each blast area. Respecting these, it is surely significant that several ancient texts aver that, when these 'stars' and the 'dragon' fell to Earth, "Heaven *departed as a scroll* when it is rolled together, and every mountain and island moved out of their place" (our italics)[193], and that Heaven was "cloven"[194] or "rent in twain"[195]. The Norse epics significantly mention that the "sons of Muspelheim" (Phaeton's attendants) "ride" through this opening as they plummet earthwards[196].

The power and velocity of these blasts and shock waves must have been appalling, and the associated wind speeds phenomenal. No organism, large or small, within scores of miles of the blast areas could have survived. Needless to add, sudden local withdrawals of air sucked into these areas by the final vaporising explosions would have been lethal for all air-breathing inhabitants of the affected regions.

Especially interesting at this juncture is the multi-headed 'dragon'. Not improbably it represents the state of the last major remnants of Kingu which, at the time, were cascading earthwards as burning masses of jagged material superficially resembling a 'horned dragon'. Presumably, the burning mountain, the 'star' named Wormwood and the 'star' associated with the 'bottomless pit' were other large pieces of Kingu preceding the 'dragon'-like portion to Earth.

We should particularly note that Michael (really Phaeton) did *not* succumb in this drama, and that in Greek legend it was Phaeton's chariot and steeds which disintegrated and fell to Earth, just as, in Ute Indian tradition, it was a wayward sun god called Ta-vi and *not* the opposing solar hero Ta-wats (Phaeton) who was "shivered into a thousand fragments which fell to Earth".

Thus it was not Phaeton, but its 'attendants' which plummeted to earth, and it was Kingu which, venturing into the terrestrial Roche zone, disintegrated and plunged earthwards in mighty blazing fragments. The lurid spectacle of this falling debris doubtless rivalled Phaeton itself in brilliance, amid the extensive gloom of 'collapsed sky' conditions, evidently leading terrified eye-witnesses unable to view events in their entirety to assume that it was actually Phaeton which was crashing.

Biblical and other texts refer to these falling objects as 'angels'. The *Epistle of Jude*, for example, states:

> And the angels which kept not their first estate, but left their habitation [Heaven], He [God] hath reserved in everlasting chains under darkness unto the judgement of the great day.[197].

A very similar statement occurs in the *Epistle of Peter*, which tells us:

> For... God spared not the angels that sinned, but cast them down to hell, and delivered them into chains of darkness, to be reserved unto judgement.[198]

All religions and mythologies which speak of Hell or a Hell-like realm invariably regard it as the abode of Satan and demons and as a place characterised by fire – everlasting fire. In the apocryphal *Book of Enoch* Hell is described as a vast abyss at "...the end of Earth and Heaven; here is the prison of the stars which had transgressed God's will... Here shall be confined the angels..."[199]. The same source elsewhere tells us: "And God confined the angels... in the fiery valley in the west... [where were] melted mountains of metal...", during a frightful natural convulsion when "heaven fell upon Earth [collapsed sky] and the Earth was swallowed up by an immense abyss [crustal dislocation]; and hills crowded on hills, and mountains on mountains [plate tectonics]"[200]. These awful events occurred when "...the waters boiled... and the Ark floated upon the water"[201], an assertion confirmed by Peter in his second Epistle when he stated that God "spared not the old world, but saved Noah the eighth person... bringing in the flood upon the world of the ungodly"[202].

These are clear references to the contemporaneity of the Deluge (Noah's), a cosmic conflict (the 'war in heaven') and the fall of celestial objects (rebellious 'angels' from Heaven). In several accounts, the latter were somehow confused or connected with a race of antediluvian giants traditionally associated with the north or the west. Thus Merezhkovsky, who equated the giants with 'fallen angels' (Phaeton's attendants), concluded:

> In the *Book of Enoch*, the human giants of the pre-flood world, the 'Sons of God', the *ben Elohim*, the fallen angels, are men of the extreme west.[203].

Norse epics place their abode in the far north-west:

> Far in the north-west – to all nations in our hemisphere [northern] the abode of darkness – is *Jotunheim*, where the giants dwell...[204]

The direction from which the celestial objects came that were apparently responsible for creating the oriented 'lakes', 'bays' and 'craters' was north or north-west relative to the present North Pole. Moreover, except for the Dutch 'bays', all these features lie far west or north-west of Europe and Asia Minor where these traditions have been preserved.

A definite northern source for this bombardment is seemingly implied in those traditions which mention the Bifrost Bridge. The Norse *Eddas* state that this bridge, allegedly constructed by the gods during the wonderful primeval Golden Age, existed near Meru in the formerly equable North Polar latitudes. When the Midgård Serpent and its associates assaulted Earth, the Bifrost Bridge was reputedly set on fire, and it broke up under the onslaught of the 'sons of Muspelheim", who are said to have ridden through a 'cloven' heaven. A huge fiery chasm opened beneath the bridge, into which it collapsed. This was presumably the 'immense abyss' and 'fiery valley' which scriptural texts locate at the 'end of Earth and Heaven' (exactly where the *Eddas* place the Bifrost Bridge), and where the 'prison' of the 'stars which had transgressed' was situated.

The opening up of a large fiery chasm at or near the North Pole seems scarcely credible, until it is realised that the pole concerned was not the present one but that of the pre-catastrophic world, which was located a considerable distance from the site of its modern counterpart. Was the final resting place ('prison' or 'fiery valley') of at least some of these celestial objects ('fallen angels') therefore some site now north-west of the present North Pole – a site which, at the time, had split open as a gigantic crustal fracture exposing sub-adjacent molten magma, or which had collapsed *en bloc* through crustal dislocation and had begun to fill with erupting magma?

The previously-mentioned references to 'everlasting chains under darkness' and the widely-held concept of hell as the domain of raging fire may thus signify gravitational or electromagnetic capture (chaining) on the one hand, and the exposure, through lithospheric fracturing, to fire on the other. Subsequent cooling and solidifying of the magma below which the 'fallen angels' allegedly lay buried would thus explain the added phrase 'under darkness'.

No exceptionally large crustal fractures that could now be termed an abyss or chasm have been traced in latitudes northwards of Spitzbergen, although the great world crack discussed in Part One runs as far North as that archipelago, and can be followed across the floor of the Arctic Ocean to the Russian mainland immediately south-west of the New Siberian Islands[205]. Much of the north polar region, however, generally exhibits evidence of massive and geologically recent crustal shortening, suggesting of a former folding-in upon itself of the lithosphere there. One such example concerns the Barents Sea and the anomalous depths of the Eurasian Basin (Nansen Basin) and its margins which:

> ...represent a regional collapse of the Earth's surface due to *material being removed from the lower mantle.*[206] (Our italics).

It would, of course, be premature to insist that this north polar crustal shortening in any way supports the admittedly unverifiable claims of ancient literature, tradition and legend. We merely draw attention here to its existence, its location and its inferred cause, and to the fact that several apparently similar crustal collapse areas lie along or near the line of the previously-mentioned oriented 'lakes'.

A particularly large and geologically recent instance has been noted immediately east of the Kamchatka peninsula. This location lies close to the suggested trajectory of the object or objects advocated as having caused the oriented 'lakes' of Siberia and Alaska and over which, we submit, must have passed the group of objects which eventually came down over north-eastern Bolivia. If the flight-lines produced by aligning these groups of oriented 'lakes' and 'bays' are extended back towards a point of convergence, that point lies in the southern hemisphere. This detail becomes interesting when we recall that several Asiatic accounts of these celestial assailants specifically state that they initially arrived *from* the south. Again, can apparent concordance between such intrinsically dissimilar details be entirely coincidental?

The preceding reconstruction of what appears to have occurred immediately after the disintegration of Kingu imparts new significance to the hitherto curious belief among many peoples that the 'devil' or 'dragon' once flung huge stones great distances over the terrestrial landscape.

Numerous independent traditions about the Phaeton disaster refer to rocks, stones and dust being cast down upon the Earth by the main celestial antagonists at the time of that dire event. Sometimes these missiles are described as 'hail' and as falling 'mingled with fire' or accompanied by loud or frightening noises. Conventional icy hail does not fall with fire and, even in heavy falls, is not particularly noisy. Obviously a different kind of 'hail' is meant. The following examples reveal that the 'hail' was largely stony.

The pre-Columbian Toltecs assert that long ago "there fell a rain of gravel" accompanied by a "rain of fire", when "all which existed burned"[207]. A Peruvian recollection tells of a vast stone which "fell from Heaven to Earth and broke into sixteen hundred pieces"[208]. Algonquin legends refer to a tremendous primeval battle between the celestial brothers *Manibozho* and *Chakekenapok*. The former prevailed and broke Chakekenapok into many pieces which he "scattered over the land" when "the face of nature was desolated by a tornado", "...the gigantic bowlders and loose rocks found on the prairies are the missiles hurled by the mighty combatants"[209].

Early Mexican accounts of the same event mention that the sky "rained not water but fire and red-hot stones"[210], and that the stones "...levelled whole forests"[211]. In the Old World, an ancient tradition from the Atlas Mountains near Bou-Merzoug asserts that long ago "...a wicked people lived there, and for their sins stones were rained upon them from heaven"[212]. Buddhist texts on world cycles say similar things: "There arises a wind to destroy the world cycle... it rains a fine dust... boulders as large ...as mighty trees on the hilltops... [it] turns the ground upside down... [when] worlds clash with worlds"[213]. Even the early Chinese believed that planets closely approaching Earth (which, of course, they do not) occasion great showers of stones[214].

This near-universal belief that ages ago Earth and everything upon it was bombarded by a multitude of cosmic missiles, both large and small, fiery and stony, cannot be without foundation, particularly when those same beliefs specifically correlate that event with a mighty celestial conflict and tremendous physical changes on Earth. We have seen that several terrestrial regions host the remarkable youthful ground structures of 'bays' and 'lakes' which, in the light of all present evidence, are *best* explained as blast effects caused by large concentrations or aerially-detonating bodies. The fact that they lie in parallel rows and chains, often overlapping each other, strongly supports that interpretation. Furthermore, their general close proximity and their localisation (in groups) in particular areas indicate the involvement of veritable swarms of objects, with their detonations following one another in rapid succession.

Rains of fire can only signify falls of burning gases or hydrocarbons, or both. Several authorities, including T A Link[215], argued that petroleum residue traced in some meteorites possibly indicates that both meteorites and petroleum are remnants of a former, but now disintegrated planet-like body on which petroleum had been present, and that such a body existed between the present Martian and Jovian orbits. This is precisely where Tiamat and Kingu apparently once existed.

The great majority of these missiles can only have been fragments of the disintegrated Kingu, which, on exploding, must have hurled burning pieces of itself literally in all directions. Those nearest Earth inevitably hurtled through the atmosphere towards the crust, igniting and fragmenting as they did so. Those thrown away from Earth may have completely escaped Earth's gravitational field and gone great distances into interplanetary space before settling down into eccentric orbits. The origin of the meteor swarms and bands of comparatively small, apparently stony, maverick objects occupying interplanetary space between the Sun and Jupiter, of which numerous sightings have been made for centuries (see Appendix C) may also be explained by this disintegration.

9
Iron Bound

Many traditional accounts of this awful calamity mention sticky or inflammable blood-like fluids falling from the sky as 'hot naphtha', 'bitumen' or 'rains of fire'. The possible hydrocarbon origins of some have already been touched upon, while we may also reasonably infer that the fluids described as blood-like consisted not of blood but of a red or brownish-red liquid. In one account from Finland it is compared to a 'red milk'[216]. This description suggests that it was thick and opaque. Like the sticky and inflammable substances, these red 'rains' were inimical to terrestrial life.

Traditions refer to these blood-like rains many times. Mt Haemus in Thrace, for example, was anciently so named because of the "stream of blood which gushed out on the mountain" when a 'thunderbolt' (a massive electrical discharge) struck Typhon (Phaeton) during its flight over the Balkans[217]. The Orphic hymns of classical Greece refer to remotely early times when, as Earth "groaned fearfully" amid terrible convulsions, a discoloured sea was "troubled with its purple waves"[218].

The Tatars of Central Asia remember a great world conflagration preceded by a 'rain of blood' which turned the "whole world red"[219], while in the afore-cited Babylonian epic the entire world is said to have been coloured red by the 'blood' of the vanquished Tiamat[220]. We also recall the 'hail mingled with blood' mentioned in the version of this cataclysm given in the *Book of Revelation*[221]. A similar statement in the *Apocalypse of Thomas* avers that "a great cloud of blood shall come down... a rain of blood upon all the Earth"[222]. Even the Maya of pre-Colombian Mexico remember a time of tremendous world upheaval when the waters of all the rivers turned to a bloody redness as the Sun's motion was disturbed[223].

These and various other similar traditions clearly state that this red liquid arrived and fell as a 'great cloud' or as a 'stream' and that it rained down globally ('all the world'). Immense quantities of it must have existed even to have fallen even as a light short-lived shower over an area as extensive as the Earth's surface. But what was its origin and its true nature? We may never be able to answer these questions for certain, although some educated guesses can be attempted, which are seemingly consistent with the available details.

Ancient Mesopotamian texts repeatedly allude to the original 'watery' nature of Tiamat – special names such as *Tehom-Raba* ('watery monster') being used to stress that characteristic[224]. Interestingly, *Tehom-Raba* means 'great Tiamat' in the Hebrew language. From such fragments we may conclude that Tiamat was essentially a watery planet and that very large quantities of water were probably dispersed into space during Tiamat's destruction.

Assuming that Tiamat possessed some sort of central core composed of dense, perhaps mainly metalliferous, material, this too might have been fragmented and partially vaporised into dust-sized particles by Marduk's final destructive 'arrow'. This 'arrow' (a gigantic bolt of intense electrical energy?), ancient texts assert, "tore her belly... cut through her insides, tore into her womb" (penetrated to Tiamat's core). If valid as an interpretation, then this disintegration of Tiamat's core produced billions of particles which were scattered into space as a vast cloud close to where Tiamat had previously existed. Indeed the ancient texts virtually record this very process:

> ...(Marduk) ***severed the channels of her blood***
> ***And caused the North Wind to bear it***

To places that have been unknown.

In other words, Tiamat's 'blood' was scattered to regions where it had never previously been – that is, the area of space just indicated.

In space, any metalliferous particles of Tiamat's former core would have rapidly oxidised red or brown, while mixing and freezing solid with Tiamat's similarly dispersed fluids. Upon freezing, ice rinds must have enveloped the constituent particles. These, with the frozen liquids (ice), probably developed a highly reflective albedo.

It is curious, therefore, that a 'sea of crystal' allegedly preceded the red 'dragon' in space prior to the fall of, firstly, the 'burning mountain' which turned the world's waters blood red, secondly the 'star' named Wormwood which turned the world's waters bitter, and thirdly the 'dragon', itself red[225].

If remnants of Tiamat's original hydrosphere, atmosphere and core indeed mixed and froze together, this 'sea of crystal' presumably consisted of those remains of Tiamat which, the ancient records allege, were 'captured' and taken in tow by Marduk (Phaeton) as it proceeded sunwards. Such frozen masses, possessing highly reflective albedos, could easily have resembled a celestial 'sea of crystal'. And when the constituent materials eventually fell to Earth, as numerous accounts insist that they did, what better description of them could be given than 'hail mingled with blood'[226] (ice mixed with liquid ferruginous matter and metalliferous particles)?

An alternative interpretation of these 'blood' rains could be, despite the traditional insistence that they were a legacy of Tiamat, as easily attributed to the break-up of Kingu in Earth's Roche zone. The larger pieces of Tiamat's former satellite – the 'burning mountain', the 'star', Wormwood, *etc* – constituted portions of its core or crust, while the red 'milk', 'rains of blood' *etc* represented liquefied and oxidised smaller fragments.

The likeliest explanation, however, is that the rains with their red pigment had indeed mostly originated with Tiamat, and that the larger objects were falling remnants of the shattered Kingu. By the very nature of things, all arrived in the vicinity of Earth at the same time, and either fell more or less simultaneously or in quick succession. Confused, panic-stricken observers understandably assumed that all this falling material shared a common origin.

The bitter taste of the waters polluted by the 'star' Wormwood and the blood colour imparted to the sea by the 'burning mountain' were obviously chemical reactions between essentially incompatible substances. It is probably reasonable to suppose that the bitterness and the bloody colour of these waters derived from ferric matter, such as often tends to stain sediments and stones with deep red or brown tints. Remarkable concentrations of ferrous minerals and traces of ferruginous staining exist in various terrestrial surface deposits evidently laid down at the time of the Phaeton disaster. A closer look at some of them is most informative.

Several geologically young deposits, both on land and under the sea, exhibit markedly red or red-brown tints. Similar tints characterise many cave earths and fissure fillings. Almost the entire floor of Kesslerloch cave in Switzerland, for example, in which numerous animal bones were embedded, was coloured red with iron oxide[227]. We have already noted some fissures in Carniola in-filled by nearly pure iron ore. So-called 'Pleistocene' bone breccias are also often strongly ferruginised and silicified as, for example, that in Tea Tree Cave, Queensland[228]. Similar iron-stained bones have been found in many fissures, such as on the Isle of Portland, England.

Bones of 'late Pleistocene' animals encountered in 'drift' deposits are frequently iron-stained. Mammal remains from high-terrace gravels at Acton and Turnham Green, west London, for example, exhibited abundant traces of a manganous deposit and were described at the time of their discovery as being "loaded with manganous oxide"[229]. Blue-grey iron sands overlay the celebrated rhinoceros carcass found in Vilyui valley, Siberia, and even some of the so-called Miocene plants found in north-west Greenland occurred in a 'sparry iron ore'[230].

Iron or manganese staining of 'drift' deposits and associated organic remains, conventionally attributed to ice action or the environment this believedly created, are usually ascribed to periglacial conditions. Thus, black manganese staining in gravels at Radley, Oxfordshire, England, is accounted for by this process, which is said to have been of brief duration[231]. But if, as argued in Part One, glacial conditions did not exist when these gravels were deposited – and, very significantly, molluscs in these same gravels indicate 'warm' ('interglacial') conditions – other circumstances must have caused the staining.

A rusty colour is also characteristic of much of the 'Pleistocene' loess formation. In northern China, for example, loess occurs extensively as a reddish-hued surface deposit in which "...iron-manganese Pisolites are *often* disseminated in its basal layer" (our italics)[232]. Studies of these loessic loams reveal that their red colour "...can neither be a quality inherited from the original matter of which the loams are composed, nor a condition brought about by slow chemical processes long after their formation"[233]. In other words, the reddish tints were imparted to the loams *during* their deposition, and one may reasonably suppose that the above-mentioned iron-manganese Pisolites were also. Loessic loams in other parts of the world show similar metalliferous associations. Thus, in Nebraska, where loam abounds, as much as 20.26% of it consists of aluminium and 7.80% of iron[234]. Although numerous other examples could be cited, it must suffice here to state that mineral grains composing loessic deposits consist "...mostly of silica and associated *heavy* minerals (and) are *fresh* and *angular*..."[235] (our italics).

The fresh and angular appearance of these grains signifies geological modernity, while the very presence of heavy minerals in a *surface* deposit is most interesting. The occurrence of so much aluminium is likewise interesting in view of the recently-monitored exceptional concentration of aluminium-26 in the outer vicinity of the solar system, referred to in Part Four.

Deltaic deposits at the mouth of the Fraser River, British Columbia, brought down from inland regions characterised by extensive 'drift' beds and alleged glacial sculpturing, represent another example of recent surface deposits charged with "abnormal concentrations" of heavy metals, including cobalt, lead, zinc, copper, manganese and iron[236]. That 'drift'-age deposits elsewhere consistently contain significant quantities of these metals reveals how many modern surface deposits (deltaic and otherwise) have acquired their metalliferous contents. Natural erosion, leaching and other processes transfer ores from older to younger deposits, often investing bones and other remains with a metalliferous (and sometimes ochreous) patina (covering). Thus, a small carved figurine retrieved late last century from coarse sand over 280ft (86m) below ground level at Nampa, Idaho, was found to be covered with reddish iron oxide[237], which must have formed around it soon after its burial.

It is clear, therefore, that appreciable quantities of metals which exist locally in the 'drift' were deposited coevally with it and the animal and plant remains it contains. Considerable amounts of gold, for example, have occurred in 'drift' gravels in California, Alaska and Siberia, where mammoth and other animal remains abound, and as small isolated nuggets at various places in North Carolina, South Carolina and Virginia[238], just to name a few localities. Significantly, these finds closely abut the main area of the Carolina 'bays'!

If, as previously suggested, the formation of the Carolina 'bays', the deposition of 'drift' and the annihilation of the mammoths and their contemporaries was due to cosmic agencies epitomised by Phaeton and its entourage, it is undoubtedly noteworthy that iron was anciently regarded as the 'bones of Typhon' by the Egyptians, or as the 'droppings of the serpent' (Phaeton) by the early Jews. Indeed, Phaeton, irrespective of the name by which it was remembered, was widely associated with a great variety of metals in antiquity. The Chinese believed gold to be the dragon's breath, and glass or crystal its congealed breath[239]. Phaeton's companions, Leviathan and Behemoth were both thought to have produced gold and precious stones[240]. Even the early Peruvians accorded a celestial origin to gold and silver, the former being regarded as 'tears wept by the Sun' and the latter as 'tears of the Moon'[241]. These notions subsequently became corrupted into dragons guarding gold and other treasures.

But fanciful and distorted though these ancient memories may now be, they unquestionably date back to the time when a severely heated Earth ran with streams of molten and magnetised metals, derived, perhaps, as much from its cosmic assailants as from existing terrestrial lodes and veins of ore. Later, after solidifying once more, men came to believe that all had been produced by terrible celestial monsters. Magnetised iron, incidentally, was the first iron known to have been worked by man.

10
THE RAINS OF DEATH

As long ago as 1872, the Challenger oceanographic expedition, which sailed over 68,000 nautical miles in circumnavigating the globe, recorded the presence on the world's ocean floors of myriads of small, black, nickel-rich magnetic spherules having diameters in the order of 10–50 microns (u). They appeared to be especially abundant in the deepest basins. The existence of these tiny objects was repeatedly confirmed in the late 1940s by the Swedish marine exploration vessel *Albatross*, the observations made then rekindling interest in the spherules. Indeed, after considering all relevant factors, both E J Opik[242] and Kurt Frederickson[243] independently concluded that the spherules were very probably of meteoric origin.

Also covering much of the floors of the deep ocean basins is a distinctive deposit which, though usually tinted a rusty brown, is known as the *red* clay. It occupies "...about 102 million km^2" and represents a prodigious tonnage since "...at an average depth of about 200 metres, there would be some 10^{16} tons of red clay on the ocean floors"[244]. Naturally radioactive, this clay derives its colour from ferric hydroxide and a small amount of manganese oxide[245], and consists of very fine-grained sediments mixed with coarse silt and sand fractions originating in the oceans, as well as hydrogenous minerals, volcanogenic debris and ferromanganese concretions[246].

