

THOUGHTS
ON A
PEBBLE
BY
DR. MANTELL

55.08

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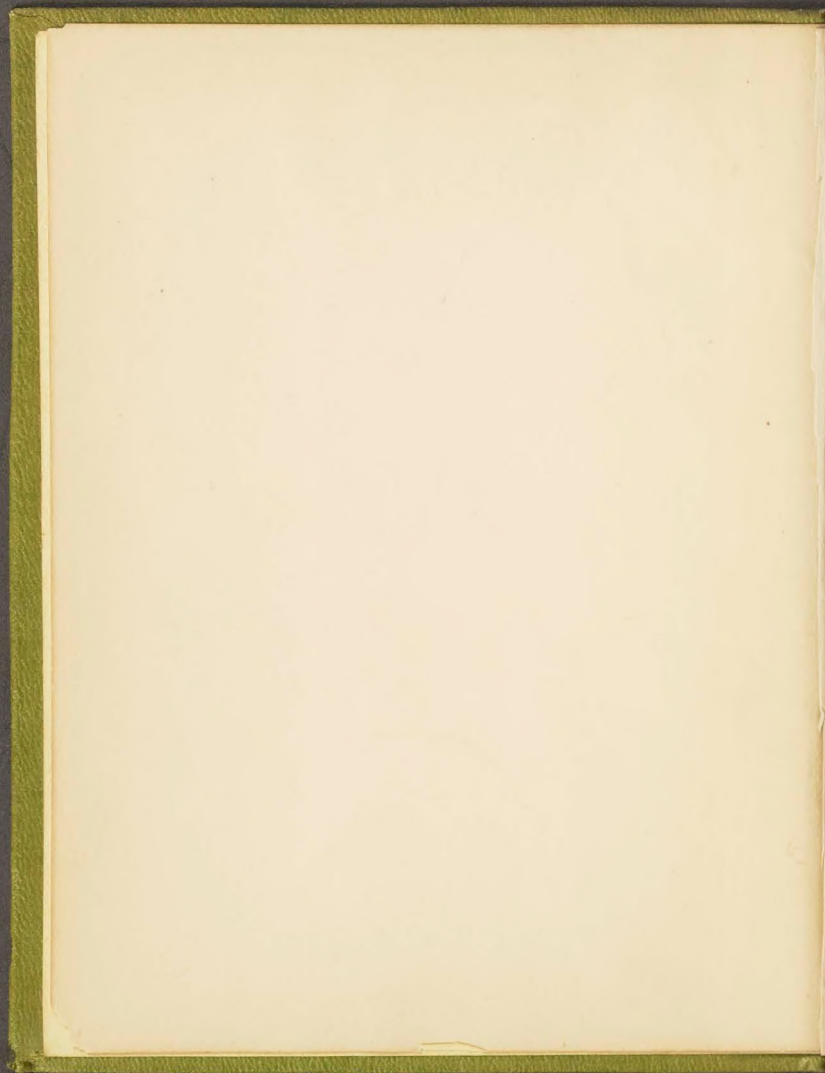