Sea-bed clays and muds from the Arctic are coloured brown due to the presence in them of enormous quantities of oxidised ferric iron particles, while those from the seafloor near the New Siberian Islands, in the White Sea and the Barents Sea contain a notably high percentage of manganese oxide[247]. Examining clay samples from the bottom of the Pacific Ocean, Pettersson discovered that they contained layers of volcanic ash and *large* amounts of nickel and radium – two elements almost completely absent from sea water. He observed that "nickel is a very rare element in most terrestrial rocks and continental sediments and is almost absent from ocean waters"[248]. Pettersson attributed the origin of the iron and nickel in these clays to "...very heavy showers of meteorites in the remote past"[249]. He also added:

> Assuming the average nickel content of meteoric dust to be two per cent, an approximate value for the rate of accretion of cosmic dust to the whole Earth can be worked out from these data. The result is very high – about 10,000 tons per day, or over a thousand times higher than the

value computed from counting the shooting stars (meteors) and estimating their mass.[250]

In many areas, however, the red clays possessing this unexpectedly high nickel content rest directly upon geologically very recent lavas and basalts, indicating that they (and their nickel content) must be younger still. At some places these clays form only thin veneers or are altogether absent. Thus, considering all these details in unison, not only must the supposed meteor shower have been recent rather than ancient, but its occurrence must have been sudden, its volume enormous and – in view of the wide distribution of the clay – its operation global.

This last factor is contrary to the normal behaviour of the average meteor shower, even of an exceptionally large one. Meteor showers inevitably enter the terrestrial atmosphere from one quadrant only at any given time. However, owing to the rotation of the Earth, most, if not all, parts of the world's surface could theoretically receive meteoric material over a twenty-four hour period. To account for the enormously high tonnage here, we must imagine either a veritable meteor blizzard continuously pounding the Earth for weeks on end, or the Earth passing through (or being passed by) a vast cloud of metalliferous debris which enveloped more or less every part of the planet's surface almost simultaneously. On remembering that, at this phase of the disaster, Earth had either been braked to a halt, or its rotation was markedly slowed, such near-instantaneous global falls of huge quantities of ferruginous dust becomes easier to understand.

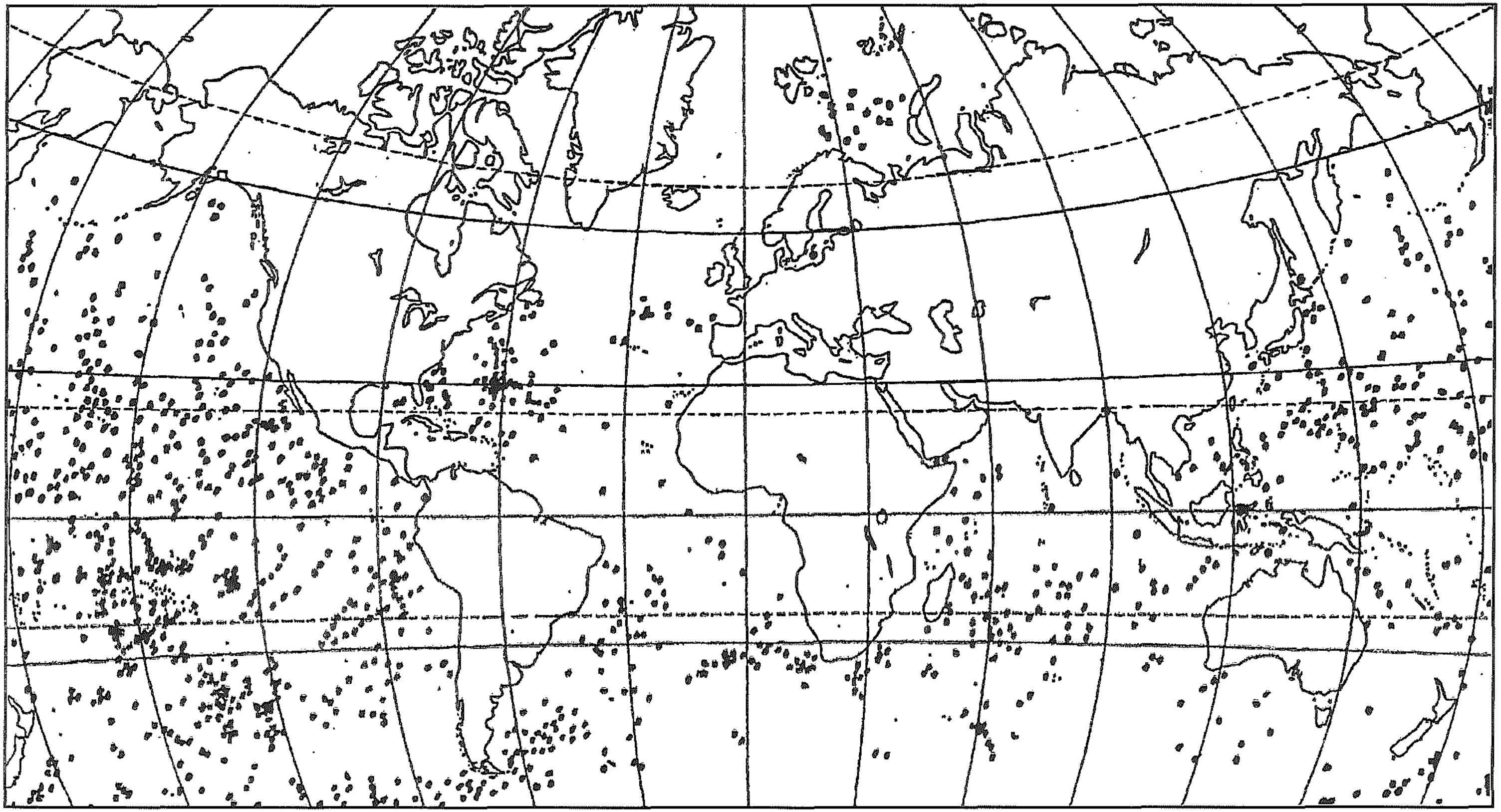
New significance thus attaches to the Finnish tradition that, when the Sun and Moon once disappeared and 'red milk' was sprinkled over the world, 'hailstones of iron' fell *prodigiously* – likewise to those recollections of fine dust falling endlessly from the skies while the Deluge waters swept across the Earth. In turn, these indicate that we are not dealing here with a meteor shower but with a gigantic cloud of cosmic debris, the origin of which we have already suggested.

Finally, we must consider more fully the ferromanganese concretions found in the red clay. Usually referred to as manganese nodules, these irregularly-shaped objects range in size from that of a garden pea to lumps up to 3ft (0.9m) in long diameter, and exist in countless numbers on the sea-bed worldwide[251]. Like the associated red clays, the nodules are naturally radioactive[252], and at some localities are astonishingly abundant, forming veritable 'fields' and 'pavements'. Some 'fields' consist of nodules packed so densely that they totally cover almost 100% of the sea-floor[253]. The wider distribution of the nodules is patchy, however. We are told, for example, that in the eastern central Pacific Ocean:

> ...records were taken with bottom-near television cameras, for hundreds of kilometres. For 5% of the records the sea-floor was covered to more than 50% by nodules, that is up to 25kg of ore per square metre. Conversely, 5% of the records showed the sea-floor free of nodules. Elsewhere, the cover varied, sometimes considerably, even over distances of only 50m. The reasons for the patchiness are not clear...[254]

The areas richest in nodules occur in the north-equatorial Pacific region[255]. Globally, however, it has been estimated that the nodules represent between 100 and 200 *billion* tonnes of material[256]. Map 5F shows the main areas from which they have been reported[257], the concentrations in the Pacific and the western Atlantic, east of the Carolina 'bays, being immediately noticeable.

Manganese nodules are rich in cobalt, nickel, copper and other heavy elements[258], a factor suggesting to several authorities the idea that the nodules, which are thought to grow through natural chemical accretion of these and other elements in sea water, are very old. A very slow growth – one estimate suggests "a few millimetres per million years, at most"[259] – has been postulated because these metal are rare in sea water, and long ages must have passed for the nod-



Map 5F. Ocean floor areas from which ferromanganese nodules have been reported. Each dot represents a separate locality, not an individual nodule. Many areas have yet to be searched for nodules – the expectation being that the final number of nodule-yielding localities will be appreciably higher than shown here.
Compiled from Berger, Horn, and other sources. Van der Grinten's projection. Scale: 1:220,000,000 at the Equator.

ules to have attained their present size by such processes. The fact that the overwhelming majority of these nodules occur on the surface or uppermost layers of the red clay has suggested to some that they have formed principally in areas of low sedimentation rates, since "...because of their slow growth they would soon be covered up in regions of high sediment supply"[260].

No plausible explanation has yet been advanced to account for the formation of nodules in such areas. We have already seen, however, that the twin notions of a great age and slow deposition rate for the red clays are apparently erroneous – especially where the clays overlie geologically *young* lavas and basalts – and the inference must be that the associated nodules are at least as youthful if not more so. In any case, major geophysical changes to ocean floors approximately 11,500 years ago (see Part One) clearly nullify the concept of sea-bed deposits slowly accumulating under generally stable conditions over very long periods of time, or of a similar slow growth for the nodules. The abundance and distribution of the nodules is remarkable, yet if the sea water below which they lie is almost devoid of the materials from which they allegedly form, and if the associated sea-floors and bottom sediments are indeed geologically youthful[261], then the nodules must have formed under other circumstances.

When all these factors are taken into consideration, they suggest that the nodules have been dumped *en masse* rather than accumulating slowly. This implies a cosmic source which, if correct, signifies that they arrived suddenly and in vast numbers. We recall that several traditional memories of that frightful event agree that some celestial object disintegrated into innumerable fragments while in the vicinity of Earth, showering it with its remnants. Are these nodules further evidence of that calamity and (considering their heavy mineral content) of shattered core material from Tiamat, or Kingu, or both?

Earth's apparently 'recent' acquisition of iron-impregnated matter (subsequently accumulated as loess and red clay) and of enormous quantities of metalliferous nodules certainly calls for exceptional circumstances. Among other effects, these acquisitions would have rendered water supplies bitter and unpalatable. World tradition remembers just such a 'recent' event – the Phaeton disaster.

As noted previously, world tradition also links the bitterness of Earth's waters with a widespread loss of marine life. Can it be coincidence, therefore, that together with other life-forms, *pteropods* suffered mass mortality in the eastern Atlantic during the alleged Weichselian (Würmian) phase of the so-called Ice Age? Today, the remains of these marine organisms are embedded in sea-floor sediments stretching from Portugal to Senegal, a distance of 1,560 miles (2,500km). These sediments, which have apparently been washed by *red tides* several times, are estimated to have been deposited sometime between 14,000 and 11,000 years BP[262] – exactly that division of time when the Phaeton disaster apparently occurred. This *pteropod* destruction has been attributed directly to a sudden increase in sedimentation resulting from "rapid hydrographic and climatic changes"[263], both highly prominent features of the Phaeton event!

It would seem, therefore, that both ferruginous dust and metalliferous nodules were simply further aspects of the tremendous celestial bombardment responsible for the aforementioned oriented 'bays' and 'lakes'. In short, they were indeed 'rains of death'.

11
THE WATER MOUNTAIN

Unquestionably the most widely remembered expression of the Phaeton disaster was the Deluge. It allegedly drowned all living things and is stated to have extinguished a terrible world fire. The Deluge was thus rather a late development during this dreadful catastrophe. Moreover, the numerous traditional accounts referred to in Part Three clearly reveal that the Deluge was an almost inevitable outcome of the tremendous events immediately preceding it.

These same accounts also describe several highly unusual aspects of the Deluge which are at variance with the popular (and over-simplified) concepts of how the Deluge supposedly behaved. Broadly speaking, the Deluge is an umbrella heading embracing three distinct phases: first, a temporary but singular heaping-up of terrestrial water in a specific region, secondly, an equally remarkable torrent of cosmic origin, and thirdly, the release across the greater part of the world of the united terrestrial and cosmic waters as an irresistible flood.

A recurrent theme in the Deluge traditions generally concerns the extraordinary heights attained by these flood waters. In *Genesis* we find that:

> ...the waters prevailed exceedingly on the Earth, and all the high hills that were under the whole heaven were covered. Fifteen cubits upward did the waters prevail, and the mountains were covered.[264]

A cubit is generally regarded as having corresponded to 17.58 inches (44.6cm), so 15 cubits would signify that the flood waters rose about 23ft (7m). If above today's highest mountains, then to more than five miles (8km)! We have seen, however, that antediluvian peaks were probably much lower than those of present times, so the seemingly exaggerated height reportedly reached by the flood-waters may not be so extravagant after all. Notwithstanding such possibilities, we are still told that "...the waters *stood above* the mountains" (our italics), as tremendous winds caused them to "...mount up to the heavens"[265], and "He [God] gathereth the waters of the sea together as a heap"[266].

Maori traditions also speak of terrific winds lashing the Deluge waters into mountain-high billows[267], just as ancient Chinese records mention that the waters, "...in their vast extent over-topped the great heights, threatening the heavens with their floods"[268]. An independent Midrashic account goes so far as to assert that: "The waters were piled up to a height of sixteen hundred miles, and they could be seen by all the nations of the Earth"[269] – a near-unbelievable claim. There are essentially similar, if less exorbitant, accounts of this watery distortion, such as the following Lappish tradition describing the destruction of a wicked antediluvian world by the angry deity *Jubmel*, who allegedly promised: "I shall reverse the world. I shall bid the rivers flow upward; I shall cause the sea to gather together itself up into a huge towering wall which I shall hurl upon your wicked Earth-children, and thus destroy them and all life"[270].

Other accounts tell of waters piled up to heights so great that they 'overtopped' mountains and appeared to threaten the 'heavens' themselves; waters gathered into a 'huge towering wall' and so on. The prevailing picture is everywhere consistent and quite unlike that usually conveyed by artists and some scholars of slowly-rising flood waters. The dominating vision, then, is of a colossal heap or wall of water gathered together at a particular locality (or hemisphere) and held there by some immense gravitational force. A hint is given of this effect in *Psalms*, where we read that this watery heap "...stood fast"[271]. In other words, it was immobile. Such a phenomenon is explicable only of a second gravitational field was acting in opposition to terrestrial gravity, a field which caused 'rivers to flow upward', which 'heaped up' the ocean waters and which then held them stationary, for a definite interval. The opposing gravitational field was presumably Phaeton's.

This point assumes particular significance when we discover the Babylonian *Talmud* asserting that: "Seven days before the Deluge, the Holy One changed the primeval order..."[272], an observation anciently remembered by numerous nations and implying a change in the Earth's previous axial stability and rotational speed, with water flowing uphill rather than downhill.

Especially significant is the conclusion reached as far back as 1936 by Hess and MacClintock, who, in considering the effects of a hypothetical astral influence which suddenly decreased Earth's rotational speed and caused a rapid change in the shape of the hydrosphere, inferred that sea levels would be greatly depressed in low (equatorial) latitudes and drastically raised in high (polar) latitudes[273]. This is precisely what the aforementioned traditions appear to imply. The heaping up of Earth's waters evidently occurred at or around the original poles, or, just possibly, principally at one pole only – the northern one.

At this juncture we should recall those traditions which refer to the Deluge waters as having flowed strongly northwards. It may be surmised that these were waters being gravitationally attracted to the polar latitudes. The incredible abnormal weight of accumulated water at one pole may have been as much the cause of an axial tilt as the near-proximity of a powerful external influence like Phaeton. Most probably, both factors working in concert effected that major terrestrial change. One agrees, therefore, with Patten when, as one of the few writers who has perceived the true nature of the Deluge, he remarked:

> If one concludes that this great event in Earth history, the Flood, was indeed a cosmic catastrophe, rather than merely a prolonged meteorological event, then one must conclude that its cause was gravitational rather than heat, which is the ultimate cause in floods caused by excessive rainfall [heat causing the evaporation and the organising of wind systems]. If the Flood was cosmic, it is not only a gravitational catastrophe – it is a gravitational-magnetic catastrophe...[274]

Inevitably, the inhabitants of high latitudes experienced the most massive rising of the Deluge waters as they became piled up into a gargantuan 'water mountain' submerging all land. Salvation in 'arks' and other floating refuges was the sole means of escape for those communities, while those in low latitudes, from which much water had been withdrawn polewards, this was not the case.

12
The Torrent from Heaven

A variety of traditional sources also refer to what was seemingly yet another aspect of the Deluge, namely that very considerable quantities of water from celestial sources contributed to its final mass.

In the *Apocalypse of Thomas*, for example, we read of blocks of 'hail' (ice) individually weighing about a hundredweight (50kg) showering Earth immediately before the Deluge. Again the *Zend-Avesta* mentions that, when Tistrya assaulted Earth, it sent tremendous rain in which the drops were the size of saucers, or of a man's head, and were sometimes boiling hot. Raindrops of phenomenal size are said to have fallen when the thunder-god of the Sac and Fox Indians of North America destroyed the primeval world long ago: they were allegedly the size of wigwams[275].

In these and many similar recollection which could be cited, we seem to be dealing with falls of what may be aptly termed 'whole water – water which descended in drops so large that their origin and formation cannot have been due to even the most chronic dust-polluted atmosphere. Obviously originating elsewhere, their great size suggests that these huge 'raindrops' were almost certainly great lumps of melted ice – pieces of the 'sea of crystal' (interpreted as an ice-field) which preceded Phaeton through space. Thus the largest pieces, melting slowest, appeared as huge 'drops' of 'whole water' when they reached the ground, and they naturally excited lasting astonishment. That their exceptional size was noticed amid the chronically deranged conditions suggests that these 'raindrops' fell, not so much in the high latitudes where the 'water-mountain' would obscure the falls, but in the low latitudes largely bereft of water, and where numerous confused individuals still dwelt.

The truly staggering duration of this rain deserves further comment. Best known, of course, is the 40 days mentioned in *Genesis*[276], a duration also given by the Tepanecas of pre-Columbian Mexico. The aforementioned tradition of the Sac and Fox tribes describes the rain as unlike any that has ever fallen before or since. It was unparalleled. It was compared to "seven water torrents"[277], described as "an overflowing rain, and great hailstones"[278], and reported as having "...descended out of the clouds [collapsed sky] as if poured out of jars... prodigiously, in drops like bull's heads, and men's heads, in handfuls and armfuls, both great and small"[279].

Therefore this rain fell torrentially and uninterruptedly as a kind of celestial cascade or waterfall. It rapidly swamped everything upon which it fell. Clearly it was no ordinary rain, a factor appreciated by many early writers who differentiated normal (seasonal or occasional) rains, which the called 'small rains', from exceptional (cataclysmic) rains, which they called 'great rains'[280]. Interestingly, these old accounts never mention 'great rains' except in association with catastrophic events, and then almost always as 'divine' retribution.

In the Norse *Eddas*, during Odin's battle with the Fenris-Wolf, the upper heaven is alleged to have been shattered, its wreckage plummeting to Earth as hail and huge blocks of ice. This shattering of the firmament or celestial vault reappears in numerous ancient traditions. The Maori, for instance, recall how their hero *Tawhaki*, in a fit of rage, once stamped on the 'floor of heaven'. The resultant crack permitted the celestial waters to pour down and flood Earth. In Chinese tradition, a marauding dragon is substituted fro *Tawhaki*; while in the Bundahish, 'demons' which "dashed against the celestial sphere" are given as the culprits[281]. Everywhere, therefore, these extraordinary rains are consistently accorded a cosmic origin and are associated with a tremendous celestial commotion – the Phaeton disaster.

Among the Jewish myths collected by Josippa ben-Gorion are some which specifically refer to an amalgamation of positively differentiated terrestrial (female) and celestial (male) waters. One even provides details of the date when this allegedly occurred: "On the seventeenth day of the month of *Cheshvan* the male waters fell from the heavens while the female waters welled forth from the depths. They united and waxed strong and overwhelmed the Earth and all that was upon it"[282]. *Cheshvan* was the second month of the old Jewish year. A variant account mentions that the event happened in the month of *Ijar*, which is the eighth month in the ordinary Jewish calendar. We shall later find these details to be most significant, merely adding here that the version in *Genesis* also states that the event occurred on the seventeenth day of the second month[283].

13
DELUGE

The disintegration of Kingu signalled a marked lessening, or even breakdown, of the opposing gravitational fields which apparently held the 'heaped up' terrestrial waters immobile in high latitudes. This diminution evidently occurred quite slowly at first, for several Amerindian legends, of which two are given below, relate how the advance of the released waters was watched for hours, even days, beforehand. It presumably reflected the steadily lessening influence of the opposing gravitational field proportional to the rate of dispersal of Kingu's debris and Phaeton's departure towards the Sun.

The Choctaw of Oklahoma recall that after the primeval Earth had been plunged into darkness "for a long time" (another reference to 'collapsed sky' conditions) a bright light appeared in the north, which occasioned great joy. The light, however, proved to be a wall of water composed of mountain-high waters advancing toward the observers.

A similar narrative preserved amongst the Navajo of Arizona describes how one morning long ago there appeared in the east, and subsequently in the south, north and west, a phenomenon which from a distance resembled a high, steep wall of rock. It was, however, water steadily advancing toward them. A variant Navajo legend contains further interesting details. Long ago, the Navajo ancestors were surprised one day to see animals of every type running from east to west. Four days later they saw a bright light in the east, and those sent to investigate it returned with the news that it was a vast flood of water proceeding in their direction. Next morning this flood had drawn quite close, and filling the entire horizon except the west, advanced like a chain of high mountains[284].

The significant point here is the consistent description of the flood waters as being prodigiously high and advancing as a watery wall. Once the 'heaped-up' terrestrial waters were released from the counter-gravitational grip holding them, they began to flow equatorwards, slowly at first, but ever more speedily as a stupendous watery avalanche of awesome power. Even the *Koran*[285] states that the Deluge bearing Noah's ark was simply a vast wave – and this rapidly united with the very considerable quantity of water which had been received in lower latitudes from cosmic sources. Upon uniting, these waters formed the Deluge proper.

A closer look at some of the effects of various major floods and marine storms of modern times provides glimpses of the probable capacity, power and behaviour of the Deluge. Moreover, measurements of water velocities amply demonstrate the terrifying force of large bodies in violent motion. Engineers concerned with coastal sea-defences have long known of the power of stormy seas, when man-made structures become puny things. Consider the following examples.

Tremendous gales in December 1872 destroyed the seaward end of a large breakwater at Wick, in northern Scotland. It was built of large concrete blocks securely bound together and to the underlying bedrock by huge iron rods, and weighed over 800 tonnes.

> During the height of this winter gale the resident engineer watched the onslaught of the waves... Before his incredulous eyes, the whole mass of the pier was 'slewed around' until it was finally broken away from its attachments, lifted and deposited inside the pier. After the storm... divers... found that not only the concrete monolith but the whole of the lower mass attached to it by iron bolts had been carried away. The waves had torn loose, lifted and bodily moved a mass weighing not less than 1,350 tons. Five years later... the new pier, weighing about 2,600 tons, was then carried away.[286]

Previously-mentioned tsunamis can reach formidable heights. One in July 1958 at Lituya Bay, southern Alaska, reached the immense height of 1,700ft (523m), and in scale and effect probably approached the equivalent characteristics of the Deluge water-avalanche. A subsequent report stated:

> Examining the sides of the bay, geologist Don Miller (and) seismologist Don Tocher... found that the wave had swept along the side of the bay at about the 100ft level, knocking down virtually all of the trees and stripping them of their bark. The greatest surprise was what happened on a mountain spur across a narrow inlet from the largest of the rock falls. Here a swash swept up onto the ridge to a height of 1,700ft, making a clean sweep of the forest so that only one tree was left standing amidst the ruins. The trees at the upper end were washed into the living forest, showing that it was a wave rather than a landslide that caused this damage. Miller, flying along the bay a few hours after the quake, saw great masses of water still running down the sides of the mountain.[287]

It is important to note that even the largest tsunamis that do occasionally invade the land are incapable of travelling very far inland *and* sustaining their destructive power. The Deluge waters clearly behaved otherwise. They consisted of colossal aqueous masses which arrived *suddenly* at particular localities, which exerted *continuous* pressures upon everything they overflowed, and which, even though of comparatively brief duration, also poured *unabated* over the land for hours and days without respite. Only something like a displaced ocean relocating itself could produce such effects. Thus, missing these crucial facts, every previous attempt to explain away the Deluge calamity as simply as an unusually severe river flood or as a series of exceptional tsunamis has failed to convince.

Discoveries made about water pressures and rates of flow today indicate how the Deluge waters must have acted in many regions all those millennia ago. It has been determined that winter gales, such as regularly batter the Scottish coast, produce water pressures as great as 6,000lbs per square foot (25,834kg/m^2)[288]. Pressures, however, largely depend on the depths of water concerned, and the speed at which it happens to move or the wind drives it. Hurricanes, for example, can drive waves ashore at speeds of 30–45mph (50–70kph), while the velocity of the falling crest of a wave only 30ft (9m) high produces a pressure of 49 tonnes per square yard[289]. The pressures exerted by the Deluge waters must have been immeasurably greater.

Studies of the rate of flow of ocean waters of different depths have produced the following results:

Depth of Sea		Height of wave		Velocity of water current	
feet	metres	feet	metres	mph	kph
200	61.5	100	30.7	22	35.2
300	92.3	100	30.7	19.5	31.2
400	123	100	30.7	17	27.2
600	185	150	46	20.5	32.8
800	246	200	61.5	28	44.8

Experiments have established that the force exerted on a surface increases as the square of the velocity, and varies as the sixth power of the velocity of the current involved. For instance, a current able to move a cube of given weight would, if its velocity were doubled, be capable of moving a cube 64 times heavier than the first-mentioned cube, and, if trebled, it could move a cube 729 times as heavy, and so on. Relating such velocities to the transportation of 'erratic' boulders by water, one investigator concluded that: "There is no doubt that blocks of 5 tons or upwards might be moved by a current of 10mph"[290].

Moreover, while currents flowing at a mere 2–3mph (3–5kph) cannot move even a modest-sized pebble, those with a velocity of about 10mph (16kph) can move blocks weighing several tonnes, currents moving at 15mph (24kph) can move 56 tonnes or so in weight, at 20mph (32kph) they can move blocks around 320 tonnes, and others flowing at 50mph (80kph) or higher could move boulders weighing many thousands of tonnes[291].

There is no reason why many of the 'erratic' boulders could not have been transported to their present locations by the Deluge waters, now that we perceive these as having been oceans undergoing relocation. Fig 5.12 shows a boulder field assembled entirely by flash-flood waters in California. In all essentials it resembles others known to have been accumulated by mud-torrents, and yet others conventionally accorded glacial origins.

But could water have actually *uplifted* 'erratics' sometimes weighing many thousands of tonnes from low to high levels – as noted in Part One? Some near Settle in North Yorkshire, England, for instance, are 200ft (61m) higher than the nearest parent rocks[292], while others elsewhere sometimes lie higher still. In view of the above statistics, and of the stupendous pressures that ocean-sized masses of water on the move could exert, there appears no good reason why the Deluge waters could not have uplifted even the largest 'erratics'. In Part One we saw that ice could *not* have moved them.

During the summer of 1810, Long Lake and Mud Lake in Vermont were catastrophically emptied of their waters. Eye-witness descriptions of what occurred furnish valuable clues as to the kind of things that must have happened in many regions on a still greater scale at the time of the Deluge, and interested readers would do well to consult the fascinating report by S Edwards-Dwight[293]. Among the effects produced in a matter of minutes was the excavating of a huge gully 1 mile (0.4km) wide, and 50–90ft (15–28m) deep. Enormous immovable rocks jutting out of the valley sides altered the course of the torrent *without* lessening its force. Sand heaps up to 20ft (6m) deep and extending as much as an acre accumulated on the sides of these obstacles, and torn-up trees were embedded in them. Marks of the torrent's violence were later seen all the way down the valley to Lake Memphremagog, 21 miles (34m) distant. At Eno's Mill, 17 miles downstream, a boulder estimated to weigh 100 tonnes had been moved many yards from its original location upstream.

A horse caught by the torrent near Keene Corner was found a great distance down the valley "literally torn to pieces". Eye-witnesses reported that the torrent bore before it all the trees in its path, so that it looked as though a forest was on the move. Some of these were buried in sand and rubbish far down the valley, while others covered a 20-acre field being piled up to a height of 25ft (7m). All eye-witnesses agreed that the noise was louder than the "loudest thunder".

Similar devastation by pent-up waters occurred in 1818 in Switzerland, when avalanches of impacted snow dammed a narrow pass containing the River Drance. A large lake was formed some 700ft (215m) wide and 200ft (61m) deep. Engineers had succeeded in draining off about half of the lake's water when the central section of the dam suddenly collapsed.

> ...the residue of the lake was emptied in half an hour. In the course of its descent the water encountered several narrow gorges, and at each of these they rose to a great height... sweeping along rocks, forests, houses, bridges... Some fragments of granitic rocks of enormous magnitude... were torn out of a more ancient alluvium and borne down for a quarter of a mile. One fragment moved was sixty paces in circumference. The velocity of the water... was thirty-five feet per second.[294]

Severe floods in Scotland during 1829 actually cut *new* ravines in local hillsides and transported huge sandstone boulders some 200 yards (185m) – one being dumped 6ft (1.8m) *above* the level of its original site[295]. The huge muddy floods resulting from the eruption of Mt St Helens in May 1980 caused similar effects:

> An avalanche of volcanic debris ploughed into Spirit Lake, forcing millions of gallons of water through the lake's outlet. The velocity of the lahar [surge] was estimated at 29–55kph... Seven of the eight existing bridges were destroyed. The muddy flow poured through two logging camps 20km downstream, flipping over heavy equipment... devouring a locomotive... Thick mud, logs, boulders and anything else in the path of the lahar were swept up, carried to 70km downstream and dumped into the Cowlitz River... About 39 million cubic metres of material reduced the 180m wide shipping channel of the Columbia River from its normal depth of 12m to a depth of 4,3m for a distance of 6km.[296]

At some places walls of mud and volcanic debris 195ft (60m) high were left behind, modern equivalents of the comparable 'Pleistocene' deposits discussed in Part One. All these examples repeatedly emphasise the erosional and excavatory powers of violently agitated waters and the sheer volume of torn-up and relocated debris they are capable of moving. In every case vast water pressures were involved.

The pressure behind the initial watery face of the Deluge must have been titanic. Until the final phase of their dispersion, when they had reached lower latitudes, these waters were irresistible. Such torrents easily demolished colossal pieces of the Earth's lithosphere and transported them great distances, irrespective of local geography. It plastered up 'drift' against hillsides facing north or north-west (surfaces opposing its direction of flow) and, as seen in Part One, rammed 'erratic' boulders into solid strata. Animal debris in numerous bone-caves and rock fissures were frequently forced unnaturally by the flooding into even the tiniest crevices and most tortuous passages, sometimes penetrating the Earth's crust to great depths at all kinds of angles. Only under immense water pressures could such effects have been produced – ice pressure could not accomplish them.

It is reasonable to infer that the external gravitational field responsible for 'heaping up' the Deluge waters in high latitudes acted similarly on Earth's internal magma tides. If so, this must almost certainly have caused crustal bulging (the lithospheric expansion suggested by Oppenheim) in the northern hemisphere, together with a northwards flow of the magma normally south of the equator. Geoidal deformation almost certainly resulted, such as Taira[297] and others have urged.

For almost one hundred years, numerous geologists and physicists have investigated this deformation as having been actual rather than theoretical. In 1889, Rudzki recognised major geoidal deformation as having occurred during the 'Ice Age'[298], while in 1939, Sauramo placed the event in late Quaternary times[299], the very period we are considering.

It has been widely recognised that this deformation was caused by the shifting of surface loads[300] and pressures[301], and with how far the flexibility of the lithosphere[302] contrived to cope with the creep-strength of Earth's mantle[303], and with the distribution of viscous matter deep within the Earth's interior[304]. The 'heaping up' of a large part of the terrestrial waters at one geographical point was a remarkable instance of the shifting of surface loads and pressures.

The rapidity of this 'heaping up' meant that the shifting of the loads and pressures, and the subsequent deformation, was equally rapid. The magnitude of the crustal dislocations caused by this deformation are thus more readily understood. However, with the dissipation of the external gravitational influences, both the magma tide and the 'water mountain' were released. This led to the magma establishing a new equatorial 'bulge' and the consequential readjustments of the crust to meet this new geoidal shape.

14
SCOUR

Bearing the above in mind, it is easy to understand how, in Cambridgeshire, England, ocean-sized masses of water wrenched out huge lumps of Cretaceous strata, 430yds (397m) long and 60yds (55m) wide, and redeposited them incongruously many miles distant upon Jurassic strata[305]; or how the weight and pressure of such watery masses so compressed and crushed rocks immediately underlying 'boulder clay' around Holderness, Humberside, that they now look as though a steam-roller had once passed over them[306].

The piling up of the Deluge waters to great heights in narrow spaces on encountering mountainous obstacles, as in the Alps for example, explains the deposition of huge rocks and great accumulations of gravel high on the flanks of infant peaks. These same waters banked up equally large accumulations of 'drift' against the lower slopes of the Himalayas, Andes, Altai mountains and other prominent ranges. Although this deposition was assumed to be the result of ice action, it is entirely consistent with water action on a stupendous scale, and supports the view of several authorities who argued for a *marine* origin for a large proportion of the 'drift'.

The passage of the Deluge waters across the landscape – from a north-south or northwest-southeast direction as the evidence previously presented consistently shows – was obviously a transient affair, but it was not entirely uniform. Traditions mention areas which escaped its ravages, and science has recognised such isolated refuges as well – albeit refuges from glaciation[307].

Numerous collapsed portions of the Earth's crust soon became basins for the new (present) seas and oceans, and the Deluge waters must have streamed off the newly-elevated land areas (the present continents) into these depressions.

The Deluge was also a powerful scouring agent. Thus, vertical polished rock faces on the *northern* side of Red Rock Pass, Alberta, were caused by water-borne pebbles carried tumultuously against them by exceptional water currents coming from the north. That the "...polished surfaces show southward flow into the Bonneville Depression"[308] merely lends credence to the ancient Chinese claim that the Deluge waters generally streamed south-east to drown great areas of land which had subsided in that hemisphere because "The whole Earth had tilted and sunk"[309].

Thus the scouring, scoring and polishing of rocks was, in many cases, caused by high-velocity water-borne debris of great depth and long continuous pressure, rather than by the conventionally-accepted glacial action.

The scouring effects of water upon land surface strata is often seriously underestimated. Many modern examples exist of cloudbursts achieving dire effects, such as the previously-mentioned 'moraine' found in Alabama last century, and the boulder debris which swamped Lynmouth, England in 1952. Dr Arkell described a similar event which occurred near Weymouth, Dorset, in 1955, when 11–12 inches (30cm) of rain fell on the adjacent hills in only 9 hours[310]. The cascading waters deepened, widened and cut new stream beds, scoured away entire hillsides and gouged out a crevasse almost 6ft (1.8m) deep in the solid chalk. Boulders, rubble, heaps of soil and uprooted vegetation were strewn everywhere.

If comparatively modest cloudbursts can produce such scour effects, the prodigious rains and the enormous aqueous movements associated with the Phaeton disaster must have denuded the landscape infinitely more acutely. Soil and softer surface deposits would have been removed from whole regions, to bury hillsides and entire valleys elsewhere.

Arkell regarded such downpours as:

> ...comparatively rare events that really mould the landscape... Lyell's principle of uniformitarianism... becomes credible only when it is realised that the 'exceptional' cloudburst is really part of the normal weather pattern, and, from the point of view of denudation, the important part.

In this context we suggest that the Phaeton disaster was also a 'rare' and 'exceptional' event, differing only from modern examples in its sheer scale and intensity. Accordingly, the violence of its action was correspondingly greater.

15
THE 'WOOD HILLS' OF THE NORTH

Enormous accumulations of sub-fossil and carbonised wood occur along the Arctic shores of Siberia, along the coastlines of the Bering Strait, and on various islands both north and south of that channel. Staggering amounts exist on many of the New Siberian Islands and, as we have seen, in the Alaskan 'muck' beds. The vast quantities of vegetable matter represent whole forests which have been obliterated and buried catastrophically. The constituent trees, which include sycamore, poplar, alder and sequoia, today flourish much further south, and represent a typical Miocene/Pliocene forest assemblage, evidently forming part of that flora which persisted more or less unchanged into 'Pleistocene' times, before being overwhelmed.

Before its submergence, it appears that Fennoscandia apparently bore luxuriant forests, for sub-fossil 'driftwood' now accumulates on the shores of several of its remaining fragments. On Koluguev Island, for example, pieces of this wood are regularly swept up from some now-submerged offshore source[311], while on Spitzbergen similar 'driftwood' occurs with whale remains several miles inland at least 30ft (9m) above present sea level[312]. Similar elevated inland locations for essentially identical 'driftwood' occur on many of the north Canadian islands, where the wood often lies embedded in steep cliff faces. At latitude 75°N on Banksland (Melville Island), for example, pine cones and acorns have been met with 300ft (92m) above the present sea level[313], and 'driftwood' occurs elsewhere on the island[314]. Fossil wood also occurs at a height of 1,800ft (550m) on Ellesmere Island, wood which surprisingly is of Siberian origin. It cannot be 'driftwood', because the north coast of the island is permanently ice-bound[315], nor can it have been transported glacially from Siberia, which has never possessed an ice-sheet of any significance, and sends no glaciers across the Arctic wastes to end at Ellesmere Island.

All across the northern Parry Islands (Melville, Cornwallis, Bathurst and Devon Islands) of the Queen Elizabeth group innumerable pieces of 'driftwood' and marine shells of 'Pleistocene' age frequently lie at heights well above the line of a supposed 'Pleistocene' submergence of those territories[316]. Many of the shells occur at quite extraordinary elevations, those on Somerset Island being 1,000ft (300m) above sea level. Others on the Fosheim Peninsula – where they occupy "several acres" – a thousand feet higher, and still others on the Grinnell Peninsula of Devon Island 2,300ft (700m) above sea level[317]. To account for their present occurrence, it has been suggested that the shells were pushed up to these elevations by a 'late Pleistocene' ice-sheet (the Laurentian)[318]. Except for Banks and Victoria Islands, this ice-field is widely alleged to have mantled the entire Canadian archipelago. As shown earlier, this is an erroneous concept.

As so often occurs when examining the wreck of the 'Pleistocene' world, the history of the Siberian tundra vegetation proves to be surprisingly complex, for the record there shows repeated changes between a cold, dry (steppe) ecology and a warm moisture-loving one. Further complications arise from the fact that a vast belt of trees, including lime, oak, elm and alder stretched at one time from the Ural Mountains in the west, through the Altai Mountains far into eastern Siberia[319]. The Ural and Altai ranges were among those which rose to their present elevations at the end of 'Pleistocene' times. The evidence implies that during the 'Pleistocene' period, a temperate *non-continental* climate existed across practically the whole of what is today southern Siberia, having no counterpart in that region today.

While trees today no longer grow further north than latitude 71°N in northern and north-eastern Siberia, their remains are consistently encountered for hundreds of miles northward towards the Pole. The story they tell is very impressive. Some of the most striking vestiges of these vanished forests were seen by Sannikov and Hedenström in 1806 during their discovery of the New Siberian Islands. They found there abundant remnants of enormous ancient forests. Many of the trees were still standing where they had grown, but others lay prostrate upon the perpetually-frozen ground[320]. Hedenström visited Kotelnyy Island, which lies at latitude 75°N, where he observed "remarkable wood hills" along its southern coast. Some of these 'hills' were as much as 180ft (55m) high and consisted almost wholly of the bituminous trunks of trees. On the summits of the 'hills' the trunks stood vertically with the tops snapped off.

Elaborating, another celebrated Arctic explorer, F R von Wrangell, said of these botanical graveyards, in which the bones of mammoths also abounded: "On ascending these hills, fossilised charcoal is met with everywhere... covered with a petrification which is so hard it can scarcely be scraped off with a knife"[321]. Lt Anjou visited these same islands on a later expedition and found the 'wood hills' extending for over 3 miles (5.2km) along the coast. He described the tree trunks as lying in clumps of fifty or more, often horizontally, and noted that the wood was friable, black in colour with a slight gloss, and how – like charcoal – it did not burn when lighted but merely glowed, giving off a resinous odour[322] At various neighbouring localities, other tree trunks, converted into a bituminous substance, lay in great horizontal piles alternating with sandstone layers containing tree stumps rooted *in situ*. Again, fossilised charcoal covered by ash, itself a petrification, was noticed everywhere[323].

In 1829, G A Erman went to Great Lyakhov Island, and was so impressed by the scene confronting him that the obvious cause of what had taken place was immediately apparent:

> On the summit of these hills (250–300ft high) [the trees] lie flung upon one another in the wildest disorder, forced upright in spite of gravitation, and with their tops broken off or crushed, as if they had been thrown with great violence from the south on a bank, and there heaped up... So it is clear that at the time when the elephants and the trunks of trees were heaped together, one flood extended from the centre of the continent... (and) may have poured from the highest mountains through the rocky valleys.[324]

The tremendous extent of these ancient forests can be judged from the occurrence on Maloi Island, in the Lyakhov group 100 miles (160km) to the south, of tree stumps *in situ* exactly like those on the New Siberian Islands, accompanied in some cases by leaves and cones. In Whitely's opinion they prove that "...when the mammoths and rhinoceroses lived in northern Siberia, these desolate islands were covered with great forests and bore a luxuriant vegetation"[325].

We venture to add that, when these 'Pleistocene' mammals roamed Siberia, the Lyakhov Island and New Siberian Island were not islands at all, but portions of the continuous land that stretched northwards from the present Asiatic mainland perhaps as far as the North Pole itself.

Further glimpses of the former flora of these northern islands were unearthed by Baron von Toll, who visited these regions several times between 1895 and 1902. One of his expeditions was to Great Lyakhov Island, where he discovered a totally frozen specimen of *Alnus fruticosa* – a member of the alder family – 90ft (28m) in length and complete with roots, leaves and fruits. Nearby were the remains of willow trees lying alongside the bones of mammoths[326].

These same forests extended over great expanses of what is presently the north Siberian mainland, for their remnants are found on the shores of inland lakes such as Lake Chastach. This lake lies on the tundra close to the River Kolyma, and "...every autumn throws up quantities of bituminous fragments of wood... the shore [being] covered to a depth of 2ft (0.7m)"[327]. Among the debris occur pieces of a solid substance like amber, considered to be the hardened resin of larch trees, but which, when burnt, failed to emit the odour of burning amber. Tree roots as fresh as if they had only just been severed from living trees, interspersed in black earth and ice-clay composing a cliff some 30–35ft (9–11m) high were found by Hedenström near Malaya-Kuropalasik-Vaga. The nearest living woods, however, were over 100 Russian *versts* (112km) distant[328]. Wrangell made similar discoveries in soil only a short depth below the surface near Kolymsk on the Chukchee Peninsula, and in cliff facing the Polar Sea. He described the permanently frozen ground there as containing "...a great measure of ice which never thaws, mixed with a little black earth and clay, amongst which are a few long thin roots of trees"[329].

Again, when Hedenström journeyed from the Indigirka River valley to Ulsiank, he observed:

> On the tundra, equally remote from the present line of forest, among the steep sandy banks of the rivers and lakes, are found large birch trees, complete with bark, branches and roots. At first glance they appear to have been well preserved by the earth, but on digging them up they are found to be in a thorough state of decay... the inhabitants of the neighbourhood use them as fuel, and designate these subterranean trees as *Adamovshtshina*, or of Adam's time. The first living birch tree is not found nearer than three degrees to the south, and then only in the form of a shrub.[330]

Herr von Ruprecht, who also travelled across Siberia, observed on the Chernoi Nos Peninsula, at the mouth of the Indiga River, where now only stunted birch bushes grow, upright rotten birch trees as tall as the average human being[331]. Nordenskiöld also noted under the tundra of the Yenisei valley large trees with their roots still fast in the frozen soil, although trees of the same type thrive today only much further south. Masses of 'driftwood' and mammoth bones occurred with these stumps[332].

Another interesting discovery was that of the shells of *Helix schrencki* which still retained *well-preserved colours*, near the mouth of the Awamka River in latitudes 68° and 69°N, and the finding by Prof Schmidt of the same mollusc with plant fragments in frozen freshwater beds below Dudinsk, latitude 77°N, well beyond the present northern limits of the trees. Speaking of his journey, Prof Schmidt informs us that: "On top of the tundra is often found Noah's wood and peat moss with *Planorbis limnaea*, and a large species of *Helix* which I have never found here alive"[333].

Apart from mentioning that the remains of vast sub-fossil forests of oaks and other trees occur near Novgorod and Tver in Russia, where living specimens cannot now grow[334], we should note that Erman ably summarised the distribution of the Siberian record as follows:

> It cannot escape notice that, as we go nearer the coast, the deposits of wood below the earth and also the deposits of bones which accompany the wood, increase in extent and frequency. Here, beneath the soil of Yakutsk the trunks of birch trees lie scattered, only singly, but on the other hand they form such great and well-stored strata under the tundras, between the Yana and the Indigirka, that the Yakadirs never think of using any other fuel than fossil wood. They obtain it on the shores of lakes, which are continually throwing up trunks of trees from the bottom... Thus, in New Siberia, on the declivities facing the south lie hills 200–300ft high, formed of driftwood; the ancient origin of which, as well as the fossil wood in the tundras, anterior to the earth in its present state, strikes at once even the most uneducated hunters. They call both sorts of wood *adamovchina* or adamitic things.[335]

Thus we find extensive areas within the Arctic Circle containing two kinds of fossil fuel – one which *drifted* to the places where it is now accumulated, and the second which plainly grew where it is now found. The distinction between these two types of timber dates from very early times in Siberia, where the former was called *Adamshina* (Adam's wood) and the latter *Noahshina* (Noah's wood)[336]. That this timber should be traditionally associated with the Noachian Deluge is of more than passing interest, particularly in view of the geologically recent occurrence of that disaster in a geographical region hosting the frozen carcasses of hairy mammoths and woolly rhinoceroses.