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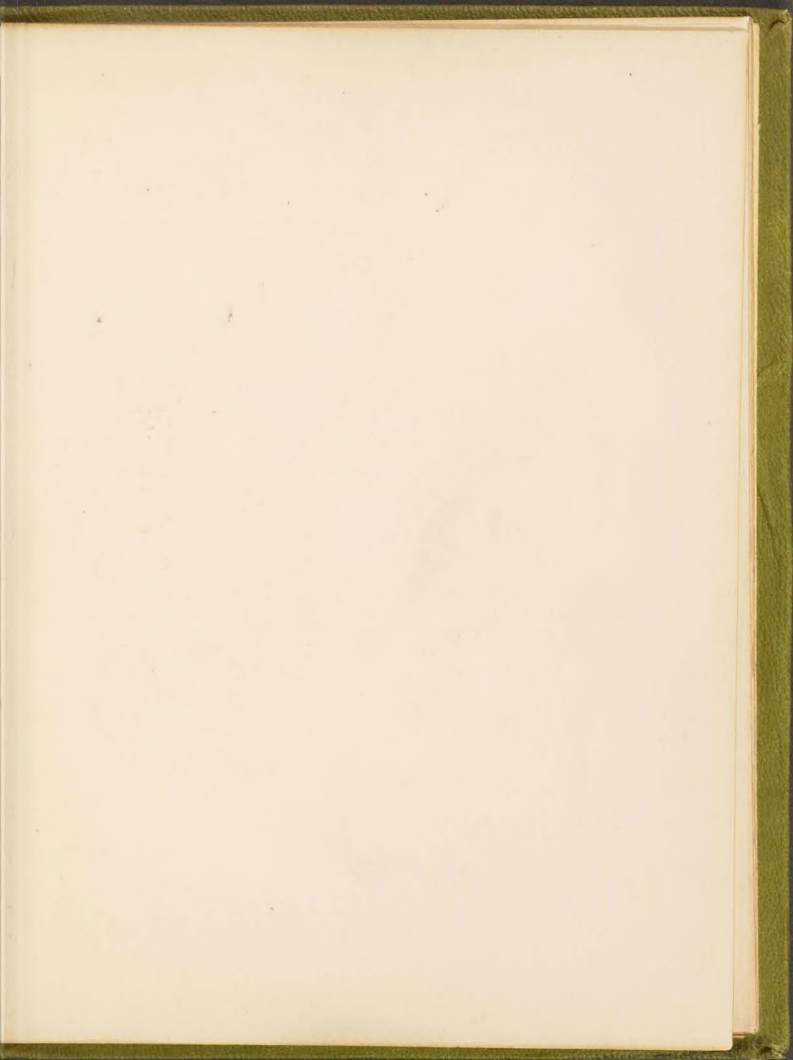
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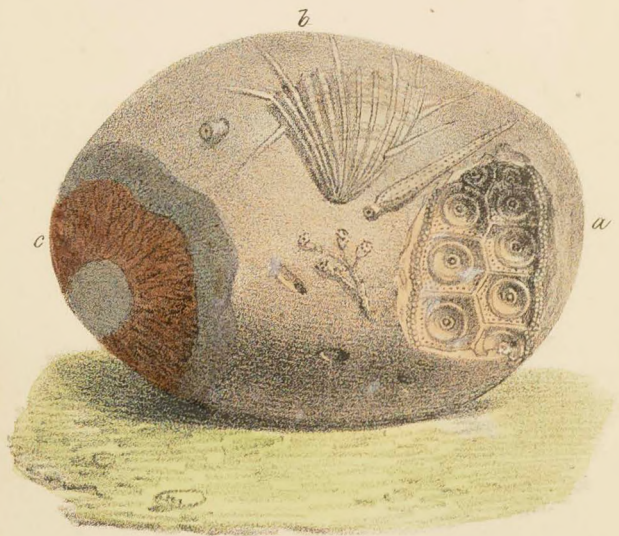
THOUGHTS

ON A

PEBBLE.

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"Sermons in Stones" *Shakspeare.*

Plate 1.

THOUGHTS
ON A
PEBBLE;

OR A
LESSON IN GEOLOGY.

BY THE AUTHOR OF "THE WONDERS OF GEOLOGY."



The Pebble and the Landscape. 1842. p. 40.

"There is something very noble in the beauty of a world, without
feeling of nature in connection with it."

— *Contemplations of Nature* —

SIXTH EDITION.

LONDON:
WELLS AND FLETCHER.

1842.



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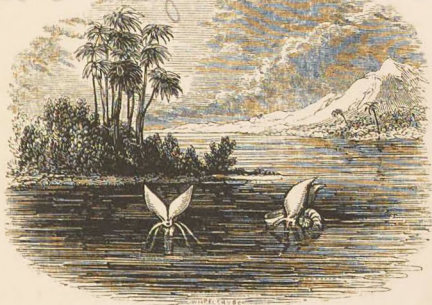
THOUGHTS
ON A
PEBBLE;
OR A FIRST
LESSON IN GEOLOGY.

55.08

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BY THE AUTHOR OF "THE WONDERS OF GEOLOGY."

Gideon Algernon Mantell



The Nautilus and the Ammonite. *Vide p. 40.*

"There is no picking up a pebble by the brook-side, without finding all nature in connexion with it."

Contemplations of Nature.

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TO

MY SON,

Reginald Neville Mantell,

THESE THOUGHTS

ARE MOST AFFECTIONATELY

INSCRIBED.

MANTELLIAN MUSEUM,
Brighton, 1837.

"EVERY grain of sand is an immensity—every leaf a world—every insect
an assemblage of incomprehensible effects in which reflection is lost!"

LAVATER.

THOUGHTS
ON A
PEBBLE.

“Honoured, therefore, be thou, thou small pebble, lying in the lane; and whenever any one looks at thee, may he think of the beautiful and noble world he lives in, and all of which it is capable.”—LEIGH HUNT'S *London Journal*, p. 10.

WELL might our immortal Shakspeare talk of “sermons in stones;” and Lavater exclaim, that “every grain of sand is an immensity;” and the author of “Contemplations of Nature” remark, that “there is

no picking up a pebble by the brook-side without finding all nature in connexion with it."

I shall confine my remarks to a *flint* pebble, as being the kind of stone familiar to every one. This pebble which I hold in my hand, was picked up in the bed of yonder torrent, that is dashing down the side of the hill, and winding its way through that beautiful valley, and over those

Huge rocks and mounds confus'dly hurl'd,
The fragments of an earlier world,

which, partially filling up the chasm, and obstructing the course of the rushing

waters, give rise to those gentle murmurings that are so inexpressibly soothing and delightful to the soul.

Upon examining this stone, I discover that it is but the fragment of a much larger mass; and, as its surface is smooth and rounded, the angles being worn off by attrition, that it has manifestly been transported from a distance. I follow the stream to its source, half-way up the hill, and find that it issues from the bed of clay and gravel, that forms the eminence on which I am standing, and is nearly 300 feet above the level of the British Channel. From this accumulation of flints the specimen has

evidently been removed by the torrent, and carried down to the spot where it first attracted our notice ; but we are yet very far from having ascertained its origin. The bed of stones on the summit of this hill is clearly but an accumulation of water-worn materials—an ancient sea-beach—consisting of chalk-flints that have been detached from their parent rock, and broken, rounded, and heaped together, by the action of the waves. We are certain of this, because we know that flints cannot grow ; that they must be formed in hollows or fissures of other stones ; and upon inspecting the pebble more minutely, we find not

only that such was the case, but also that it was moulded in *Chalk*, for it contains impressions of extinct shells and corals, which are found exclusively in that rock. Here another wonderful phenomenon presents itself.—This flint, now so hard and unyielding, must have been in a state of softness or fluidity, for we have the most delicate markings of a species of the sea-hedgehog, (*Echinus*) impressed on its surface,* and the cast of a fragile shell covered with spines; † nay, more, upon breaking off one end, we perceive that a sponge, ‡ or some analogous marine production, is en-

* Plate 1, a.

† Pl. 1, b.

‡ Pl. 1, c.

veloped in its substance ; and also that there are here and there several minute corals, and scales of fishes. What a “ medal of creation ” is here ! — what a page of nature’s volume to interpret ! — what interesting reflections crowd upon the mind !

To avoid confusion, we must reverse the order of our inquiry, and first contemplate the formation of the flint in its native rock. The Chalk,—that beautiful white stone, which, (as an American friend, who saw it for the first time, observed,) is so like an artificial production,—abounds in marine shells and corals, and in the remains of fishes,

crabs, lobsters, and reptiles, all of which differ essentially from living species, although a few of the corals and shells resemble, in some particulars, certain kinds that inhabit the seas of hot climates. These remains are found in so perfect a state—the shells with all their spines and delicate processes, and the fishes with their scales and fins entire—that no doubt can be entertained that these animals were surrounded by the chalk while living in their native seas, and that many of them were entombed in their stony sepulchres suddenly, and while the rock was in a state of fluidity, like liquid plaster of Paris. Now flint