The consistently tumultuous manner of deposition of all this ancient timber, and the immense geographical extent of its remains, everywhere bespeaks of the sudden and violent demise of these huge forests. Likewise, the exceptional piling up at some localities, and the deep burial at others, of numberless trees could only have been accomplished on such a scale by tremendous water action wholly indiscriminate in its activities. The Deluge was just such an event.

But if the eventual draining away of the Deluge waters seemed to herald the end of Earth's ordeals, one more was yet to come – refrigeration on a grand scale.

16
Refrigeration

For almost 150 years it has been acknowledged that, geologically recently, Earth has undergone a cold period epitomised by glacial conditions in both the northern and southern polar latitudes. However, no satisfactory theory has yet been proposed which actually explains what *caused* the 'Ice Age' in the first place. There appear to be no terrestrial conditions, as we know them, capable of producing the heat necessary to evaporate vast quantities of water to form continental-sized ice-sheets.

As it was recognised that warm air and elevated land areas were necessary to produce ice and rime (frost), the recent inception of the Gulf Stream in the North Atlantic was invoked as one of the prime causes of refrigeration[337]. Some have even argued that the Deluge itself induced glacial conditions[338]. It would appear that the key to solving the so-called 'Ice Age' problem lies in the Arctic, where the evidence has been frozen in a macabre fashion. The deeply frozen trunks of trees still bearing leaves and berries, the refrigerated carcasses of mammoths, woolly rhinoceroses, musk-ox and other 'late Pleistocene' animals are preserved today in the same chaotic order in which they died and were deposited. They represent a unique picture of a former world coming to a sudden halt and remaining at that point until today.

As we have already mentioned, the demise of mammoths and other animals was not caused by the onset of glacial conditions, as many authorities would have us believe, for the evidence shows that they were, in most cases, already dead before they were abruptly frozen. Therefore, instead of a slow gradual freeze and build-up of glacial conditions over a prolonged period, as is generally proposed, refrigeration was remarkably sudden and unrelenting. This was another of Phaeton's legacies.

The factors which led to this sudden glaciation have already been mentioned in other parts of the book. However, in order to trace a coherent sequence in the events before us, they are briefly itemised below:

- The tilting of the Earth from its previous axis immediately turned the 'Golden Age' polar sub-temperate zones away from the Sun's heat;
- The waters of the world became 'heaped up' in polar regions;
- The induced tectonic changes caused massive volcanic discharges leading to 'collapsed sky' conditions. In high latitudes these conditions effectively blocked out sunlight and solar warmth at ground level in all regions for a very long time. This atmospheric pollution and the heat generated by crustal dislocations greatly increased precipitation[339] which fell as snow and sleet. In high latitudes, temperatures were thus severely reduced and held there for years due to a virtual perpetual night;
- After the release of the waters and the establishment of new oceanic and meteorological regimes, circulating warm currents (such as the Gulf Stream) created fog banks along polar and sub-polar coastlines. Enhancing the already-thick cloud cover blanketing those regions, this led to the formation of ice and rime. Furthermore, practically all land surfaces in these regions had been drenched, even waterlogged, by the Deluge, and this undoubtedly ensured the perpetuation there of a general refrigeration. In lower

latitudes, this waterlogged ground led eventually to the formation of numerous peat beds. Thus, the Deluge and the Gulf Stream indirectly contributed to the glaciation.

Bodies of former Deluge water trapped in valleys and depressions in high latitudes would have quickly frozen solid. Ice-cliffs and buried ice lenticles, as well as the strings and ribbons of ice accompanying biological debris in the Alaskan and Siberian 'drift' are surviving remnants of trapped Deluge water.

Glacialists supporting the conventional notion of alternating glacial and interglacial episodes have recognised the abruptness of both the beginning[340] and end[341] of the last glacial period in their scheme of events. Many authorities now hold that this was *swift* and *rapid*, two terms repeatedly used to convey the speed of first the ice build-up and, later, its dissipation. Lamb and Woodroffe, for example, have argued that after the inception of the last glacial period there was a "...swift establishment of ice over northern and north-western Europe, and over some extensive hinterland in North America... within 100–500 years"[342]. Others have suggested still shorter times[343].

The inception of Greenland's present ice-sheet, considered at some length earlier, has lately been attributed to massive 'post-glacial vulcanism[344]. We have repeatedly seen that Phaeton's visit abruptly generated severe vulcanicity around 11,500 years ago – a date strikingly close to that (11,000 years BP) now widely held to mark the end of alleged 'Ice Age' and the beginning of Holocene (Recent) times, when prodigious quantities of volcanic ash were deposited within the aforementioned Alaskan 'muck' beds enveloping countless diluvially-entombed remnants of late 'Pleistocene' animals.

The scale, extent and abruptness of this vulcanicity worldwide, and the attendant atmospheric pollution, was so great that the *inevitable* lowering thereby of temperatures globally, especially in high latitudes, was *automatically* rapid. Direct connections between widespread severe late 'Pleistocene' vulcanism and profound climatic changes (glaciation included) have been repeatedly stressed on previous pages and have formed the subject of successive studies by, among many others, Lamb[345], Hammer[346], Aubert de la Rüe[347], Nixon[348] and Pollack[349], and tie in closely with the swift environmental changes which, as noted previously, were prominent features of the Younger Dryas episode.

The great lenticles and ribbons of ice which locally penetrate the Alaskan 'muck' beds, just as they do in equivalent deposits containing similar organic remains in Siberia, were clearly frozen more or less at, or very shortly after, the actual accumulation of the beds. In other words, the freezing of these beds, the deposition of the volcanic ash layers within them, the slaughter of the innumerable animals they now yield, and the aqueous (diluvial) mixing of this assorted debris into chaotic 'muck' deposits was *extraordinarily* rapid. The singular evidence of the suddenly and permanently refrigerated animal carcasses found in both the Siberian and Alaskan deposits (see Appendix A) not only overwhelmingly confirms this but suggests that in at least those regions refrigeration was virtually instantaneous and occurred during the final stage of the Deluge phase of the giant calamity we are outlining here.

Most significantly, several writers have urged that the radical climatic changes of the so-called glacial and interglacial episodes are explained only by major vulcanism arising from discontinuous motions of disturbed crustal plates[350]. This is precisely what occurred at the time of the Phaeton disaster and in the period immediately afterwards. The disaster apparently set in motion a chain-reaction, with one set of effects leading inevitably to the next, and of which the latest and less severe are still being experienced today.

In our opinion, the growth of the present polar ice-caps did not lead to the development of the vast ice-sheets advocated by Geikie and Penck, but rather to a multiplicity of glaciers (many of very large size) on all the recently elevated plateaux and mountain ranges. These even formed on high land in tropical regions. Thus, glaciers descended Mt Kilimanjaro in Tanzania to 3,000ft (900m) *lower* than their remnants do today[351]. Others even then existed on the equator[352]. Worldwide, they represented what is now termed the Little Ice Age[353].

Between 11,500 and 7,500 years BP, these glaciers produced a massive rearrangement of many superficial 'drift' deposits, relocated detached boulders, left thousands of moraines and influenced climates locally. But not all moraines were or are necessarily of glacial origin[354]. Glaciers proceeded at different speeds depending on local conditions, sometimes retreating and re-advancing several times over the same routes. In doing so, they locally modified existing mountain valleys, fiords and hillsides, and carved out mountainside depressions such as cirques. Only very occasionally did they unite to form ice-sheets of limited extent. These actions did not cause the polishing, fluting, gouging or striation of rock strata which, though commonly attributed to supposed ice action during the 'Ice Age', were made during the Phaeton confrontation *before glaciation commenced*. Thus, while the ice-sheets so beloved of orthodox glacialists never really existed, the glaciers most certainly did. The glaciers of today are the last vestiges of a frigid era that ought more properly to be styled the 'Glacier Age' rather than the 'Ice Age'.

Obviously these glaciers did not all form at the same rate, for their growth depended on variations of snowfall, the latitude of their occurrence and the gradient of the hill or mountainside down which they descended. Scientists have calculated some reliable dates for the initiation and maximum expansion of several famous glacier (including the Mer de Glace on Mont Blanc and the Rhone Glacier), and these not only correlate with the 11,500 years BP date we have advocated for the Phaeton disaster, but show that the entire 'Glacier Age' occurred within the Holocene period. Incidentally, the date given for the great tectonic changes which occurred on Spitzbergen and neighbouring islands and for their *glaciation* is also Holocene[355].

It would appear that the conditions producing the growth of the glaciers were geologically of short duration and lasted until early historical times – say 6,000–7,000 years ago in Eurasia and as late as 3,000 years ago in North America. Thus, the terrible Fimbul winter of Norse tradition is quite credible, and is in keeping with the belief of the Aymara Indians of Andean Peru that, after the Deluge, the mightiest of the gods punished the wicked by throwing a coat of snow and ice over the whole country[356].

Even the Polynesians, now living in idyllic surroundings, have memories about early times when their gods and ancestors lived in severe wintry conditions. S P Smith noted that: "The Tongans have also a tradition of the ice-covered ocean, which they call *Taifatu*, which means the thick fat-like or congealed ocean, and which some of their ancestors had been in ages ago"[357]. And Brown observed that: "Most of the Polynesian gods and demigods of the underworld have indications in their careers of having come from a land of bitter winter"[358].

It is surely significant, therefore, that in the Babylonian *Talmud* a celestial body known as *Kimah* is described as the *source* of 'great cold'; and that an ancient Jewish legend states that a change in, or of, Kimah was *responsible for* the Deluge[359]. Kimah was regarded either as a planet or the constellation of the Pleiades, which, as the undermentioned details suggest, was a most interesting concept.

The ancient association of a period of intense cold on Earth with some celestial influence is also found in the Old Testament, which links the icy phase with the Pleiades and with *Mazzaroth* (alias Phaeton/Marduk), for we read:

Out of whose womb came forth the ice?
And the hoary frost of heaven,
who hath gendered it?

Table 5C

Phaeton's record compared: geological/biological, astrophysical and traditional.

Geological/Biological (factual) (all dated 'late Pleistocene')	**Astrophysical** (theoretical)	**Traditional** (memories)
Deposition of 'drift' and silt		Deposition of mud and gravel
	Change in atmosphere, Nitric acid formed and chemical reactions due to release of energy	Changed atmosphere - described as poisoned
Changed bio-ecological regimes		Changed biological regime
Changed polar axis	Change in polar axis of rotation Slowed rotational speed	Change in polar axis
Variable axial rotation - length of day fluctuates	Change in length of day, year and seasons	Changes in length of day and seasons
		Changes in position of polar constellations
Changed topography with: land elevation/subsidence, mountain elevation/subsidence, disappearance and creation of seas, desert formation		Land subsidence mountain elevation/subsidence disappearance of seas
	Noise from sonic booms and earthquakes	Deafening noise
Changed water levels		Drought
Conflagration in some areas	Rise in temperatures above boiling point of water	Tremendous fire and heat boiling seas, lakes and rivers
Destruction of flora and fauna		Destruction of animal life, withering of vegetation
Dust in the atmosphere	Atmospheric pollution: low cloud-cover in high latitudes	Rains of fire and dust - a collapsed sky
Flooding	Giant tides raised and pulled polewards - when released caused global flooding	Northward trend of water followed by world deluge
Geoidal deformation	Geoidal deformation	
Global crustal fracturing with: crustal shortening, expansion, inversion, overthusting, tilting, lateral displace-ments, coastal warping	Global earthquakes. Puncturing of crust produces violent explosions. Impacts cause low-presure areas leading to hurricane force winds	Earth cracks into great chasms Hurricane force winds
Magnetic reversal with: anomalous magnetic losses, anomalous magnetic trends	Magnetic reversal	
Massive lava/magma flows	Lava flows	Rivers of fire
Marine displacements		Tritonis, Han Hai
Period of intense cooling	Drop in temperatures globally due to vulcanism	Sun blotted out
Sudden onset of glacial conditions in northern hemisphere	Earth plunged into darkness for 5 years or longer depending on duration of vulcanism	Sudden arrival of glacial conditions and perpetual night
Uni-directional 'meteoric' fall in northern hemisphere		Falls of metal and stones
Uni-directional movement of huge 'erratics'		Movement of huge rocks
Uni-directional striation flow across northern hemisphere		
Worldwide vulcanism	Severe vulcanism	Widespread conflagration

> ***The waters are hid as with a stone***
> ***and the face of the deep is frozen.***
> ***Canst thou bind the sweet influences of Pleiades,***
> ***or loose the bands of Orion?***
> ***Canst thou bring forth Mazzaroth in his season?***[360]

Here, perhaps, is an indication of the celestial direction from which Phaeton arrived – from that of the Pleiades and Orion.

So in antiquity at least, the notion of great terrestrial cold was directly associated with significant celestial events and with a period of great darkness, and to have quickly followed a worldwide Deluge. These traditions, therefore, are not only consistent with one another, but also reflect the correct sequence of physical processes and effects traceable by scientific investigation. Furthermore, they also largely coincide with the theoretical propositions of astrophysicists respecting the probable effects sustained by Earth in the event of a close cosmic flyby. Table 5C gives a comparison of these effects. Surely such harmony between essentially disparate material cannot be fortuitous.

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Part Six

Phaeton's Legacy

1
AFTERMATH

In the days immediately following Phaeton's departure sunwards, the effects of the tremendous physical trauma which Phaeton had wrought on Earth were formidable and acute for practically every living organism that had somehow survived the catastrophe. The world's topography had been largely rearranged. Prior to the disaster, the general trend of the major landmasses appears to have been east-west; after it they were aligned in a predominately north-south direction – as is still plainly discernible today.

New mountain ranges and lofty plateaux had been upheaved, and deep gorges and huge fissures had come into being. Unimaginably large eruptions of magma, lava and other volcanic ejecta, including steam and gases, had attended these derangements. Former seas and lakes had been drained or drastically reduced – the displaced waters (the biblical Deluge) roaring as immense irresistible watery avalanches over the newly emerging landscape, as they sought new basins. Only the very largest obstacles withstood these churning torrents.

Where the waters had met heated rock surfaces and erupting lava or magma, violent explosions occurred, wrenching huge boulders and lesser debris from parent strata and hurling them great distances in all directions, as prodigious clouds of steam rose to drench and scald adjacent districts. In many regions, once the Deluge waters had drained away, countless boulders of every composition, size and shape dotted the landscape.

Astounding quantities of gravel, sand, clay, mud and silt had accumulated on hillsides – even on hilltops – and had spread over valley floors and across plains. Such old rivers as still existed now flowed along highly modified courses or in entirely new directions. Wholly new drainage systems, occasioned by the youthful topography, were the norm. In some places lakes and lagoons left by receding Deluge waters were extensive but shallow, and certain traditions describe how creatures of many kinds – and the ancestors of particular human tribes – crept or swam in them in their quest to find dry land[1].

Organic debris had been deposited in all sorts of localities. Intense water pressures had rammed these remains into fissures, crevices and the innermost recesses of tortuous caverns – totally without regard to the size or class of the organisms concerned. Gargantuan rafts of mangled vegetation lay here and there in thick banks as far as the eye could see, while, protruding through or lying upon the surface, everywhere, lay the corpses of animals of all kinds. These occurred singly, in small groups or as great assemblages congregated locally by arresting obstacles or trapped within newly-formed lagoons, dammed valleys, lakes or bogs.

Accordingly, the stench of death and decay must have pervaded many districts, especially in lower, warmer latitudes, where unpolluted water must have been rare and the risk of pestilence high for an appreciable time. The offensive odours eddying out from bone-caves (crammed with countless cadavers or dismembered parts thereof), and from the decaying banks of vegetation, must have been truly frightful in the weeks immediately following Phaeton's departure.

Precipitation (rainfall) would probably have been intense, particularly in high latitudes, due to the tremendous atmospheric pollution caused by the massive volcanic activity in virtually all hemispheres. This pollution would have enhanced the 'collapsed sky' conditions already established during Phaeton's visit, so that a gloomy shroud continued to envelop much of the Earth. This gloom, and the resultant progressively cold conditions in high latitudes due to a blotting out of sunlight and solar warmth at ground level, together with the rapid growth of glaciers and ice-fields, were vivid features of these dire early post-catastrophic days.

Certainly they are enshrined in ancient traditions and memories the world over: and these, very significantly, almost invariably place them shortly after the retreat of the Deluge waters and the passing of the main catastrophe.

2
The Survivors

While traditional descriptions of the Phaeton disaster reflect an almost identical pattern of events world-wide, great diversity exists in the ways specific groups of people are said to have survived that ordeal. Instantly recalled are arks, rafts, great canoes, uprooted trees and other floating objects. Yet, although these devices could at best accommodate only limited numbers of individuals – and some, like the tomtom drum of the Annamese hero[2] and the ball of rubber or pitch in the Pima Indian legend[3], could serve but one person. Those who entrusted themselves to floating objects feature in traditions as true Deluge-heroes.

Among these were people who deliberately constructed vessels (arks) before the onset of the Deluge – usually on the advice of others alleged to have superior or 'divine' advance knowledge of the impending disaster. Several widely scattered traditions refer to arks being built on mountains far inland[4]. And there were others who, perhaps ignoring clear signs and portents, or who were simply caught unawares, literally commandeered the first sizable floating object available to them when the disaster broke.

Another group of survivor legends gives mountain tops as sanctuaries or places where arks, 'swimming houses' or the like came to rest with the ebbing off of the Deluge waters. With the terrifying arrival of the Deluge waters, safety was probably instinctively sought on the nearest high ground. As we have already mentioned, there are accounts of mad, panicky scrambles up mountain sides by those hoping to avoid drowning[5].

It is noteworthy that several of the mountain-top survivors had, like those urged elsewhere to build arks and great vessels, received 'divine' advice to seek safety on particular peaks before the onset of the Deluge. In the well-known Greek story of *Philemon and Baucis*, for example, the righteous Phrygian couple were taken by the gods Zeus and Hermes to the top of a lofty mountain to escape the fate reserved for their fellow men, who perished shortly afterwards in a Deluge[6]. A similar account concerns two human pairs who became the ancestors of the *Sing-Pohs* of Assam. They had previously been urged by one of their deities to ascend Mt Singrabhum so that they might survive the Deluge[7]. The neighbouring *Lakhers* relate how their forefathers found asylum on Mt Leiparang during the same event. The name *Leiparang*, incidentally, signifies 'Old Earth' because the mountain, allegedly, was never submerged by the Deluge[8].

Sometimes 'divine intervention' was seen as occurring only after the climb to a mountain summit had been accomplished, the hard-pressed refugees (animals included) being offered sanctuary in floating vessels, as in a Lithuanian tradition[9]. This association of human and animal refugees crowding a Floodgirt mountaintop is similar to the Peruvian Deluge legend involving the Andean peak of Ancasmarca[10]. Similar beliefs were preserved also among Formosans and Polynesians[11].

Before leaving these fragments of prehistory, we should emphasise that the mountain-top survivors were seldom likely to see clearly the surrounding turmoil. Almost all the accounts describe a combination of driving rain, furious winds and a thick gloom which for a long period obscured the Sun, Moon and stars. The South American Caingang Indians described the darkness as 'pitchy' and as punctuated by howls, piercing screeches and other unearthly sounds[12]. These were presumably the peculiar sounds of hurricane force winds and possibly also of the passage through the atmosphere of still-falling cosmic debris.

Parallelling these flood traditions is another category recording how people and animals survived the disaster in caves. Many examples could be cited and in Part Three we mentioned the reactions of the refugees to the chaos and din that raged outside their sanctuaries. Elsewhere, we have mentioned bone-caves yielding the remains of sizable groups of human beings, as though those particular asylums had been ill-selected and their sheltering occupants overwhelmed by gases or tumultuous water action.

It is probably significant that most accounts indicate that caverns were sought more as protection from super-hurricane winds, conflagration[13] and cosmic bombardment[14], than from the subsequent Deluge. Given all the circumstances under discussion, it is obvious that deep caverns would have been ideal refuges from missiles and fire, but extremely dangerous shelters against rampaging water.

Some refugees became buried in caverns, as earth and rocks were piled up at the entrances by 'drift' borne by the Deluge waters. In Part Two we noted several instances of completely blocked-up bone-caves. Some groups, like the cruel race of the Tahoe legend, were entombed permanently[15], but others, like the Lenni-Lenape Indians of Delaware, tell how their forefathers were once buried in the Earth, but survived the ordeal by successfully digging their way out[16].

Probably the most complete memory of this kind is preserved amongst the Navajo Indians. It describes how:

> ...at one time all the nations – Navajos, Pueblos, Coyoteros and white people – lived together underground, in the heart of a mountain, near the river San Juan. Their food was meat, which they had in abundance, for all kinds of game were closed up with them in their cave; but their light was dim, and only endured for a few hours each day...[17]

Later they successfully dug their way to the surface, only to find themselves on the outside of a mountain surrounded by water. Shortly afterwards, the waters had ebbed away, leaving a sea of mud, and the legend continues:

> Then the men and the animals began to come up from their cave, and their coming up required several days. First came the Navajos... then came the Pueblos and other Indians... [and] lastly came the white people, who started off at once for the rising sun, and were lost sight of for many winters... When these nations lived underground they all spoke one tongue; but, with the light of day and the level of earth, came many languages. The earth was at this time very small, and the light was quite as scanty as it had been down below, for there was as yet no heaven, no sun, nor moon, nor stars.[18]

This remarkable narrative, which contains several elements repeated in various other independent cave-survivor legends, forms a graphic account of the burial of a remnant of early humanity with many animals in a cave on a mountain. What buried them is not actually specified, although it had blocked up the cavern's entrance with material that could be dug. The people evidently subsisted on the animals for a considerable time, during which not only did the cave remain mostly dark and gloomy, but so did the outside world. The absence of heavenly luminaries almost certainly relates to the 'collapsed sky' conditions prevalent then.

On eventually receding, the water left everything covered with wet mud, and this, after slowly drying out, apparently enabled various survivor groups to set off in particular directions. The reference to 'white people' who apparently wished to sever their association with the Indians, is especially interesting. It could be concluded from this action that they regarded themselves as belonging to a different race. It is surely pertinent that almost all traditions which refer to culture-heroes (virtually every one of whom was active *immediately* after the Deluge) describe them as white, tall, bearded and invariably superior to the aboriginal peoples among whom they appeared – often suddenly – to impart laws, crafts and useful information.