occurs in the chalk in various forms: sometimes in nodules, or irregular globular masses; sometimes in continuous layers, and in veins either horizontal or oblique. The nodules have generally, as nuclei, shells, corals, sponges, or other zoophytes, as in the specimen before us; while the veins fill up fissures in the rock. The chalk is stratified,—that is, it is separated into layers or strata,—as if a certain quantity had been precipitated, and had sunk to the bottom of the sea, and enveloped the animals which fell in its way, and this layer had hardened into stone before a fresh stratum was deposited. There is conclusive

evidence that the flint and chalk were dissolved or suspended in the same liquid, and that the two substances separated from each other (upon well known chemical principles) as they passed into a state of consolidation, the organic bodies serving as centres, around which the siliceous matter concentered. Hence, we often find a coral, shell, or fish, partly imbedded in chalk, and partly in flint. We may also add, that we know the chalk (at least of the South-East of England) was deposited in the basin of a profound ocean, for the fossil shells, called Ammonites, or *snake-stones*, which, like the recent Nautili, were inhabi-

tants of deep waters, abound in the chalk. The Ammonites *occur in a fossil state only*, and were very abundant in the ancient oceans of our globe; those of Whitby are well known from the legend attached to them, and from which the popular name of *snake-stone* originated.

Thus the nuns of Whitby told,
How of thousand snakes, each one
Was changed into a coil of stone,
When holy Hilda prayed:
Themselves within their sacred bound,
Their stony folds had often found.

SCOTT'S *Marmion*.

We have now obtained proof that our pebble was once in a state of solution, in an ocean which teemed with countless myriads

of beings, of species unknown in a living state; and that there it consolidated, and became invested by the chalk, entangling the shells, corals, and other organic remains, which are now attached to its surface, or imbedded in its substance. Thus much for its origin. Let us next inquire by what means it was dislodged from its rocky envelopment, cast up from the depths of the ocean, and elevated to the summit of this hill. If we stroll along the sea-shore, we shall find an answer to some of these inquiries, for

There is a *language* by the lonely shore,—
There is society where none intrudes,
By the deep sea, and music in its roar.

BYRON.

The incessant dashing of the waves against the base of the chalk cliffs, undermines the rock, and huge masses are constantly giving way and falling into the waters. The chalk then becomes softened and disintegrated, and is finally transported to the tranquil depths of the ocean, where it forms new deposits; the flints, thus detached, are broken and rolled by attrition into the state of pebbles and gravel, and ultimately of sand. But we must bear in mind, that had the chalk remained at the bottom of the deep sea in which it was originally deposited, it could not have been exposed to these destructive operations. It

is therefore manifest, that at some very remote period of the earth's history, the bed of the chalk ocean was broken up, and that great portions of it were elevated, and formed the boundary of the existing mass of water. In like manner the beach on this hill has been raised to its present situation, several hundred feet above the level of the sea-shore!

Every part of the earth's surface presents incontrovertible proofs that the elevation of the bottom of the deep in some places, and the subsidence of the dry land in others, have been always, and are still, going on;*

* See Wonders of Geology, 4th Edit. vol. i. p. 104.

and that, in truth, the mutability of the surface of the earth, is the effect of one of those laws which the Author of the Universe has impressed on matter, and thus rendered it capable of eternal renovation :—

Art, Empire, Earth itself, to change are doomed ;
Earthquakes have raised to heaven the humble vale,
And gulfs the mountain's mighty mass entombed,
And where the Atlantic rolls wide continents have bloomed.

BEATTIE.

The beautiful and sublime apostrophe to the sea, by Lord Byron, embodies the startling fact established by modern geological researches,—namely, that if the character of immutability be applicable to

anything on the surface of our globe, it is to the ocean and not to the land!—

Thy shores are empires, changed in all save thee,—
 Assyria, Greece, Rome, Carthage, what are they?
 Thy waters wasted them while they were free,
 And many a tyrant since; their shores obey
 The stranger, slave, or savage,—their decay
 Has dried up realms to deserts:—not so thou,
 Unchangeable, save to thy wild waves' play—
Time writes no wrinkle on thine azure brow:—
Such as Creation's dawn beheld, thou rollest now!

CHILDE HAROLD.

We will conclude this “first lesson” with the following remark of an eminent philosopher:—To discover order and intelligence, in scenes of apparent wildness and confusion, is the pleasing task of the geological

inquirer; who recognises, in the changes which are continually taking place on the surface of the globe, a series of necessary operations, by which the harmony, beauty, and integrity of the Universe are maintained and perpetuated; and which must be regarded, not as symptoms of frailty or decay, but as wise provisions of the Supreme Cause, to ensure that circle of changes, so essential to animal and vegetable existence.

MORE THOUGHTS

ON A

PEBBLE.

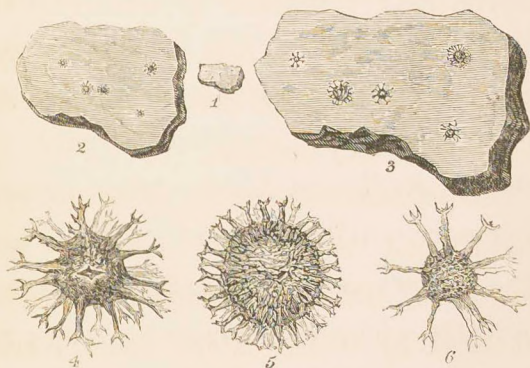
“ Not a mote in the beam, not an herb on the mountain, not a pebble on the shore, not a seed far-blown into the wilderness, but contributes to the lore that seeks in all the true principle of life—the beautiful—the joyous—the immortal.”—SIR E. L. BULWER'S *Zanoni*.

MORE thoughts on a pebble!—is not the subject exhausted? have not all the hieroglyphics impressed on the flint been interpreted?—Can Science, like the fabled wand of the magician, call forth from the stone and from the rock their hidden lore, and

reveal the secrets they have so long enshrined?—Gentle Reader! but one page of the eventful history of the pebble has been decyphered; I proceed to transcribe this natural record of the past, explain its mysterious characters, and present to thy notice the marvels they disclose.

Our previous examination of the specimen showed that the flint had once been in a fluid state, and had consolidated in a sea inhabited by shells, echini, fishes, corals, sponges, and other zoophytes; and the appearance of the fractured end (Plate 1, c), indicated that some organic body formed the nucleus of the pebble, and that traces

of its structure still remained. To ascertain if this inference be correct, it will be necessary to divide the stone in a longitudinal



FOSSIL ANIMALCULES IN FLINT.

direction;—but I will first strike off a small fragment, and examine it by the aid of a microscope.

By a sharp blow of a hammer, a very thin and minute portion of the flint has been detached (see Fig. 1); it is translucent, and when held between the eye and a strong light, appears like a slice of horn; and a few extremely minute specks may with difficulty be detected. Under the microscope, five of these almost invisible points are well defined, and present a radiated appearance (see Fig. 2); but I will substitute a higher power, and lo! they are seen to be distinct spherical bodies beset with spines (see Fig. 3); and with a still more powerful lens, one which magnifies many hundred times, their nature is clearly

demonstrated. The whole five possess this general character—a central globular case or shield, surrounded with tubes or hollow spines, which terminate in fringed or divided extremities (see Figs. 4, 5, 6); but they differ from each other in the relative proportions of the body and spines, and in the number, shape, and length of these tubular appendages. The group, in short, is clearly separable into three distinct species, of the same kind of fossil remains.

But what are these bodies?—They are the cases of animalcules, many species of which swarm in our lakes and seas, and are so minute, that thousands may be contained

in a drop of water! In a living state, the case is filled with a granular jelly, which is the soft body of the animalcule, and the tubes and the outer surface are invested with a similar substance of a beautiful green colour. After death the soft parts dissolve; but the case and its spines, being composed of siliceous earth or flint, remain unchanged. Our investigation has thus shown, that a great proportion of the mass of the pebble is actually composed of the aggregated skeletons of living atoms, so minute as to elude our unassisted vision, but which the magic power of the microscope reveals to us preserved in all their original

sharpness of outline, and delicacy of structure !