One such culture-hero, Caboy by name, allegedly brought the ancestors of the Brazilian Karaya Indians out of a 'subterranean world' following the Great Flood[19]. Elsewhere, another culture-hero, using a golden spade-like implement, dug Amerindian Deluge survivors out of a blocked-up cavern[20]. The hill tribes known as the Pankhoos and Bungogees, who inhabit the Chittagong area of Bangladesh, preserve a similar tradition. They recall how, after the recession of the Deluge waters "...their ancestors came out of a cave in the earth, under the guidance of a chief named Tlandrokpah[21].

The early post-diluvian activities of this superior culture-bearing white race are chronicled in numerous traditions distributed globally, but are regrettably too complex and important to discuss adequately here. They will, however, be fully considered in a later volume devoted to unravelling this now almost-forgotten era of organised endeavour.

Clearly, members of several different races sometimes took refuge in the same caverns or on the same mountain peaks, being as often as not complete strangers to one another. Such mixed gatherings were not expected, for, faced with an all-encompassing common danger, the sole aim of every individual must surely have been survival. Previous social considerations such as race, rank, gender or age, became meaningless instantly. It is, therefore, significant that echoes of precisely this scenario appear in the *Book of St.John the Divine*:

> And the kings of the earth, and the great men, and the rich men, and the chief captains, and the mighty men, and every bondman, and every freeman, hid themselves in the dens and in the rocks of the mountains.[22]

By its very nature the Phaeton disaster affected all men indiscriminately. Small cross-sections of pre-catastrophic society found themselves sharing common refuges and, those groups which somehow managed to survive, entered the post-diluvian world together, equally destitute, and bereft of basic necessities[23].

3
AN UNCERTAIN FUTURE

Many garbled and incomplete recollections have come down to us of the dismal period characterising earliest Holocene times. They describe not only the ever-worsening climate but humanity's general poverty and wretchedness. These deleterious after-effects of the catastrophe were catalogued by the Babylonians in the *Atra-Hasis*, their account of the Great Flood and its aftermath. In it, we read:

> The womb of the earth did not bear... vegetation did not sprout... people were not seen... the black fields became white... the

> broad plain was choked with salt... [and:] For one year they ate couch grass... for the second they suffered itch... the third year came – their features [were altered] by hunger.[24]

The reference to salt-choked plains is echoed on the other side of the world, when the Kwakiult Indians of British Columbia recall how:

> ...when the flood had subsided there was no fresh water to be found. They were nigh on dying from thirst, and chewed plants to obtain moisture. But then a great rain came, very heavy and very long, which filled the valleys with fresh water lakes and rivers, which have remained there ever since.[25]

The undrinkable character of the pre-rain waters are also alluded to in the *Bundahish.* This states that the "poison and venom of the noxious creatures" which had perished in the Deluge "were all mixed up in the water, and the waters became quite salt."[26] Elsewhere, the waters are said to have been made 'bitter'[27].

The Norse *Eddas* refer explicitly to terrible cold – the Fimbul Winter: "The mighty, the great, the iron winter..."[28] and the *Elder Edda* adding:

> ***The sunshine blackens***
> ***In the summers thereafter.***
> ***And the weather grows bad.***

According to the *Younger Edda*:

> ...as soon as the streams that are called *Elivogs* [the rivers flowing under the ice] had come so far... [they] ...turned into ice. And when this ice stopped and flowed no more, then gathered over it the drizzling rain... and froze into rime, and one layer of ice was laid upon another clear into Ginungagap... All that part of Ginungagap that turns north was filled with thick and heavy ice and rime, and everywhere were drizzling rain and gusts...[29]

Darkness and great cold were remembered everywhere as having reduced a great majority of human survivors to pitiable physical and mental states. A prayer addressed by the Mexican Aztecs to their god *Tezcatlipoca* evidently refers to this epoch and runs as follows:

> Know, O Lord... the men have no garments, nor the women, to cover themselves with, but only certain rags rent in every part, that allow the air and the *cold* to pass everywhere... With great toil and weariness they scrape together enough for each day, going by mountain and wilderness seeking their food; so faint and enfeebled are they that their bowels cleave to their ribs, and all their body re-echoes with hollowness, and they walk as people afrighted, the face and body in likeness of death... they draw a rag over them at night, and so sleep; there they throw down their bodies, and the bodies of the children thou hast given them. For the misery that they grow up in, for the filth of their food, for the lack of covering, their faces are yellow, and all their bodies of the colour of the earth. They tremble with *cold,* and for leanness they stagger in walking. They go weeping and sighing, and full of sadness... though they stay by a fire, they find little heat.[30] (Our italics).

Many were obliged to eat whatever they could find. Food must have been mostly recently-annihilated plants and animals, and many survivors must have died then as much from food poisoning as from cold and hunger. Fresh food was undoubtedly scarce or non-existent in many regions, and several districts must have remained uninhabited, and uninhabitable, for decades.

Different effects were experienced in warmer latitudes, but even there the prevailing damp allegedly turned such food as then existed mouldy[31].

In the *Ten Stems*, an ancient Chinese work, which divides world history into ten periods or stages, we read: "At *Wu* – the sixth stem – the Darkness and the Light unite with injurious effects – all things become solid (freeze into ice), and the Darkness destroys the growth of all things. At *Kung* – the seventh stem – the Darkness nips all things."[32] Another ancient Chinese record, the *Twelve Branches*, similarly reports: "*K'wun-tun* stands for the period of chaos, the cold midnight darkness. It is said that with it all things began to germinate in the hidden recesses of the underworld."[33] In the *Ten Stems* we learn, similarly, that: "At *Jin* – the ninth stem – the Light begins to nourish all things in the recesses below."[34] These would seem to be references to the germination of seeds and plant roots swept by the Deluge waters into caves and fissures.

After the Phaeton upheaval people's diet differed appreciably from that which had prevailed previously. In *Genesis* there is more than a hint that antediluvian Man was vegetarian:

> And God said, Behold, I have given you every herb bearing seed, which is upon the face of all the earth, and every tree, in the which is the fruit of a tree yielding seed; to you it shall be your meat.[35]

The same source then informs us that, following the Deluge, God said to Noah and his family:

> And the fear of you and the dread of you shall be upon every beast of the earth, and upon every fowl of the air, upon all that moveth upon the earth, and upon all the fishes of the sea; into your hand are they delivered. Every moving thing that liveth shall be meat for you.[36]

In other words, post-diluvial people became omnivorous by being obliged to eat meat. Ancient Chinese annals mention the same thing: "At first even the rulers dwelt in caves and desert places, eating raw flesh and drinking blood"[37]. Not improbably, this memory refers to the consumption of animal carcasses, when rapidly-falling temperatures in high latitudes might have permitted meat to remain edible for an appreciable time. The description of the flesh as raw certainly suggests this. We should not forget that frozen Siberian mammoth meat is known to have been devoured in historical times by wolves and human beings (see Appendix A).

That dead meat was indeed eaten is indicated elsewhere in *Genesis*, which mentions how God instructed Noah: "But the flesh with the life thereof, which is the blood thereof, shall ye not eat"[38]. This was an injunction that *living* animals were not to be eaten: survivors of animal populations decimated by the catastrophe were to be left to multiply and replenish stocks.

That meat eating became a necessity for many Deluge survivors is clearly implied in the following account of how searches for plant foods proved unsuccessful:

> They sought for food everywhere. For nine days they roamed about, but found none such as they used to eat in Paradise. 'We used to have angels' food then', they complained.[39]

Occasionally, people seem to have supplemented a meat diet with other food. Charred ostrich eggshells, radiocarbon-dated at 10,720 ±132 years BP, found in a rock-shelter in Tanzania[40], suggest that eggs and perhaps birds were eaten in those difficult days.

Meat eating usually meant the removal of the animal's hide or pelt. Several traditions describe how some superior race (the Sarku?) made garments from these skins for the less expert survivors of Adamic humanity. *Genesis* greatly simplified these relationships, where the superior race is represented by God and the needy survivors by Adam and Eve[41].

This suggests that the making or wearing of garments had been rare among ordinary antediluvian humanity, accustomed to equable 'Golden Age' climates, and that they lacked the knowledge to manufacture clothing. Nevertheless, one early cave drawing of a clothed individual evidently dating from the period under discussion shows that unexpectedly sophisticated garments were made then and could only have resulted through long familiarity with clothes-making generally. Yet the production of such attire required not only particular skills but also tools – and tools were probably in short supply during those wretched times.

Nevertheless, some implements did exist even in those desperate years, and were presumably made by pre-catastrophic peoples familiar with their manufacture and use before the onset of the Phaeton disaster. Very well-made curved bone sewing needles having small eyes, attributed to the Solutréan culture, existed in France as far back as c20,000 years BP. These indicate that fitted garments, probably of skin or leather, were made at a surprisingly early stage.

Solutréan arrowheads and knives are also beautifully made, and it is hard to imagine that they were produced by barbarian peoples groping for survival. On the contrary, they evince every sign of having been produced by well developed, long established techniques.

The references in traditions and ancient sagas everywhere to the dreadful physical conditions and general poverty during early post-catastrophic times have no real meaning, of course, unless the situations described actually once existed. Very significantly, however, those situations are precisely those which can be expected to have followed global disruption on the scale of the Phaeton disaster. The future of humankind at this time was unquestionably very uncertain.

4
THE STONE AGE ARRIVES

Early post-diluvian social degradation was almost certainly occasioned as much by lack of adequate tools as by adverse physical and climatic conditions. Indeed, such degradation was exacerbated not only by an absence of tools but, in some communities, by an actual ignorance of tools.

Knowledge of tools amongst early post-diluvians depended upon whether individuals had formerly belonged to the apparently small ruling class or to the seemingly large semi-ignorant masses: semi-ignorant because, although many had doubtless seen the great antediluvian buildings, large boats (arks included), irrigation systems, pottery, metallic utensils and weaponry specifically mentioned in innumerable traditions, they had not themselves designed, built or used those inventions, and few possessed the skills to do so. But what firm evidence is there that such diverse artificial creations existed before the Phaeton disaster? After all, we are referring to a period 11,500 years or more ago, and which orthodox history views in a very different light. Strangely enough, there is quite a large corpus of evidence, both circumstantial and factual, indicating that civilised communities existed on Earth before that shocking calamity.

Many of the previously-cited traditions refer unmistakably to various antediluvian structures (for example, houses, temples, towers, canals), land vehicles (carts, chariots), aquatic vessels (rafts, canoes and arks) and implements (ploughs, bows, arrows, spades). Elaborating on this theme, Bellamy has pointed out that:

> Many myths tell of tools having been saved more or less accidentally (quite apart from the elaborate ark myths, some of which even describe the salvage of a lot of quite unnecessary odds and ends). In various North American Indian myths fire-drills are mentioned, in others stone implements, pots, bows, jewellry are reported to have been saved. Some myths say that the people who had escaped on rafts, and had saved certain personal belongings, believed that the waters would

> never subside unless they sacrificed something from their store. Such saved tools were frequently stolen from their owners, probably because of their efficiency, though the myths usually stress the 'magical' properties of the 'other-worldly' implements.[42]

Scholars have either ignored or dismissed these essentially circumstantial references as fanciful or allegorical devices. Latterly, however, the same material has been adopted by writers who, possessing scant knowledge and lively imaginations, have concocted outrageous hypotheses purporting to identify culture-heroes as prehistoric astronauts and the various artefacts as the products of their supposed technology. Viewed individually, none of these intriguing references is either important or verifiable. Assessed collectively, however, they form a recurrent theme in the symphony of traditional world history, and as such increase in significance. Nevertheless, they will forever remain scientifically worthless without supportive material evidence, and it is only when we consider physical artefacts that they acquire *any* value.

Among the physical evidences for exceedingly early civilisation are the innumerable stone walls retaining agricultural terraces on the slopes of the Peruvian and Bolivian Andes. These occur at several places well above the present line of perpetual snow, where cultivation is no longer possible. Unless much warmer climates occurred here relatively recently they can only have attained their present elevation when the mountains were upheaved. As noted previously, the latest uprise of the Andes occurred at the close of the so-called 'Pleistocene' times, about 11,500 years ago.

Cyclopean stone ruins now 13,000ft (4,000m) above sea level at Tiahuanacu, SSE of Lake Titicaca, and apparently similar lithic structures on islands in the lake, seem to be equally ancient[43]. Their enormous size and extent testify eloquently to markedly different environmental conditions and population densities throughout that region in the distant past. Commenting specifically on the Tiahuanacu ruins, but in terms equally applicable to all these ancient stone structures, Sir Clements Markham once observed:

> The city covered a large area, built by highly skilled masons, and with the use of enormous stones. One stone is 36ft long by 7ft, weighing 170 tons; another 26ft by 16ft by 16ft. Apart from the monoliths of ancient Egypt, there is nothing to equal this in any other part of the world. The movement and placing of such monoliths point to a dense population, to an organised government and consequently to a large area under cultivation, with arrangements for the conveyancing of supplies from various directions. There must have been an organisation combining skill and intelligence with power and administrative ability.[44]

The undoubtedly genuine discovery, noted earlier, of a carved figurine at a great depth under 'Pleistocene' lava near Nampa, Idaho, represents the handiwork of some very early cultured race. So, also, do the well-made granite dishes in undisturbed auriferous (gold-bearing) gravels containing the remains of typical 'late Pleistocene' plants and animals (including the celebrated Calaveras skull), far below the surface in California. As argued previously, all these artefacts are very ancient indeed. So are the following.

Vessels of vesicular basalt were obtained in 1880 from gravels also yielding bones of the extinct giant ground-sloth *Mylodon*, near the Klamath River, California.[45] Many comparable finds from the same Californian gravels were listed by Dr James Southall in 1882 and are collectively of much interest. These include a mortar found 150ft (46m) below the surface in gravel capped by volcanic deposits at San Andreas; a triangular polished stone hatchet 75ft (23m) below ground level 300ft (90m) inside a mine tunnel penetrating Table Mountain; many stone dishes, pestles, mortars and other carved lithic utensils found along with bones of elephants and mastodons at a place called 'Murphy's' in Tuolumne County; and numerous grooved discs, mortars, and other stone objects at various depths in gravels subjacent to volcanic deposits in the same district[46]. The curious grooved discs were investigated in a special study by Dr Eberhart in 1961[47]. The unknown makers of these artefacts also used a circular vessel having three legs and a spout made of lava, 'hard as iron'.

By 1888, as many as 300 stone mortars had been found in undisturbed gravels capped by basalt at Cherokee in Butte County, California. Interestingly, these gravels were deposited by an ancient river pre-dating the present, quite differently oriented, river system there, and have even been observed on the very *summits* of neighbouring mountains 6,000ft (1,850m) high. Geologists have assigned them to either 'Upper Pleistocene' or 'glacial' times[48]. Still more stone objects, including bowl-shaped mortars, graceful sandstone pestles, serpentine cups and steatite tobacco pipes, have been retrieved from considerable depths in these gravels near Santa Barbara, California[49], while essentially similar stone bowls, often very well made, have been dredged from so-called 'late Pleistocene' deposits off the Californian coast[50]. It is very significant that these gravels and volcanic beds occupy the valleys indenting the flanks of the Sierra Nevada and Sacramento Valley[51], which exhibit many geological features (*eg*, striated and polished rock surfaces) conventionally ascribed to former glacial action but which we contend were products of other agencies acting tumultuously at the time of the Phaeton disaster.

Particularly telling evidence of very early cultured endeavour came to light in 1940, when Dr Asbjourn Ousdal – a dental practitioner and amateur fossil collector – unexpectedly discovered an inscribed bowl in a block of solid sandstone near the summit of a hill in the Santa Barbara range. Part of the rim of this bowl, illustrated here for the first time (fig 6.1), bears strange, elaborate and carefully executed script-like signs or decorative devices. In considering the great antiquity of this relic, we should recall: a) the previously-mentioned stone utensils in the Santa Barbara gravels; b) Dr Bower's report on the bones of cetacean and other marine mammals in Pliocene deposits (later identified as 'Pleistocene') met with "...especially

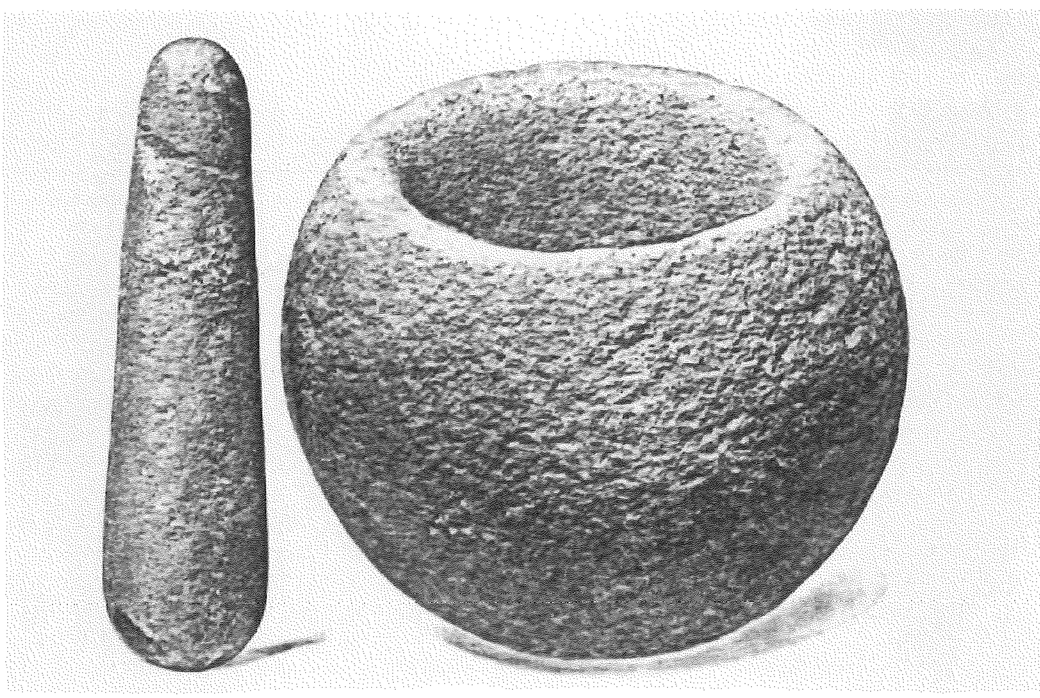

Fig 6.1. Mortar and pestle found in gravels in California. *Courtesy of Geological Society of America.*

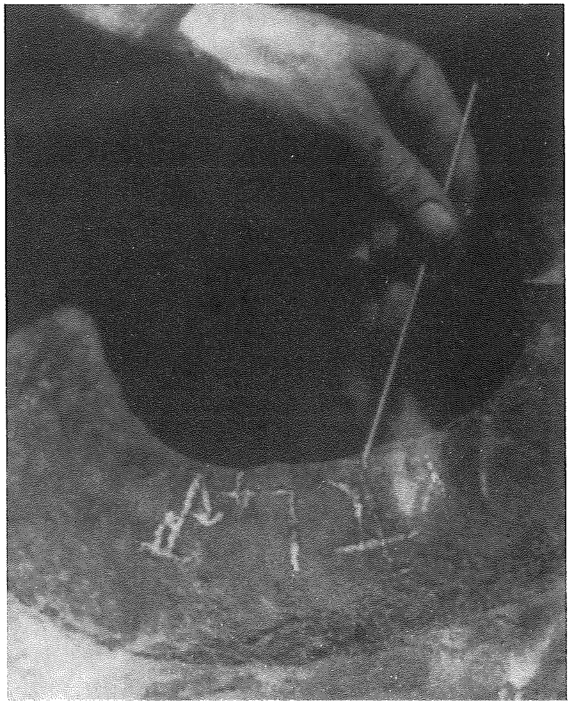

Fig 6.2. Prehistoric inscribed bowl, Santa Barbara Range, California.

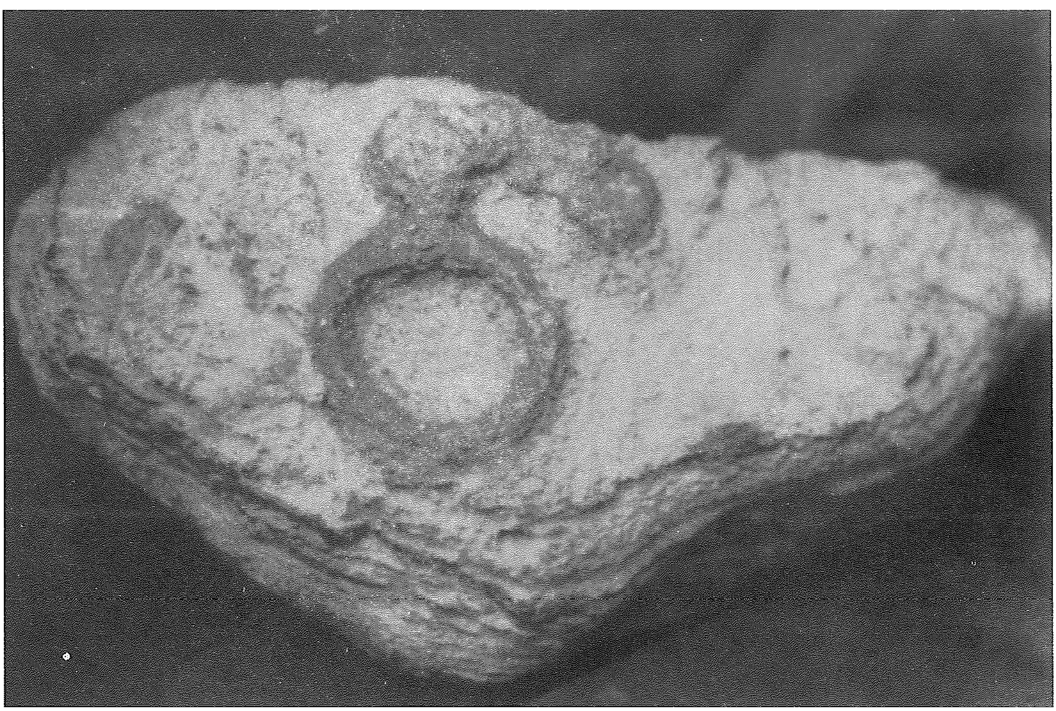

Fig 6.3. Prehistoric iron chain.

along the sides and crests of the Santa Paula mountains..." and the hills just north of Buenaventura[52], near the Santa Barbara range; and c) that the sandstone enveloping this bowl had been upheaved with the hill of which it was a part.

Equally noteworthy is the portion of an iron chain accidentally discovered in solid sandstone exposed in the side of a deep ravine, at the junction of Clark and Nye counties with the California stateline, by the late Frederick G Hehr of Los Angeles during 1952. Hehr, an artesian well specialist, collected the curiosity and supplied the photograph of it, published here for the first time (fig 6.3). The sandstone lay 37ft (11m) below the rim of the ravine wall – a rather modest depth compared to the 184ft (56m) at which undoubted fragments of a paved road or causeway which were found by Hehr, protruding from a canyon wall 13 miles (21km) SSE of Lake Owens, westward of the notorious Death Valley, California[53].