On another fragment of this pebble, two glittering specks, not larger than a pin's head, are discernible ; these, with a magnifier of moderate power, are seen at a glance to be scales of fishes. But they differ from each other ; both have the surface smooth, and without enamel : in the one the margin or edge is simple ; in the other, it is divided like the teeth of a comb ;— trifling as this difference may appear, it is sufficient to enable the naturalist to determine that the fishes which furnished these scales, belonged to two distinct orders, of

which the Salmon, and the Mullet, are examples.

SECTION OF THE PEBBLE.

Plate 2.

We will now avail ourselves of the assistance of the lapidary, and divide the pebble lengthwise;—what a beautiful and interesting section is thus obtained! The markings observable on the fractured portion of the stone (see Plate 1, c) are seen to have originated, as we surmised, from some organic body, which the flint, when fluid, had penetrated and enveloped. The enclosed fossil was obviously one of those soft marine



Section of the Pebble

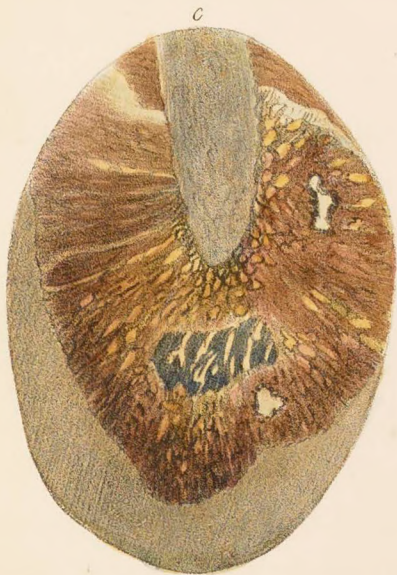
Plate 2

which the Salmon, and the Mallet, are examples.

SECTION OF THE FISSURE.

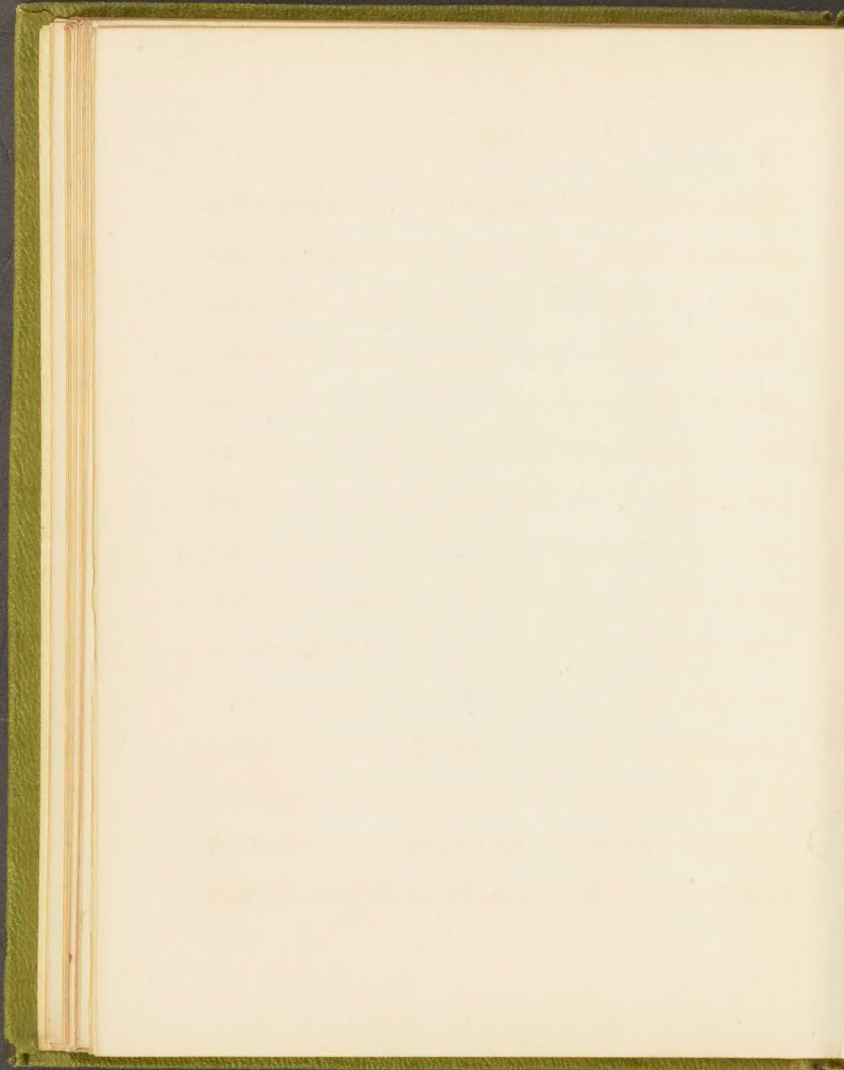
FIG. 2.

We will now avail ourselves of the assistance of the lapidary, and divide the pebble lengthwise;—what a beautiful and interesting section is thus obtained! The markings observable on the fractured portion of the stone (see Plate 1, c) are seen to have originated, as we surmised, from some organic body, which the flint, when fluid, had penetrated and enveloped. The enclosed fossil was obviously one of those soft marine



Section of the Pebble.

Plate 2.



zoophytes, called *Alcyonia*, which are of a globular, spherical, or pyriform shape, consisting of a tough, jelly-like substance, permeated with tubes disposed in a radiating manner around a central cavity,—a structure admitting of that constant supply and circulation of sea-water, which the economy of these extraordinary forms of animal existence require. The outer surface of the living zoophyte is covered with minute pores, or cells, each containing a polype, or animalcule, which although permanently united at its base to the general mass, has an independent existence, and possesses sensation and voluntary motion, expanding its thread

like feelers or tentacula to catch its prey, and withdrawing into its little cell at pleasure.*

The surface exposed by the division of the pebble, is an oblique vertical section of the enclosed zoophyte, and shows a central cavity filled with grey flint (Plate 2, c), in a mass traversed by tubes or channels, presenting considerable variety and beauty of colour. †

* See Wonders of Geology, 4th Edit. vol. ii. p. 505, for a popular account of Polyparia, and other Zoophytes.

† A *transverse* section would, of course, have shown a central spot, with rays proceeding to the circumference; specimens of this kind are mounted as brooches by the lapidaries of Brighton, who term them *petrified sea-anemones*.

These zoophytes must have swarmed in the ocean in which the chalk and flint were deposited, for in some localities almost every boulder and pebble contains examples more or less perfect; and in the chalk they are equally abundant.*

From these investigations, we learn that the pebble, which has formed the subject of our contemplation, had its origin in a living

* The sea-beach at Brighton and Bognor affords innumerable examples. It may be permitted, in a "First Lesson in Geology," to inform my fair readers, who may visit the "*Queen of Watering Places*," that by far the greater part of the so-called *Brighton moss-agates*, sold by the jewellers, are of German origin and manufacture; and that the *Brighton false emeralds*, and *aqua-marines*, are water-worn fragments of common green-glass bottles!

mass, composed of aggregated thousands of the most delicate forms of animal existence, which was attached to a rock in a sea, whose boundaries have long since been swept away ;—that corals, shells, and echini inhabited the bottom of the deep ; and that fishes related to existing families, sported in the waters of that ancient ocean. In fine, we have presented to us the scene so exquisitely portrayed by the American poet :—

Deep in the waves is a coral grove,
Where the purple mullet and gold fish rove,
Where the sea-flower spreads its leaves of blue,
That never are wet with the falling dew,
But in bright and changeful beauty shine,
Far down in the green and glassy brine.

The floor is of sand, like the mountain drift,
And the pearl-shells spangle the flinty snow ;
From coral-rocks the sea-plants lift
Their boughs, where the tides and billows flow.—
And life, in all its beautiful forms,
Is sporting amidst those bowers of stone.

PERCIVAL.

Our previous examination of the pebble had prepared us for these results ; but the microscope, that mighty talisman of wisdom, has shown us, that even those infinitesimal creatures, to whom a drop of water is an unbounded ocean—those living atoms of that world of being which is for ever concealed from the uninstructed mind—the inhabitants of that universe beneath us, which the eye of science can alone penetrate,

existed in ages incalculably remote, and were, like their gigantic contemporaries, the living instruments by which a large proportion of the solid materials of the surface of our planet was elaborated ; their imperishable siliceous and calcareous skeletons, constituting no inconsiderable amount of the crust of the earth.