No less interesting is the copper coin-like object (fig 6.4) discovered at Lawn Ridge, Illinois, last century, described by Prof Alexander Winchell in 1881[54]. So, too, the copper knife found close to a much-decayed Mastodon leg-bone, 5–6ft (1.6m) below ground level in *undisturbed* 'drift' gravel near Stirling, Illinois[55].

Before leaving North American evidence, of which much more could be cited, we should mention the beautifully-fashioned plummet-like object of sienite discovered 30ft (9.2m) below ground level during the sinking of a well at Woodbridge in the San Joaquim Valley, California. Embedded in *undisturbed* Pleistocene gravel, the object was so expertly ground and polished that Prof Foster considered it to be "...an exhibition of the lapidiary's skill superior to anything yet furnished by the Stone Age of either continent"[56]. The implement had been drilled by a process which, instead of producing a uniform gauge, resulted in a rimmed aperture, the rimming having been started from each end. Such technological accomplishments bear eloquent testimony for the existence of a civilized race at this early time.

But if the foregoing fails to impress as certain evidence of wide-ranging technical ability before Phaeton's visit, how does one view

Fig 6.4. Copper coin, found buried 114ft underground in Illinois.

the ruins of a well-made village at Jarmo, 30 miles (48km) east of Kirkuk in north-eastern Iraq, where charcoal samples have been dated at 11,200 ±200 years and 11,240 ±300 years BP respectively?[57] The village itself is apparently at least as old as, if not older than those dates. The capacity to build such a village so soon after the inferred date of the Phaeton disaster was only possible if knowledge of organised construction and the requisite skills to effect it already existed amongst the builders. These must have been catastrophe survivors, or their immediate offspring, possessing a tradition of building techniques.

Larger relics, such as the buried remains of large well-formed boats or ships, probably coeval with at least some of the aforementioned artefacts, have occasionally been encountered at various depths in 'drift' deposits. As these ships, which have been discovered in Peru[58], Switzerland[59], Russia[60], and South Africa[61], occur either in *solid* stone or at remarkable depths underground, and are unquestionably of great antiquity, reasonable grounds exist for regarding them as vessels which were probably overwhelmed and buried during the Phaeton disaster. Statements like those of the Mandan Indians, who aver that shortly after the Deluge their forefathers were visited by a mysterious bearded white culture-hero who arrived in a huge wooden ship made with 'metal tools'[62], appear as valuable if fragmentary confirmation of prehistoric technological abilities.

Not improbably, therefore, a great cross-section of antediluvian artefacts and useful objects lay strewn about the post-diluvian landscape some 11,500 years ago, often partly buried or obscured by sediments, fallen rock or erupted lava, and no doubt frequently cracked, broken or otherwise damaged. Many, in fact, must have been irretrievably damaged and were unusable. More elaborate objects – even if broken – may still have yielded useful components (*eg*, cogs, nails, *etc*) or simply useful flat surfaces or sharp edges which could be salvaged and adapted by those who knew how to do so.

Ignorant and semi-ignorant individuals would have remained unaware of the potential value of such debris, although occasionally they may have preserved such items as 'sacred' or 'magical' relics of a lost and much greater past. In this way quite mundane objects may have come to be worn outlandishly as amulets and charms. On the other hand, more knowledgeable individuals would have been near-ecstatic at finding, say, an intact bowl, a knife, a cut plank of wood or even an isolated brick.

In the very earliest post-diluvian days, many human corpses would have been found with at least some of their clothing still on them. High latitude survivors, facing rapidly cooling climatic conditions, would doubtless have had no compunction in stripping wearable garments from the dead. Living animals with hides and pelts were rare and, without cutting instruments, difficult to skin and harder still to flense properly, even if successfully parted from their original owners. Where they occurred, sharp edged stones must have been among the very first objects used to cut and pound raw flesh, cut off skins and furs, sever small branches from the multitude of smashed trees and other botanical rubbish littering the countryside or washed-up as great mats and rafts along beaches or choking creeks and backwaters.

Flatter stones must have served as the first hammers and mauls, being utilised to crack open animal bones and drive in stout branches around which the earliest artificial windbreaks must have been constructed. Certainly the salvaging of all transportable timber must have been an early activity of post-diluvian Man, for these plants simultaneously afforded fuel (and therefore warmth), building materials for both permanent and portable refuges, enclosures, mating, fibres and weapons, to name just a few uses.

Through necessity, stones – in many places the most common objects on the surface of the ground – began to be used for all kinds of purposes, and a whole new culture developed with the use and adaption of stones as the underlying motive. Hesitantly at first, and certainly crudely, stones began to be employed as tools, utensils and weapons, with refinements gradually added to the earliest stumbling adaptions. The 'Stone Age' had arrived.

5
A New Beginning

Catapulted into the unfamiliar, often hostile, Younger Dryas world generated by Phaeton's visit which contrasted so markedly with the previous 'Golden Age', the surviving remnants of humankind faced what, in effect, was a new beginning. The prehistoric (Pliocene/Pleistocene) world had gone and a new, historic (Holocene) world had just dawned.

Initially, the enforced degradation and vastly depleted population of the survivors would combine to retard people's progress for decades, even centuries. Relocation to more favourable localities became an early priority, especially for survivors who at first found themselves in high latitudes. Accordingly, great treks to more benevolent regions were undertaken, the participants learning *en route* how effectively to utilise the smallest item to their common advantage. The seeds of nomadic lifestyles were born then. People had to adapt or perish.

Organised re-peopling and husbandry assumed special urgency then, as did the remarkable civilising activities of the aforementioned mysterious white culture-heroes of global tradition. Certainly grassy steppes were among the first of the re-vegetated regions occupied by the early survivors. There, pastoral communities developed and bred horses, cattle, sheep and goats, which were in time moved systematically from one suitable locality to the next as pastures were eaten down and left to regenerate. A wandering nomadic existence became the norm for many survivor groups, and, as Prof Scott-Elliot long ago pointed out:

> ...the point... of most importance to us here is the effect of this sort of life in producing not only breeds of cattle, sheep and goats capable of looking after themselves without much assistance, but also a kind of person of a totally new character. There must have been, as soon as this sort of life became possible, an extraordinary increase in population. Both people and animals would multiply with extreme rapidity in a practically unlimited ranch such as were the steppes in this early period. The life was healthy enough, though dirty and restless... The mere fact of living in company involves... invaluable discipline...[63]

In warmer latitudes, where collapsed sky conditions and persistent bitingly cold winds were either less acute, infrequent or non-existent, re-vegetation of the new landscape would have proceeded with surprising rapidity, especially in regions extensively covered by freshly deposited muds heavily charged with organic remains and nutritious mineral and volcanic debris. Seeds, cones, pollen and spores buried in such deposits must have germinated comparatively quickly in such regions with highly beneficial results. Modern studies of botanical regeneration in flood-afflicted regions, so intimately governed during Younger Dryas times by often severe climatic fluctuations both north and south of the equator[64], themselves induced by an unstable, wobbling Earth, strongly support the high probability of such developments[65].

Such herbivores as had survived would have naturally gravitated towards botanically revitalised areas, and the same would also have been true of many types of birds and insects. Reptilian and amphibian survivors, on the other hand, could have re-established themselves and multiplied only *in* warm latitudes.

Developments like these in equatorial areas would have been strong inducements to human survivors aware of them to reach and settle such regions to partake of, and perhaps harvest, the varied life already beginning to proliferate there. This reaction apparently also extended to the settling and exploitation of equatorial, subtropical and warm-temperate marine and lacustrine coastlines and their offshore waters. Numberless early Holocene 'kitchen' middens, containing the remnants of vast numbers of fish-bones and edible molluscs are known from many parts of the world, attesting to the attraction such localities and life-forms had for hard-pressed humanity. In South Africa, for instance, early Holocene communities evidently subsisted on shellfish over a very long span of time[66], the duration of which can be gauged from the significant changes observable in the isotopic record embodied in the mineralogy of shells obtained from different levels within specific middens accumulated then[67]. Essentially identical records have now been traced for the same period almost worldwide.

As we have previously noted, environmental changes like this were rather characteristic of Younger Dryas times. But of all the changes which took place then, two in particular were especially critical, and unquestionably influenced a great deal of early Holocene human activity. Apart from the aforementioned high winds and thick cloud cover in high latitudes (collapsed sky conditions), ice-caps began to form around earth's relocated poles, as much as a result of Earth's new axial tilt as of the persistent cloud cover itself. An ice-cap began to form and expand across what today is Antarctica, with concomitant climatic effects across much of the southern hemisphere.

In warmer latitudes, innumerable glaciers developed in the majority of upland regions everywhere – even in the tropics[68] – and continued until the onset between seven and eight thousand years ago of warmer conditions. These caused their general recession and, in many cases, disappearance. In turn, the melt-waters resulting from this widespread diminution of glaciers served to raise world sea levels, with subsequent further effect upon climatic regimes. The release of so much additional water then also contributed to the natural rearrangement of much of the original 'drift' deposits, reducing these in many places to the valley and river-terrace sands and gravels of present times.

All these developments were further legacies of Phaeton's visit, just as are the present day climatic vicissitudes – transient but calamitous local flooding, sudden landslides and the multitude of isolated seismic and volcanic disturbances. As Wigley[69] and Lamb[70] have so ably pointed out, these and other environmental factors have had a pronounced influence of the development of Holocene people, their thoughts and industries, so that, in a sense, we are still combating and experiencing the last-gasp effects of the Phaeton disaster itself, insofar as those affect our home planet, Earth.

That the Phaeton disaster proper marked the single most momentous point in intelligent humanity's history so far – the Deluge of global tradition representing our most abiding memory of it – can surely no longer be doubted. Earlier scholars who, using the Deluge as a critical datum, scheduled ancient events as either *ante-* or *post-*diluvian were, despite some of their quaint and often spurious arguments, essentially correct. To be more accurate, however, we should perhaps henceforth classify humanity's past history as either *pre-* or *post-*Phaetonic.

This is a possibly startling yet eminently defensible proposition, in which the celebrated Ice Age largely vanishes, and the associated Pleistocene period shrinks to become an event which, though appallingly violent worldwide, was actually of surprisingly brief duration. Evidence – much of it of *recent* discovery – repeatedly demonstrating these propositions is not only numerous – itself a most impressive point – but truly interdisciplinary and of a genuinely global scope. Certainly the collective message transmitted by this evidence cannot be justifiably ignored or side-stepped any longer.

Yet, despite all the foregoing, the story of the Phaeton disaster remains unfinished. For obvious reasons the present outline of that event's terrible character and effects is inevitably incomplete and uneven, for much additional evidence supporting its former reality undoutedly awaits discovery.

There can be no question that future research and discoveries will markedly enhance some of the many aspects still traceable of this remarkable event or will, with equal incisiveness, modify or even negate others advanced on earlier pages. Nevertheless, the story's main fabric will not fall; the prolific evidence adduced in support of it is too wide-ranging and incontrovertible to permit that.

In the light of recorded knowledge, therefore, our presentation of the time when *Earth Nearly Died* actually consists of little more than a preliminary study of an infinitely greater puzzle, en route merely stressing vital links, important hints, apparently endless ramifications, and suggesting various line of further enquiry. The field affected is unquestionably immense, and countless future researches will be undertaken before the full extent of this awesome event will be revealed in all its towering majesty.

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Appendix A
Refrigerated Mammoths

Before the Phaeton disaster, much of the present Arctic region was covered with forest-steppe vegetation – forests interspersed with grasslands – maintained by moist, mild climatic conditions typified by an annual average temperature at least 10°C, much higher than today. Prodigious herds of herbivores roamed the area and depended heavily on this vegetation.

When the catastrophe occurred, animals and plants alike were destroyed as the climate was changed drastically. The location of the poles altered and the Arctic region, cut off from the heat of the Sun, was plunged into a prolonged night of devastating cold. Temperatures there dropped almost immediately below –40°C, and perhaps eventually to –71°C, which is that of the present 'Cold Pole' in Siberia. Chronic volcanic pollution of the atmosphere worldwide not only accompanied this axial shift but also greatly accelerated this tremendous (and permanent) drop in temperature. Large scale watery displacements also occurred in these latitudes more or less simultaneously.

The intense refrigeration was unquestionably sudden, *very* sudden. All observers have commented upon this inescapable fact. It froze the ground solid, turned lake and ground water into great lenses of ice, and froze dead and dying animals and plants throughout the region into grim memorials which have survived, unchanged, in that condition, down to our own day. Among these have been the frozen carcasses of mammoths, woolly rhinoceroses and their large contemporaries.

It is the physical state of the flesh of these frozen cadavers which provides evidence of the astonishing suddenness and completeness of this refrigeration. Digby, in his book about Siberian mammoths, quotes Herz as describing mammoth flesh as "...fibrous and marbled with fat", and as looking "...as fresh as well-frozen beef"[1]. Excellent soup has been made from the meat of some frozen mammoth carcass, and the meat itself, apparently, was cooked and eaten[2].

This deep refrigeration, therefore, did not seemingly destroy the flesh of these animals, even though Merryman and others have contended that sudden, intense freezing would probably destroy the constituent cells. Merryman cites Lovelock as opining that –5°C is "...the lowest temperature to which mammalian cells may be slowly frozen and still survive"[3]. Others, however, have disputed such statements[4], and it is clear that the evidence of these frozen Siberian carcasses does too.

It is important to note that these mammoth carcasses represent healthy well-nourished individuals. They do not belong to very old, degenerate or starving animals as some have maintained. Indeed, a deep-frozen six month old baby mammoth carcass found in 1977 was so perfectly preserved that analyses could be made of its blood and protein, and its tissues were used for genetic studies. Interestingly, the date suggested for its demise was about 12,000 years BP[5]. This is within the 14,000–9,000 years BP period assigned on the basis of other C^{14} datings for the general extinction of mammoths in the Arctic[6], and relatively very close to the date of the Phaeton disaster advocated in this book.

According to professional opinion, to freeze a warm-blooded mammal the size of a mammoth requires a temperature of below –30°C to –40°C. This temperature is needed in order that there is no injury to the cellular tissue, and that the physio-chemical and enzymic reactions are halted – there is no question of the freeze being either slow or gradual[7].

Merryman has pointed out that, once the temperature has fallen to a low level, it must remain at that level if a frozen product is to escape serious damage. This is because, if these low levels are not maintained, a recrystallisation process may take place within the ice initially freezing the product. In such a process numerous small ice crystals combine into larger ones, and, in the case of frozen flesh, their growth would disrupt cells and membranes, allowing the escape of natural juices, nutriment and flavour[8]. Fluctuating freeze-levels would thus damage the flesh and lead eventually to decay and dissolution.

From this brief analysis of the mechanics of freezing, we can conclude that the preservation of mammoth meat for over 11,000 years in virtually unimpaired condition calls for an initial freeze followed by a great lowering of temperature which has been maintained uninterrupted throughout the intervening millennia. The sequence of events comprising the Phaeton disaster – insofar as it directly affected Earth – described in part five requires precisely the set of effects epitomised by these Siberian carcasses.

It has often been argued that the mammoth, with its thick hairy coat and layer of adipose tissue (established from several of the best preserved frozen cadavers) was admirably equipped to withstand the harsh conditions of Ice Age times. This theory was tested when a microscopic examination of retrieved mammoth skin was compared with another of the skin of the living Indian elephant. The comparison showed that both skins were identical and that neither contained the vital sebaceous glands for secreting the oil necessary to keep and animal sufficiently warm under icy conditions. Without a natural supply of oil, the hairy coat of the mammoth, and also that of its contemporary the woolly rhinoceros, would have been useless in such conditions. On the other hand, a sheep, and in particular the musk-ox, with its oily coat, is much better equipped than the mammoth or the woolly rhinoceros to withstand severe cold[9].

Fat, or adipose tissue, does not necessarily imply a defence mechanism against cold either. It constitutes a useful food store against winter scarcity or during months of aridity. As the seeds found in the mouths and stomachs of various frozen mammoths indicate a summer demise[10], the presence of fat on these individuals would, in fact, be completely normal. The bison, a companion of the mammoth at many and various localities, is an ecologically-specialised animal having a double hump. This feature, like the mammoth's adipose tissue, represents a food store enabling the animal to survive periods of aridity in the grasslands it inhabits[11]. Very probably, the woolly rhinoceros was similarly equipped, because it was not specifically adapted to Arctic tundra vegetation, but, like the bison, preferred rolling grasslands, as demonstrated by the remains which have been found across the plains of Spain[12].

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Appendix B
Dating of Finds from the Catastrophe Period

This concerns dated evidence for major worldwide environmental and faunal changes approximately 11,500 years ago.

Organic material has been dated almost exclusively by the Carbon-14 dating method, whereas most of the tectonic, meteorological and hydrological dates have been determined by other methods (including Argon-Potassium dating), or by a combination of two or more methods.

Among other dating methods now in use are those involving uranium-radium, thorium, chlorine, beryllium, rubidium-strontium, thermoluminescence, fission-track and tephrochronological (volcanic ash)[1]. All have limitations, however, as the Argon-Potassium method, outlined below, readily illustrates.

Potassium-bearing minerals have often been deposited with accumulated sediments. Potassium (K) is a very active alkaline element including in its composition a radioactive isotope which decays at a known rate into two other elements – Argon and Calcium. During this process, an electron from the Potassium 'shell' is captured by a nucleus, and 12% of the Potassium is converted into Argon-40, and 88% into Calcium.

Calculating the ratio of Potassium to Argon and calcium is quite accurate and easily applicable for periods extending back several millions of years before present. Unfortunately the half-life is not accurately known and the distribution of Argon has been found to be inhomogeneous in rocks and minerals. The difficulty is compounded by the fact that no basis presently exists for estimating the isotopic composition of the original Argon, and by the uncertainty surrounding what is taken to be 'original' Argon being, perhaps, actually a recent loss of Potassium[2].

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DATES AND PLACES OF FINDS PERTAINING TO THE PHAETON DISASTER

All dates cited are in years before present (BP). **amsl** signifies 'above mean sea level' and **bpgl** signifies 'below present ground level'.

OLD WORLD
ORGANIC – BOTANICAL

Material	Location	Date
Charcoal	Bushman's Rock, *Africa*	12,090
Charcoal	*Uganda*	11,350 ±340
Wood in peaty mud	Sjelland, *Denmark*	11,090 ±240
Wood	Sjelland, *Denmark*	11,310 ±500
Charcoal in fossil soil	Folkestone, *England*	11,944 ±210
Plant debris 4m bpgl under alluvium	Warwickshire, *England*	10,560 ±142
Charcoal in red soil with volcanic ash	Gala Lakes, *Ethiopia*	11,510 ±110
Charcoal in mud-flow	Andernack, *Germany*	11,150 ±200
Birch, willow	Kiel, *Germany*	11,270 ±130
Charcoal in mud-flow	Mayen, *Germany*	10,800 ±300
Charred wood	Inghiottitoio, *Italy*	11,150 ±650
Charcoal under tufa	Hokkaido, *Japan*	11,520 ±400
Carbonised tree	Komoro, *Japan*	11,300 ±400
Wood in lava flow	Kosakamachi, *Japan*	12,000 ±250
Wood in clay	Tokyo, *Japan*	11,300 ±360
Charcoal	Cyrene, *Libya*	12,580 ±172
Wood	Rudnja, *Lithuania*	11,970 ±180
Charcoal	Bodel, *Netherlands*	11,070 ±90
Wood	Blomvag, *Norway*	12,200 ±350
Driftwood	Bluno Is, *Norway*	12,100 ±350
Wood in sandy gravel	Cizysko, *Poland*	11,390 ±210
Charcoal residue	Kasama, *Zimbabwe*	10,820 ±430
Fossil tree from mammoth horizon	Taimyr Pen, *Siberia*	11,700 ±300
Wood in sand on top of 'till'	Dattnau, *Switzerland*	12,206 ±73
Wood fragments under basal 'till'	Petit-Saconnex, *Switz*	11,560 ±280
	Average date	**11,517**

ORGANIC – PEAT DEPOSITS

Basal peat showing start of bog	Spisska Kotlina, *Austria*	11,010 ±160
Peat	Anvers, *Belgium*	10,920 ±540
Peat	Anvers, *Belgium*	11,950 ±430
Peat	Campine, *Belgium*	11,640 ±250
Moss peat	Cornwall, *Britain*	11,071 ±180
Moss peat	Durham, *England*	11,011 ±230
Moss peat	Lincolnshire, *England*	11,205 ±120
Peat	*Lithuania*	11,200 ±340
Moss peat	Usselo, *Netherlands*	11,300 ±140
Moss peat	Usselo, *Netherlands*	11,620 ±140
Pollen-rich peat	Troms, *Norway*	10,720 ±240
Peat in clay	Stirling, *Scotland*	11,024 ±199
	Average date	**11,222**

Material	Location	Date
SEDIMENTS		
Lake mud	*Denmark*	10,970 ±300
Black mud	Wexford, *Eire*	11,060 ±250
Lake mud	Darlington, *England*	10,851 ±630
Organic marsh soil	Kent, *England*	11,960 ±160
Clay-mud in end moraine	Rappiner on Rugen *Germany*	12,100 ±600
Sediments below 'till'	Usedon, *Germany*	11,244 ±640
Organic carbon in clay	Tokyo, *Japan*	11,840 ±290
Basal gyttja	Bear Is, *Norway*	11,135 ±130
Gyttja in bog	Blindfunon, *Norway*	12,100 ±100
Grey gyttja	Brondmyra, *Norway*	11,300 ±300
Gyttja in kettle-hole	Troms, *Norway*	11,680 ±170
Organic sediments	Shetland Is, *Scotland*	10,055 ±300
Gyttja	Shetland Is, *Scotland*	12,090 ±900
Basal gyttja	*Sweden*	11,730 ±150
Gyttja with chalk and clay	*Switzerland*	10,950 ±200
Gyttja with clay	Dalpe, *Switzerland*	10,900 ±250
Gyttja in lake deposit	L Origlio, *Switzerland*	12,00 ±200
	Average date	**11,409**
NEW WORLD, OCEANIA & AUSTRALASIA		
ORGANIC – BOTANICAL		
Wood in ice-wedge	Baldwin Pen, *Alaska*	11,340 ±400
Wood 3.5m bpgl	Barrow, *Alaska*	10,800 ±300
Wood and shells 0.8m bpgl	NSW, *Australia*	11.140 ±160
Conifer 2m bpgl	British Columbia, *Canada*	11,590 ±280
Wood in lake silt	L Iroquois, *Canada*	11,570 ±260
Wood & peat between 2 till layers	Port Hood I, *Canada*	10,710 ±240
Wood 12m bpgl	Oldman River, *Canada*	11,000 ±250
Wood in mastodon horizon	Ontario, *Canada*	11,400 ±450
Plant remains in mastodon site	Ontario, *Canada*	12,000 ±200
Charcoal	Saskatchewan, *Canada*	10,800 ±300
Wood 19m bpgl	Vancouver I, *Canada*	12,000 ±450
Organic residue in marl 2m bpgl	Yukon, *Canada*	12,120 ±140
Wood in peat	Aghawagon, *New Guinea*	11,330 ±150
Wood 2.5m bpgl with gravel, basalt and loess in clay	Dunedin, *New Zealand*	11,500 ±170
Wood	Wellington, *New Zealand*	11,500 ±160
Organic layers	*Tristan da Cunha*	10,770 ±156
Various trees, charcoal	Arizona, *USA*	11,290 ±500
Charcoal with mammoth remains	California, *USA*	11,800 ±800
Plants with Folsom artefacts and	Clovis, New Mexico, *USA*	10,490 ±900
carbonised plants		11,170 ±360
Wood below mastodon remains	Indiana, *USA*	12,000 ±450
Spruce in 'glacial' deposit	Iowa, *USA*	11,120 ±400
Spruce 8m bpgl	Iowa, *USA*	11,600 ±200
Charcoal in mammoth site	Michigan, *USA*	11,290 ±500
Wood 1m under 'glacial' clay	Minnesota, *USA*	11,710 ±325
Spruce tree	New York, *USA*	11,410 ±400
Wood 4m bpgl S	South Dakota, *USA*	12,000 ±400
Spruce tree	Wisconsin, *USA*	10,877 ±470
Picea wood	Wisconsin, *USA*	12,000 ±300
	Average date	**11,390**
ORGANIC – PEAT DEPOSITS		
Peat	Anchorage, *Alaska*	11,600 ±300
Peat with twigs 2m bpgl	Copper River, *Alaska*	11,390 ±300
Peat below Holocene marine sediments	*Alaska*	11,570 ±130
Peat in marine terrace	Munday Creek, *Alaska*	10,820 ±420
Peat	Ontario, *Canada*	11,950 ±350
Peat in kettle-hole	Vancouver Is, *Canada*	11,780 ±450

Material	Location	Date
Peat, pollen 10m bpgl	Hauraki, *New Zealand*	11,900 ±750
Peat	*Colombia*, S America	11,350 ±140
Peat	Cape Fear, *USA*	10,430 ±590
Peat in estuarine deposits	Chesapeake Bay, *USA*	11,500 ±1200
Peat	36°-42°N, E Coast, *USA*	11,000
Peat in estuarine deposits	Georges Bank, *USA*	11,000 ±1200
Peat 1m bpgl	Wisconsin, *USA*	12,000 ±500
	Average date	**11,406**
SEDIMENTS		
Sediments	Baffin I, NWT, *Canada*	11,910 ±140
Muck in mastodon horizon	Ontario, *Canada*	12,000 ±500
Carbonaceous matter	*Guatemala*, C America	11,560 ±360
Organic carbon 2m bpgl	Eugene I, Mexican Gulf	11,950 ±650
Organic soil under 'till'	Aghawagon, *New Guinea*	11,810 ±250
Loess	*Slavonia*	11,700 ±500
Organic carbon with foraminifera	California, *USA*	12,460 ±700
Muddy clays	California, *USA*	12,360 ±2600
Organic carbon 1.8m bpgl	California, *USA*	12,500 ±600
Organic carbon	California, *USA*	12,300 ±450
Organic carbon	California, *USA*	11,400 ±600
Sterile clay overlying 'till'	Massachusetts, *USA*	12,310 ±320
Organic matter in clay	New Mexico, *USA*	11,445 ±230
Clay gyttja	Ohio, *USA*	10,558 ±365
Organic matter	Wyoming, *USA*	11,330 ±320
	Average date	**11,839**
OLD WORLD		
ZOOLOGICAL – Vertebrates		
Fossil fish	*Kenya*, E Africa	12,300
		12,000 ±220
Reindeer bone	Picken's Hole, *England*	12,400 ±1500
Antler	Montastruc, *France*	12,070 ±180
Antlers	Meiendorf, *Germany*	11,750 ±200
Whale	Trondheim, *Norway*	11,290 ±190
Mammoth sinews and skin	Taimyr Peninsular, *Siberia*	11,450 ±250
Bone	Cueva Bora cave, *Spain*	11,470 ±500
White whale	Agnesberg, *Sweden*	12,270 ±220
Whale	Essunga, *Sweden*	11,495 ±100
Seal	Grums, *Sweden*	10,150 ±180
Seal	Hastefjorden, *Sweden*	10,875 ±160
Seal	Lagmansered, *Sweden*	11,840 ±180
Greenland whale	Orust I, *Sweden*	12,500 ±240
	Average date	**11,670**
ZOOLOGICAL – invertebrate		
Shells in marine sediments	Disko Bay, *Greenland*	1,000 ±900
Shells 45m amsl	Glommen, *Greenland*	10,720 ±150
Shells in sand amsl	Ekrukorn, *Iceland*	11,620 ±240
Shells in silt under gravels	Kaldarbrn, *Iceland*	11,230 ±160
Foraminifera	Washtana, *India*	11,130 ±150
Shells in 'glacio-marine' clay	Belsvik, *Norway*	11,250 ±180
Shells in 'till'	Bergen, *Norway*	11,500 ±300
Shells in 'glacio-marine' clay & silt	Björkvik, *Norway*	10,020 ±130
Shells in marine bed, end moraine	Rensa, *Norway*	11,900 ±250
Shells	Sandstrand, *Norway*	11,400 ±250
Shells	Sandstrand, *Norway*	12,100 ±160
Shells in laminated clay	Troms, *Norway*	11,500 ±400
Shells in clay under gravels	Troms, *Norway*	11,500 ±400
Shell fragments	Norwegian Channel	11,950 ±290

Material	Location	Date
Shells	Ardyne Point, *Scotland*	12,150–11,680
Shells	Argyll, *Scotland*	11,530 ±210
Shells in marine sediments	Cardross, *Scotland*	11,787 ±122
Shells above 'boulder clay' but under 3cm of clay	Dumbarton, *Scotland*	11,805 ±205
Shells in end moraine	Loch Lomond, *Scotland*	11,700 ±170
Shells in marine clay	Mentieth, *Scotland*	11,800 ±170
Shells in marine clay	Paisley, *Scotland*	12,615 ±230
	Average date	**11,533**
INORGANIC – GEOLOGICAL		
Limestone	Bergen, *Norway*	11,700 ±230
Carbonates	Hormuz, *Iran*	12,350 ±145
Carbonates	*Tunisia*	12,470 ±540
	Average date	**12,173**
NEW WORLD, OCEANIA & AUSTRALASIA		
ZOOLOGICAL – Vertebrates		
Bison horn	*Alaska*	12,460 ±320
Diprotodon molar	Orroroo, *Australia*	11,100 ±130
Paramilodon bone	Rio Grande, *Brazil*	12,770 ±220
Mammoth tusk	British Columbia, *Canada*	11,600 ±1000
Musk ox	Banks I, NWT, *Canada* 1	0,600 ±320
Mastodon	Ontario, *Canada*	12,000 ±500
Giant sloth	Brunswick, *USA*	11,310 ±90
Dwarf mammoth	California, *USA*	11,800 ±800
Mammoth tusk	Colorado, *USA*	11,200 ±500
Musk ox	Michigan, *USA*	11,100 ±400
Ground sloth dung	Nevada, *USA*	11,690 ±250
Mastodon	New York, *USA*	11,410 ±400
Mylodon skull	Oregon, *USA*	11,310 ±800
Bison bone	Wyoming, *USA*	11,830 ±410
	Average date	**11,564**
ZOOLOGICAL – Invertebrates		
Shells in end moraine	Baffin I, NWT, *Canada*	10,760
Shells	Banks I, NWT, *Canada*	10,920 ±100
Shells in marine sediments		11,200 ±100
Shells	B Columbia, *Canada*	12,230 ±200
Oyster – warm-water species	Georges Bank, *Canada*	10,600 ±130
Shells	Green Bay, *Canada*	11,950 ±170
Shells in marine sediments	Melville I, NWT, *Canada*	11,310 ±150
Shells	Pr Edward I, *Canada*	12,410 ±170
Shells in marine sediments	Pr Patrick I, *Canada*	11,600 ±370
Foraminifera in moraine	Quebec, *Canada*	11,500 ±630
Shells	Victoria I, *Canada*	11,310 ±150
Reef coral	*New Guinea*	10,360 ±110
Foraminifera 0.5m bpgl	California, *USA*	11,180 ±550
Foraminifera 3.5m bpgl	California, *USA*	11,280 ±875
Foraminifera 1m below sea bed	California, *USA*	11,840 ±800
Foraminifera 0.25m bpgl (older than horizon)	California, *USA*	12,250 ±1200
Oyster shells	36–42°N, East coast, *USA*	c11,000
Foraminiferal faunal change	Atlantic coast bed, *USA*	c12,000
Shells	Maine, *USA*	11,800 ±240
Shells	Maine, *USA*	13,020 ±240
Shells	Missouri River, *USA*	12,250 ±400
Shells	Nebraska, *USA*	10,850 ±300
	Average date	**11,541**
INORGANIC – GEOLOGICAL		
Tufa	California, *USA*	12,000 ±400
Dolomite	Utah, *USA*	11,300 ±250

Material	Location	Date
Tufa	Nevada, *USA*	11,150 ±250
Coralline tufa	Nevada, *USA*	11,950 ±250
Banded caliche	Arroyo, NM, *USA*	11,900 ±300
Platy caliche	Texas, *USA*	11,730 ±300
	Average date	**11,671**
General average date for the above worldwide:	**11,577 years BP (Before Present)**	
GEOPHYSICAL – miscellaneous		
Elevation	Bight of Benin, Africa	12,250–10,750
Elevation	Ivory Coast, Africa	11,900
Dramatic rise in water levels	Lakes in Mauritania, Chad, Afar, Hoggar, Ethiopia	11,000
Core with four ash layers	L Tanganyika, Africa	11,690 ±300
Water depth more important	N Atlantic Ocean basin	c12,000
Marine transgression	*Denmark*	11,950 ±190
Temperature change	*Taiwan*	c10,000
Maximum monsoons	Rajasthan, *India*	c10,800
Land elevation	Ulster, SW Scotland	11,500
Shorelines tilt	*Sweden*	10,700
Land rose *en bloc*	*Sweden*	11,750
Warm climate starts suddenly	Yenisei, *Siberia*	c10,000
	Average date	**11,125**
GEOPHYSICAL – miscellaneous		
Tectonic, Meteorological, Hydrological *etc*		
Deglaciation	Unmak I, *Alaska*	12,000–11,000
Dramatic rise in lake-water levels	S E *Australia*	11,000
Rain forests expand	Queensland, *Australia*	12,000–11,000
Change in sediment source	East-central Bering Sea	c13,000
Laurentid ice retreats by 500km	SE *Canada*	11,000–8,500
Glaciers shrink	*Chile*	11,000
Subsidence	Gulf of Mexico	10,200
End moraine	Westland, *New Zealand*	11,450
Ice overlies tephra deposits	Cascade Range, *USA*	12,250–11,250
Glaciers disappear	Rocky Mts, CO, *USA*	11,000
Subsidence	East cont'l shelf, *USA*	11,090
	Average date	**11,600**

Appendix C
Remnants of the Celestial Battle?

The explosive destruction of any non-gaseous planet or planetary satellite within the solar system would inevitably produce an outwards dispersal of the disintegrated fragments radially from the epicentre of the explosion – from the core of the destroyed object. Such an explosion would be of appalling violence and power, even for a small satellite, and would hurl all large fragments of the dismantled world vast distances in every direction into interplanetary space. Some fragments would hurtle away as single objects, others as groups, and yet others as great swarms of variously shaped and sized debris, before settling down into orbits around the Sun. These orbits would almost certainly be eccentric and lie at all kinds of planes relative to the solar and terrestrial equators, and some might even extend out to the confines of the solar system itself. In many cases, they would undoubtedly resemble those described in Part Four of the Earth-crossing Apollo asteroids. Orbital eccentricity is a powerful indication of the geologically *very* recent origin of these objects.

In time many fragments would pass close to Earth or between Earth and its planetary neighbours, the largest pieces being, in favourable circumstances, observable from Earth. The celebrated 'law of averages' would ensure that.

Following such a disaster, lesser fragments and dust particles would settle down comparatively quickly into a loose shell of immense size but of slight density around the general location of the explosion, and this too would obey gravitational laws and eventually orbit the Sun – in the process gradually becoming progressively elongated. Such a fate would also befall any unvaporised portions of the atmosphere and hydrosphere which the destroyed world may originally have possessed, although in the case of surviving liquids and gases, these would, in the low temperatures of space, rapidly freeze into various types of ice.

If, as we contend, such a catastrophe occurred in the solar system as recently as 11,500 years or so ago, then the existence within it of myriads of such varied fragments should not only be theoretically possible but actually expected. As shown below, this is precisely what astronomers have apparently been reporting for at least 300 years – although except for a large object sporadically sighted near Venus during the 17th and 18th centuries, few have been observed for any appreciable length of time, and fewer still on more than one occasion. The problem of what these objects signify has never been satisfactorily resolved in astronomical literature.

From the many now long-forgotten accounts of these transient, anomalous objects we present a *small* selection of those which *antedated* the advent of ballooning and the appearance of man-made satellites, rockets, space vehicles and disintegrated parts thereof – hence all references derive from before 1900. Meteors are excluded from these notes since their true origins are still under review, but falls of ice, sometimes of remarkable bulk are included, despite being in recent years commonly explained away as ice detached from high-flying aircraft. Such ice reportedly fell to Earth quite regularly in years predating the modern discovery of aviation.

Our brief survey proceeds systematically from the Sun outwards as far as Mars.

Objects crossing the solar disc

Three observations were made of dark, unknown bodies passing across the face of the Sun on different occasions between February 1762 and May 1764[1]. In 1777, Charles Messier, the French astronomer, saw myriads of black spherical objects cross the solar disc[2]. Similar objects were seen by Loff in 1818, and by Stark in 1820[3]; and again in 1826 and 1828[4]. They were seen no less than six times in 1834, twice in 1836, and once in 1837, when Pastorff watched two objects moving on different courses across the Sun's face[5]. Other objects were seen in 1847, 1849[6], 1850[7], 1853[8], 1860[9], 1864[10], 1865[11], 1875 and 1876. Hosts of irregularly-shaped black objects were seen to cross the Sun in 1883 as if in alignment – similar to the North American meteor train of 1913[12].

Some of these objects were either very large or were comparatively close to the terrestrial observers, for one, apparently one-fifth of the diameter of the Sun, was sighted with the naked eye between 1st and 5th May 1764 by Hoffman, who saw it slowly traverse the solar disc from north to south, an almost unheard-of direction of motion: but not for an object following a highly eccentric orbit. An almost equally large (or near) object was sighted by Lichtenberg in November 1762. It took approximately three hours to cross the Sun's face. Objects as large as these would, if they penetrated the solar system, undoubtedly cause planetary disturbances. These did not, so the conclusion must be that the objects were really quite close to Earth when observed. Indeed, at 800 miles (1280km) distance, such objects would need to be only about one mile (1.6km) in diameter to appear that large or take that amount of time to transit the solar disc. Obviously the further away the objects were from Earth the larger they must actually have been. What, however, was their origin and why did they follow such unusual orbits?

Objects near Mercury

In 1799, the astronomers Harding and Schroedter independently reported seeing a luminous body of unknown identity crossing the face of Mercury, and on May 22nd 1854 three unknown objects of varying sizes were sighted in space apparently close to Mercury, and have not been seen since[13]. Points of light were observed crossing the unilluminated parts of Mercury[14] and Venus[15] on several occasions in 1892[16].

Objects near Venus

Early modern astronomers considered that Venus possessed a large satellite which they named *Neith.* As early as 1645 a moon-sized object was sighted near Venus, and was reportedly seen four times during the first half of the eighteenth century, and again in 1867. Denning in 1871 and Hind in 1873 both saw a rather similar object, while in April 1876, at Berlin, Weber watched a black body pass across the illuminated part of the Venusian globe. Seven more sightings of 'Neith' were made in 1886, although whatever it was has not been observed since.

Objects near to or crossing the lunar disc

There have been numerous sightings of dark bodies traversing the face of the Moon. In the 19th century, a dark triangular-shaped object was observed for three minutes, which obliterated almost a quarter of the Moon's face[17]. In 1917, Dr Harris saw a large object silhouetted against the Moon which he estimated to be about 250 miles (400km) long and 50 miles (80km) wide[18]. Other maverick travellers through solar space appear to reflect the Sun's light, the albedo being due to their composition – probably of ice or frozen gas. Bright lights have been seen against the Moon over the last 200 years. They were seen in 1783[19] and 1787[20] and again in 1821[21]. Prof Harrison saw a bright point of light "...resembling a reflection from a moving mirror" in 1877[22], while a similar object was seen in 1881. Even in more modern times such observations have occurred, such as in 1910[23] and 1917. These instances are but a small fraction of the recorded reports of similar sightings of objects close to the Moon.

Objects on or close to Mars

In 1864 and 1865, small shining reddish lights were noticed on the Martian disc[24], while a light-reflecting body was seen in space above the unilluminated portion of Mars in 1894[25]. It was not Phobos or Deimos. In the twentieth century, a "...fountain of flashing light" was seen on the face of Mars by Prof Pickering for 70 minutes in 1900, while on more than one occasion several brilliant moving spots of light crossed the Martian disc in 1911.

Objects in the vicinity of Earth

Unexplained phenomena have been noticed closer to our own planet. Henry Waldner saw a large number of small shining bodies pass at great altitude from East to West in 1863. This group of objects had been seen previously crossing the sky above Naples in 1845. The objects were of diverse shape, and it was concluded they were made of ice[26]. In 1849, Sir Robert Inglis watched thousands of brilliant white objects cross a cloudless sky for 25 minutes[27]. A similar phenomenon was watched by Rev W Read for no less than six hours in 1851[28]; a repeat performance occurred in 1860, which was described as having "...shone with a remarkably brilliant light"[29].

The brilliance of these unknown objects suggests that they were either burning meteors, or were pieces of ice illuminated by sunlight as they passed close to the Earth's upper atmosphere. In 1882, Prof Schwedoff argued that ice of celestial origin existed and accounted for the bombardment of the Earth by curious hailstones and huge chunks of ice which occur from time to time[30].

Anomalous Meteorological Phenomena

From time to time Earth experiences singular falls of ice, stones (not meteoritic), mud and strange snows. On balance these do not readily conform to the known workings of terrestrial meteorology and show every sign of having non-terrestrial origins. Their very nature and common celestial origin suggests that they form part of the lesser residue of one or more disintegrated former worlds. Again, only a small number of the total recorded instances can be given here.

Falls of ice

In May 1802, a mass of ice 3ft long, as many wide, and over 2ft thick fell in Hungary. Pieces of ice, a foot in circumference, fell in Derbyshire, England, in May 1811, and in 1828 a lump about a cubic yard in size fell at Candeishe in India. A block of ice weighing 11lbs fell at Cette, France, in 1844; while a huge mass, some 20ft in circumference, fell at Ord in Scotland during 1849. Another, of comparable dimensions, fell in August of the same year at Bulvullich, also in Scotland. Pumpkin-sized pieces of ice fell on Gunfalore in India in 1851; and in March 1860, during a snowstorm, giant lumps of ice fell so thickly on hillsides in Upper Wasdale, England, that from a distance they resembled flocks of sheep. An 80lb block of ice fell during August 1882 near Salina, Kansas, while five years later 'snowflakes' 15in across and 8in thick fell prodigiously in Montana. In November 1901, innumerable pieces of ice each weighing a minimum of 1lb fell in Victoria, Australia. Very significantly, many reports (which collectively embrace practically the entire world) specifically note that, upon inspection, pieces of fallen ice give the appearance of being fragments of recently-disintegrated larger sheets or blocks.

Showers of Stones

So many little stones fell during a violent storm at Wolverhampton, England, in June 1860, that they were cleared away with shovels[31]. Great numbers of small black stones fell at Birmingham during a storm in August 1858, and a large quantity of water-worn pebbles, unlike any known from the district, fell in Palestine, Texas in July 1888[32]. Similarly, numerous *smooth* pebbles fell at Kandahar in Afghanistan in 1834, while in May 1884 two falls of flinty stones occurred at Bismarck, North Dakota, each separated by an interval of 15 hours[33]. Interestingly, some of the many stones which rained down upon Dhurmsalla, India, in 1860 were coated with ice – Dhurmsalla is located in one of the warmest parts of India. It must be obvious that all these falls, and many others omitted here, were of non-meteoritic stones. Nor will it escape notice that, like the falls of ice, they occur globally.

Rains of Mud and Dust

During November 1902 staggering quantities of dust and mud fell over Australia, and fell there again in 1903 – 50 tons of it per square mile. It also fell in stupendous quantities simultaneously over much of Europe and western Russia, and was reported as having also fallen then over the Canary Islands, and by ships half-way between Britain and Barbados in the Caribbean. No less than 10 million tonnes of it is said to have fallen on southern England alone[34]. At the time it was fatuously alleged to be dust and sand whirled up from the Sahara Desert, an explanation still commonly advanced to account for modern falls of similar red dust and mud. Did Earth pass in 1902 and 1903 through part of the great cloud or shell of particles which, as previously argued, formed after the explosive disintegration of one or more once-solid bodies over 11,500 years ago – a cloud or shell on an orbit intersecting with that of Earth and perhaps occasionally at that?

And what, we may also ask, was the origin of the thick shower of marble-sized balls of soft, pulpy matter, which crumbled when dry, which fell at Queenstown, South Africa, in 1883?[35]. It was hardly a volcanic product, although some might reason that the following probably was, when on June 7th 1846 a 'slag'-like matter fell at Darmstadt, Germany.

It would seem that all the foregoing aerial missiles and 'falls' share certain common denominators. All are either of exceptional size and bulk, are extraordinarily abundant, or exhibit characters or behavioural patterns contrary to those which might otherwise be expected of *known terrestrial* equivalents. Why, for instance, should two falls occur of flinty pebbles at Bismarck on the same day, but separated by 15 hours, and why should essentially similar falls of mud and dust fall prodigiously over Australia hardly four months apart? Such patterns again suggest occasionally intersecting orbits – Earth's with eccentrically orbiting planetary debris. If correct, then the innumerable objects featured in these falls are, like the mysterious unidentified objects previously mentioned as transiting the Sun, Mercury, Venus, the Moon and Mars, very probably remains of Tiamat and Kingu. Certainly there are strong reasons for believing that they are in all likelihood the remnants of those worlds destroyed during the great 'War in Heaven' about 11,500 years ago.