Fossil animalcules similar to those we have discovered in the pebble, and thousands of other genera and species equally minute, occur in such prodigious quantities, in such overwhelming numbers, as to warrant the conclusion, that this class of animal existence has contributed more largely than any

other, to the formation of the sedimentary strata.

Whole mountain-ranges, and deposits of great thickness and extent, are found to consist entirely of these remains. In the state of rock, of sand, of clay, of marl—in the coarsest limestone, and in the purest crystal, the petrified skeletons of animalcules alike abound. The town of Richmond, in Virginia, is built on a bed of stone twenty feet thick, which is entirely composed of the skeletons of many different kinds of marine animalcules. And the polishing slate of Bilin, in Germany, wholly

consists of an aggregation of the siliceous shields of similar beings, disposed in layers without any connecting medium ; and which belong to species so minute, and are so closely compressed, that in a cubic inch of the stone, weighing but two hundred and twenty grains, there are the remains of *forty-one thousand millions* of animalcules !*

Here we must bring our “Thoughts on a Pebble” to a close ; but not without advert-
ing to the pure and elevating gratification

* See Wonders of Geology, 4th Edit. vol. ii. p. 802.

which investigations of this nature afford, and the beneficial influence which they exert upon the mind and character. In circumstances where the uninstructed and uninquiring eye can perceive neither novelty nor beauty, the mind imbued with a taste for natural science, finds an inexhaustible source of pleasure and instruction, and new and stupendous proofs of the power and goodness of the Eternal!

Every rock in the desert, every boulder on the plain, every pebble by the brook-side, every grain of sand on the sea-shore, is fraught with lessons of wisdom to him

whose heart is fitted to receive and comprehend their sublime import. Amidst the turmoil of the world, and the dreary intercourse of common life, we possess in these pursuits a never-failing source of delight, of which nothing can deprive us—an oasis in the desert, to which we can escape, and find a home “wherever the intellect can pierce, and the spirit can breathe the air.”* For like the plant which the Prophet threw into the waters of Marah, † that changed the bitterness of the wave into sweetness, a branch from the tree of knowledge thrown

* Sir E. L. Bulwer.

† Exod. xv. 23.

into the turbid stream of life, purifies its waters, and imparts to them a healing virtue, which sheds a hallowing and refreshing influence over the soul!

THE
NAUTILUS AND THE AMMONITE.

(See Page 13.)

FROM SKETCHES IN PROSE AND VERSE,
BY G. F. RICHARDSON, Esq.

THE Nautilus and the Ammonite
Were launch'd in storm and strife ;
Each sent to float, in its tiny boat,
On the wide, wild sea of life.

And each could swim on the ocean's brim,
And anon, its sails could furl ;
And sink to sleep in the great sea deep,
In a palace all of pearl.

And their's was a bliss, more fair than this,
That we feel in our colder time ;
For they were rife in a tropic life,
In a brighter, happier clime.

They swam 'mid isles, whose summer smiles
 No wintry winds annoy ;
Whose groves were palm, whose air was balm,
 Where life was only joy.

They sail'd all day, through creek and bay,
 And travers'd the ocean deep ;
And at night they sank on a coral bank,
 In its fairy bowers to sleep.

And the monsters vast, of ages past,
 They beheld in their ocean caves ;
And saw them ride, in their power and pride,
 And sink in their billowy graves.

And hand in hand, from strand to strand,
 They sail'd in mirth and glee ;
Those fairy shells, with their crystal cells,
 Twin creatures of the sea.

And they came at last, to a sea long past,
But as they reach'd its shore,
The Almighty's breath spake out in death,
And the Ammonite lived no more.

And the Nautilus now, in its shelly prow,
As o'er the deep it strays ;
Still seems to seek, in bay and creek,
Its companion of other days.

And thus do we, in life's stormy sea,
As we roam from shore to shore ;
While tempest-tost, seek the lov'd—the lost—
But find them on earth no more !

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