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Appendix D
List of Bibliographic Contractions

Actes 4th Congr Int Quat	Acts of the 4th International Congress on the Quaternary.
Akad Nauk USSR Sibirskoye Otdeleniye, Inst Vulkanologii, Izdatef	Akademiya Nauk USSR Sibirskoye Otdeleniye, Instituta Vulkanologii, imeni Izdatef.
Akad Savet FNRJ Bull Sci	Scientific Bulletin of the Savet Academy, Yugoslavia.
Amer Anthrop	American Anthropologist.
Amer Antiq	American Antiquity.
Amer Antiq Orient Journ	American Antiquarian and Oriental Journal.
Amer Assoc Petrol Geol	American Association of Petroleum Geologists.
Amer Geogr Soc Res	American Geographical Society Resume.
Amer Geol	American Geologist.
Amer J Sci	American Journal of Science.
Amer J Sci Art	American Journal of Science and Arts.
Amer Mus Nat Hist	American Museum of Natural History, New York.
An Serv Geol Nacl El Salvador	Anales del Service Geológico Nacionales, El Salvador.
Ann Carnegie Mus	Annals of the Carnegie Museum, Pittsburgh.
Ann Géogr Paris	Annales de Géographie, Paris.
Ann Mus Zool St Petersburg	Annals of the Museum of Zoology, St Petersburg.
Ann Paléont	Annales de Paléontologie, Paris.
Ann Rep Dept Mines, NSW	Annual Report of the Dept of Mines, New South Wales.
Ann Rep Smithson Inst	Annual Report of the Smithsonian Institute, Philadelphia.
Ann Sci	Annals of Science.
Ann Sci Dig	Annual Science Digest.
Ann Sci Indust	Annales de Science et l'Industrie.
Annln Phys	Annalen de Physik, Leipzig.
Annls Soc Linn Lyon	Annales de la Societé Linnéenne de Lyon.
Annls Sci Nat Paris	Annales des Sciences Naturelles, Paris.
Annls Scient Univ Besancon	Annales Scientifiques de l'Université de Besancon.
Archaeol Inst Amer.	Archaeological Institute of America.
Arch Mus Nat Hist Lyon	Archives du Muséum d'Histoire Naturelle de Lyon.
Arch Naturgesch	Archiv für Naturgeschichte, Berlin.
Arch Wiss Kunde Russ	Archiv für Wissenschaftliche Kunde von Russland, Berlin.
Astr Astrophys	Astronomy and Astrophysics.
Astron J	Astronomical Journal.
Astron Nach	Astronomical Nachrichten.
Astron Reg	Astronomical Register.
Astrophys Journ	Astrophysical Journal.
Atlantic Coast Plain Geol Assoc Guidebook	Atlantic Coast Plain Geological Association Guidebook.
Atti Mus Civ Stor Nat Trieste	Atti del Museo Civico do Storia Naturale di Trieste.
Aust J Earth Sci	Australian Journal of Earth Sciences.
Aust J Phys	Australian Journal of Physics.
Beitr Kennt Russ Reichs	Beiträge zur Kenntniss de Russischen Reiches und die Angränzenden Lander Asiens, St Petersburg
Ber Offenbach Ver f Naturkunde	Bericht über die Tätigkeit des Offenbach Vereins für Naturkunde.
Ber Sächsischen Akad d Wis Phil Hist Klasse	Bericht der Sächsischen Akademischen der Wissenschaftliche der Philosophie und Historischen Klasse.
Biol Rev	Biological Review.
Bot Rev Lond	Botanical Review, London.
Brit Journ Hist Sci	British Journal for the History of Science.
Bull Amer Assoc Petrol Geol	Bulletin of the American Association of Petroleum Geologists, Chicago.
Bull Astron Inst Czch	Bulletin of the Astronomical Institute of Czechoslovakia.
Bull Canadian Petroleum Geol	Bulletin of Canadian Petroleum Geology, Calgary.
Bull Comm Geol Finland	Bulletin of the Geological Commission of Finland.
Bull Geol Soc Amer	Bulletin of the Geological Society of America.
Bull Geol Soc China	Bulletin of the Geological Society of China.
Bull Geol Soc Fr	Bulletin of the Geological Society of France.
Bull Im Acad Sci St Petersburg	Bulletin of the Imperial Academy of Science, St Petersburg.
Bull Inst Oceanogr	Bulletin of the Institute of Oceanography, Monaco.
Bull Internat de l'Acad des Sci de Cracovie	Bulletin International de l'Académie des Sciences et des Lettres de Cracovie, Poland.
Bull l'Acad St Petersburg	Bulletin de l'Académie de St Petersburg.
Bull Mus Anthrop Prehist Monaco	Bulletin du Musée Anthropologie Prehistorique de Monaco.
Bull Mus Comp Zool	Bulletin of the Museum of Comparative Zoology, Cambridge, Massachusetts.
Bull NY St Mus	Bulletin of the New York State Museum.
Bull Scient Cons Acad RSF Youg	Bulletin Scientifique, Conseil des Academies de la RSF de Yougoslavie, Zagreb.
Bull Soc Climat Algér	Bulletin de la Société de Climatologie Algérienne.
Bull Soc Hist Nat Afr N	Bulletin de la Société d'Histoire Naturelle de l'Afrique du Nord, Algiers.
Bull Soc Hist Nat Toulouse	Bulletin de la Société d'Histoire Naturelle de Toulouse.

Bull Soc Nat Moscou	Bulletin de la Société des Naturalistes de Moscou.
Bull Soc Zool Fr	Bulletin de la Société Zoologique de France, Paris.
Bull US Geol Surv	Bulletin of the US Geological Survey, Washington.
Bull US Natl Mus	Bulletin of the United States National Museum, Washington DC.
Bull Vulcanologique	Bulletin Vulcanologique, Bruxelles.
Canad Jl Earth Sci	Canadian Journal of Earth Sciences, Ottawa.
Contemp Rev.	Contemporary Review.
Congr Geol Internat	International Geological Congress.
Contrib Palaeont Carnegie Inst	Contributions to Palaeontology, Carnegie Institute.
C R Acad Sci Paris	Compte Rendue de l'Academie des Sciences, Paris.
C R de la Soc Geol de Finlande	Compte Rendu de la Société Geologique de Finlande.
C R Int Con Zool Monaco	Compte Rendue de la Conferance Internationale de Zoologie, Monaco.
C R Soc Sci Lett Pologne	Compte Rendu de la Société des Sciences et des Lettres de Pologne.
Earth & Planetary Sci Letts	Earth and Planetary Science Letters, Amsterdam.
Edinb New Phil J	Edinburgh New Philosophical Journal.
Engl Mech	English Mechanic.
Erlanger Forsch	Erlanger Forschungen, Erlangen, Reihe B, Nuturwissenschaften.
Essex Nat	Essex Naturalist.
Folia Quatern	Folia Quaternaria.
Geofisica Internat	Geofisica Internationaler.
Geogr J	Geographical Journal.
Geogr Rev	Geographical Review.
Geol Mag	Geological Magazine.
Geol Mijnbouw	Geologie Mijnbouw.
Geol Soc Amer Spec Paper	Geological Society of America, Special Paper.
Geophys J	Geophysical Journal, London.
Geophys J Roy Astr Soc	Geophysical Journal of the Royal Astronomical Society, London.
Geophys Res Letts	Geophysical Research Letters.
Gesamtinhaltsverz Wiss Zn Univ Hochsch DDR	Gesamtinhaltsverzeichnis der Wissenschaftlichen Zeitschriften de Universitäten und Hochschulen der Deutschen Demokratischen Republik.
Hist Sci	History of Science.
Illinois Geol Surv Circ	Illinois Geological Survey Circular.
Indian Sci Cong	Indian Scientific Congress.
Inst Geol Soc Lond, Min	Minutes of the Institute of the Geological Society of London.
Int Congr Prehist Archaeol	International Congress of Anthropology and Prehistoric Archaeology.
Irish Astron	Irish Astronomy.
J Amer Folk	Journal of American Folklore.
J Amer Orient Soc	Journal of the American Oriental Society.
J Anthrop Inst	Journal of the Anthropological Institute, London.
J Atmosph Sci	Journal of Atmospheric Science.
J Brit Astron Assoc	Journal of the British Astronomical Association.
J Geophys Res.	Journal of Geophysical Research.
J Hist Astr	Journal of the History of Astronomy.
J Mammal	Journal of Mammology, Baltimore.
J Palaeont	Journal of Palaeontology.
J Phys	Journal of Physics.
J Proc Roy Soc NSW	Journal and Proceedings of the Royal Society of New South Wales.
Jb K-K Geol Reichsanst Wien	Jahrbuch der Kaiserlich-Königlichen Geologischen Reichsanstalt, Wien.
Journ Egypt Archaeology	Journal of Egyptian Archaeology.
Journ Geol	Journal of Geology.
Journ Geol Soc Lond	Journal of the Geological Society of London.
Journ Roy Geogr Soc Lond	Journal of the Royal Geographical Society of London.
Journ Trans Vict Inst Lond	Journal and Transactions of the Victoria Institute of London.
K Dansk Vidensk Selsk Skr	Kongelige Danske Videnskabernes Selskabs Skrifter, Copenhagen.
L'Année Scient	L'Anées Scientifiques.
L'Astron	L'Astronomie.
Matér Hist Prim Homme	Matériaux pour l'Histoire Positive et Philosophique (Primitive et Naturelle) de l'Homme, Paris.
Mem Acad Sci Lett Montpellier	Memoirs dl l'Académie des Sciences et Belles-Lettres de Montpellier.
Mem Asia Soc Bengal	Memoirs of the Asiatic Society of Bengal.
Mem Geol Surv Amer	Memoirs of the Geological Survey of America.
Mem Geol Surv Engl & Wales	Memoirs of the Geological Survey of England & Wales.
Mem Geol Surv India	Memories of the Geological Survey of India.
Mem Mus Civ Stor Nat Verona	Memorie del Museo Civico de Storia Naturale di Verona.
Mem Soc Géol Fr	Memoires de la Société Géologique de France.
Mem Soc Hist Nat Paris	Memoires de la Société d'Histoire Naturelle de Paris.
Mem Univ California	Memoirs of the University of California, Berkeley.
Mitt Naturw ver Steiern	Mitteilungen der Naturwissenschaftlichen Vereins für Steiermark, Graz.
Mon Nots Roy Astron Soc	Monthly Notices of the Royal Astronomical Society.
Monogr Ser	Monograph Series.
Mon Weather Rev	Monthly Weather Review.
Nachbl dt Malakozool Ges	Nachrichtsblatt der Deutschen Malakozoologischen Gesellschaft, Frankfurt.
NASA Sp Publ	NASA Space Publications.
Nat Geogr Mag	National Geographic Magazine.
Ned Akad Wet Versl	Nederlandsch Akademisch Wetenschappelijke Verslagen.
NW Nat	North Western Naturalist, Arbroath, Scotland.
NY Lyceum Nat Hist	New York Lyceum of Natural History.
Ohio J Sci	Ohio Journal of Science.
Öst Staats Wien	Österreichische Staatanstalt, Wien.
Overseas Geol Surv Min Resour Divn	Overseas Geological Survey and Mineral Resources Division.
Palaeogeogr Palaeoclimat Palaeoecol	Palaeogreography, Palaeoclimatology, Palaeoecology.
Phil Mag	Philosophical Magazine.
Phil Trans Roy Soc Lond	Philosophical Transactions of the Royal Society of London.
Pop Astron	Popular Astronomy.
Pop Sci Mon	Popular Science Monthly.
Pop Sci Rev	Popular Science Review.
Proc Acad Nat Sci Philad	Proceedings of the Academy of Natural Sciences, Philadelphia.

Proc Acad Sci Lett Montpellier	Proceedings de l'Académie des Sciences et Belles-Lettres de Montpellier.
Proc Amer Philos Soc	Proceedings of the American Philosophical Society.
Proc Berlin Acad	Proceedings of the Berlin Academy.
Proc Boston Sci Nat Hist	Proceedings of the Boston Society of Natural History.
Proc Brit Acad	Proceedings of the British Academy.
Proc Dorset Nat Hist Archaeol Soc	Proceedings of the Dorset Natural History and Archaeological Society.
Proc Geol Assoc	Proceedings of the Geologists' Association, London.
Proc Geol Soc Lond	Proceedings of the Geological Society of London.
Proc Imp Acad Japan	Proceedings of the Imperial Academy of Japan, Tokyo.
Proc Internat Symp Tsunamis & Ts Res	Proceedings of the International Symposium on Tsunamis & Tsunami Research.
Proc Roy Geogr Soc Lond	Proceedings of the Royal Geographical Society of London.
Proc Roy Irish Acad	Proceedings of the Royal Irish Academy, Dublin.
Proc US Natl Acad Sci	Proceedings of the US National Academy of Science.
Proc Yorks Geol Soc	Proceedings of the Yorkshire Geological Society.
Proc Zool Soc Lond	Proceedings of the Zoological Society of London.
Prof Papers Geol Surv India	Professional Papers of the Geological Survey of India.
Publ Carnegie Inst	Publications of the Carnegie Institute, Pittsburgh.
Q Jl Geol Soc Lond	Quaterly Journal of the Geological Society of London.
Q Jl Lit Sci Arts Lond	Quarterly Journal of Literature, Science and Arts, London.
Q Rev	Quaternary Review.
Quat Res	Quaternary Research.
Quat Sci Rev	Quaternary Science Review.
Rep Brit Assoc Adv Sci	Report of the British Association for the Advancement of Science.
Rep Bur Amer Ethnol	Report of the Bureau of American Ethnology, Washington DC.
Rep Inst Polar Stud	Report of the Institute of Polar Studies.
Rep Smithsonian Inst	Report of the Smithsonian Institute, Washington DC.
Rev de l'Histoire des Religions	Revue de l'Histoire des Religions, Paris.
Rev Palaeobot Palynol	Review of Palaeobotany and Palynology.
Rev Sci Nat Montpellier	Revue des Sciences Naturelle, Montpellier.
Sber Heidelb Akad Wiss Math	Sber die Heidelberg Akademisch für Wissenschaftlichen und Mathematik.
Sber Preuss Akad Wiss	Sber die Preussischen Akademie der Wissenschaften.
Scient Amer	Scientific American.
Sci Dig	Science Digest.
Sci News	Science News.
Scient Mon	Scientific Monthly, London.
Sida Sida	Contributions to Botany, Dallas.
Slov Akad Znan Umetn Razr Priorod Vede Razr Jugosl	Slovenska Akademije Znanosti in Umetnosti, Razprave Prirodslovnega Vede, Razprave, Jugoslavia.
Smithson Contb Knowl	Smithsonian Contributions to Knowledge, Washington DC.
Smithson Misc Coll	Smithsonian Miscellaneous Collections, Washington DC.
S Afr J Sci	South African Journal of Science, Cape Town.
Sov Geogr	Soviet Geography.
Stanford Univ Publ Geol Sci	Stanford University Publications, Geological Sciences.
Tidsskr Pop Fremst Naturw	Tidsskrift for Populaere Fremstillinger af Naturvidenskoben, Copenhagen.
Trans Amer Geophys Union	Transactions of the American Geophysical Union, Washington DC.
Trans Chicago Acad Sci	Transactions of the Chicago Academy of Science.
Trans Edinb Geol Soc	Transactions of the Edinburgh Geological Society.
Trans Linn Soc Lond	Transactions of the Linnaean Society of London.
Trans Manch Geol Soc	Transactions of the Manchester Geological Society.
Trans New Zeal Inst	Transactions of the New Zealand Institute.
Trans Norfolk Norwich Nat Hist Soc	Transactions of the Norfolk and Norwich Natural History Society.
Trans Roy Soc Edinb	Transactions of the Royal Society of Edinburgh.
Trans Roy Soc New Zeal	Transactions of the Royal Society of New Zealand.
Trans Roy Soc Tasmania	Transactions of the Royal Society of Tasmania.
Trans Wiscon Acad Sci Arts Lett	Transactions of the Wisconsin Academy of Science, Arts and Letters.
Trans Zool Soc Lond	Transactions of the Zoological Society of London.
Uchen Zap Leningr Gos Ped Inst A I Gercen	Uchenye Zapiski Leningradskogo Gosudarstvennogo Pedologiskiy Instituta, A I Gercen.
Univ Okla Soc Sci Bull	University of Oklahoma Society's Science Bulletin.
US Geol Surv Prof Paper	United States Geological Survey Professional Paper.
US Geol Surv Water Supply Paper	United States Geological Survey Water Supply Paper.
US Geol Survey Mon	United States Geological Survey Monograph.
Verh Geol Reichsanst	Verhandlungen der Geologischen Reichsanstalt.
Z dt Geol Ges	Zeitschrift der Deutschen Geologischen Gesellschaft.
Zeit Ges Erdk Berlin	Zeitschrift der Gesellschaft für Erdkunde zu Berlin.
Zool Zh	Zoologischeskii Zhurnal, Moscow.

Glossary

An explanation of the more complex or technical terms in the text of the book.

Agglutination – united as with glue.
Albedo effect – high-level reflection of sunlight by Earth, owing to snow or cloud cover.
Alluvial – pertaining to water-borne material (mud, silts, *etc.*) deposited by river action, as against flood action.
Argillaceous – of or like clay.
Auriferous – gold-bearing.
Biota – animal and plant life of a region.
Boulder clay – mixture of boulders, in tough clay (peculiar to 'drift').
B P – years before present.
Breccia – angular stones and coarse grit cemented by lime.
Calcareous – of or containing calcium carbonate.
Caldera – deep cauldron-like cavity on summit or side of a volcano.
Carbonaceous – of or like coal or charcoal.
Chondrite – meteorite containing granules.
Cirques – bowl-shaped hollow at head of a valley or on a mountain-side.
Deltaic – pertaining to or characterised by a delta.
Denudation – degree of natural erosion of topographical features.
Diluvial – Flood-water action, or flood-borne material (usually unstratified, unconsolidated, and of uneven thickness) deposited under agitated conditions.
'Drift' – detrital material (*eg* gravel or sand) deposited by wind, water-currents or ice.
Drumlin – low, smoothly-rounded, elongated oval hill, mound or ridge of compact 'till' or 'drift'. Height may be from 8–60m and length 400–2000m.
Eolian – wind-sculpted, or wind-deposited, physical features and sediments (*e.g.*, various rock faces, dunes, dust-bowls, *etc.*)
Erratics – boulders, often large, of a composition alien to the strata upon which they rest.
Exfoliation – the process by which concentric scales, plates or shells of rock are successively stripped from the bare surface of a large rock mass.
Ferruginous – of or containing iron-rust or iron as a chemical constituent: rust-coloured.
Foraminifera – microscopic organism with a shell.
Geoidal – Earth's shape.
Gyttja – black lake-bed sludge.
Hydrocarbon – any organic compound, gaseous, liquid or solid, consisting solely of carbon and hydrogen.
Hydrological – of water, particularly of its movement on, under and above land.
Hydrographical – studies having to do with water.
Ice-wedge – wedge-shaped foliated ground-ice in permafrost, occurring as a vertical or inclined sheet.
Interstadial – a warm interlude within a glacial cycle in orthodox Ice Age chronology, and marked by a temporary retreat of the ice.
Kettle-hole – a steep-sided bowl-shaped hole or depression on land-surface, commonly without surface drainage.
Lahar – an avalanche-like mud-flow composed chiefly of conglomerated volcanic materials usually erupted during volcanic eruptions.
Lapilli – stone fragments thrown out by volcanoes.
Latitudes, high – polar latitudes.
Latitudes, low – tropical latitudes.
Lignite – brown coal showing traces of plant-structure, intermediate between bituminous coal and peat.
Lithosphere – the Earth's crust.
Loess – an homogeneous predominately fine-grained silty surface deposit, commonly

non-stratified, usually porous, non-friable and highly calcareous.

Magmatic – of, or pertaining to, the magma or semi-molten stratum under the Earth's crust.

Metalliferous – metal bearing.

Moraine – debris commonly carried down and deposited by a glacier, and more rarely accumulated through freak rain-storm action.

Morainic – of or like moraines.

Nuées ardentes – a swiftly flowing, high temperature, gaseous cloud sometimes incandescent, erupted from a volcano.

Ochreous – pale brownish-yellow.

Orogeny – process or processes by which mountains are formed.

Osseous – consisting of bone.

Ossiferous – yielding bones.

Palaeoclimatology – study of past climates.

Palaeogeography – study of the earth's past physical features.

Palaeontology – study of past life forms.

Parabolic – of or like a parabola.

Patina – a mineral sheen often coating the surface of rocks or other materials by weathering, solution, *etc.*

Perihelion – the nearest point to the sun on the path of an orbiting planet (the furthest point being the *aphelion*).

Permafrost – subsoil remaining below freezing-point throughout the year in polar regions.

Phytology – the science of plants.

Plate tectonics – a theory in which Earth's lithosphere is divided into a number of continental plates whose movement is horizontal.

Plicated – folded, or contracted into wrinkles.

Pyroclastic – rock material formed by volcanic explosion; also rock texture of explosive origin.

Roches moutonées – highly polished or exceptionally smooth rock surfaces.

Scarp – steep slope, usually on the steep edge of an escarpment.

Seismic – of earthquakes.

Slickensides – a polished and smoothly striated surface that results from friction along a fault plane.

Solifluction – the slow viscous down-slope flow of waterlogged soil and other unsorted material.

Stadial – a stage in orthodox Ice Age chronology marked by the development and advance of glacial conditions.

Stratal inversion – rock layer, or layers, turned upside down.

Striation – linear furrowing or scoring of a rock surface.

Subduction – the process of one crustal plate under-riding another.

Tectonic – relating to the deformation of the Earth's crust.

Tholiform – rotation round a perpendicular axis.

'Till' – stiff clay containing boulders, sand *etc*, (peculiar to 'drift').

Topography – natural surface features of the world.

Tuff – a general term for all consolidated pyroclastic rocks.

Volcanogenic – Processes or effects directly arising from vulcanism.

Water table – level of sub-surface water relative to surface of local terrain.

Waves of translation – to impart motion without rotation by water.

INDEX

When *the* Earth Nearly Died

Compelling Evidence of a Catastrophic World Change 9,500 BC

D.S. Allan & J.B.Delair

About 11,500 years ago all life on Earth was almost wiped out by appalling conflagration, overwhelming flood and a bombardment of an awesome extent.

A thankfully rare but nevertheless real confrontation with an unwelcome cosmic visitor caused terrible earthquakes and volcanic eruptions, the upheaval of most of the world's greatest mountain ranges, the warping of Earth's crust and the tilting of its axis to a new angle. Land masses rose and sank, seas and rivers flooded catastrophically, storms abounded, vegetation rotted - and survivors faced a darkened and bleak future.

This is a serious multi-disciplinary scientific study of a major and recent global catastrophe. Researchers Allan and Delair question many assumptions about the great Pleistocene Ice Age which is said to have lasted until about 9,000 BC, and show how these assumptions took root. They investigate abundant geological, biological and climatological evidence for this dire event - which they show to be part of a larger convulsion affecting virtually the entire solar system. The causal agent is also unmasked. They show how this cataclysm has played a much greater role in human history than was previously realised.

If you are concerned about the effect on Earth of a cataclysm like Jupiter's recent bombardment, this book will give you important data. If you are interested in earth sciences, it could fundamentally change your way of understanding Earth's recent geological past. From fossils to climatology to ancient maps and traditions, this wide-ranging work represents a breakthrough of enormous proportions.

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