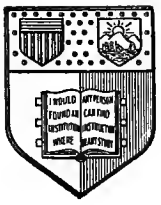

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NOTES

ON

THE GEOLOGY OF JAMAICA.

With a small Geological Map.

To accompany "The Rainfall of Jamaica from about 1870 to end of 1909, with Maps."

BY

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NOTES ON THE GEOLOGY OF JAMAICA.

There are two important works on this subject:—"Reports on the Geology of Jamaica" by James G. Sawkins, published in 1869, and "The Geology and Physical Geography of Jamaica" by Prof. R. T. Hill, printed for the Harvard College Museum in 1899.

There is also a valuable summary of the latter work by Mr. A. G. Nash entitled a "Sketch of the Geology of Jamaica" which appeared in the Scottish Geographical Magazine for December 1899.

As it is not easy to obtain any of the volumes containing these works, it is hoped that the following notes and the attached map may prove to be useful and interesting; the map is of course on a very small scale, but it shows the physical features of the Island, and with different colouring it was used to illustrate the Rainfall of Jamaica.

The following are the principal formations:—

I. ALLUVIAL DEPOSITS on the low-lying plains, consisting of débris brought down by rains and floods from the higher lands and mountains. The plains of St. Andrew, St. Catherine, and Clarendon afford good examples of this formation; which at once opens before us the wide scope of Geology with its almost unlimited time of action, and its ever-shifting flow of water; sands, gravels, and boulders have been swept down from the mountains which are chiefly composed of Igneous rocks, so that specimens of these rocks may be found scattered all over the plains.

The thickness of this formation may be seen where a river has cut its way through it; for instance, at Mona the banks of the Hope River show a thickness of 200 feet or thereabouts.

The soils resulting from this formation are suitable for agriculture; but irrigation is required to supplement the small rainfall on the particular plains referred to above.

Fresh water can often be found at a depth of a few feet below this formation, where it probably thins out as it meets beds of clay presumably of the yellow limestone.

II. The next formation consists of WHITE LIMESTONE, which covers the greater part of the Island; it is of every variety, from compact limestone which can hardly be distinguished from marble to a loose friable material hardly fit for "metal" on the roads. It is for the most part stratified, having been deposited in the geologic ages when Jamaica was submerged, all but the highest mountains; it is composed of the remains of marine shells and corals which show that it belongs to the Oligocene formation in the Tertiary system, when there were a few forms of life such as we now find existing. But the fossils of this limestone are not very conspicuous; for the most part they have been absorbed into the substance of the stone—carbonate of lime—together with all the rest of the calcareous matter forming that substance. On the other hand, many rocks may be seen to consist almost entirely of minute fragments of fossil shells.

The general appearance of the limestone mountains is greatly diversified; they often form more rounded or uniform slopes than the deeply cut sides of the Igneous mountains—as may be seen at Kingston by comparing the Long Mountains to the east with the Port Royal Mountains to the north-east; but again the limestone mountains often have high and precipitous cliffs—as for instance, the Alps in Trelawny which tower over the road leading up to Ulster Spring. And lastly there is the remarkable "Cock-pit" formation consisting of a series of the roughest possible cones and hollows contained within a more or less circular area of about 15 miles in diameter, and situated 15 or 20 miles south of Falmouth. As the railway skirts the south-western part of this area, it is well known to most of our readers.

Again, when we consider the surface of this limestone formation there is also the greatest difference; when exposed to the action of rain the softer parts have been dissolved, leaving a remarkably rough "honey-comb" surface, difficult to walk over, dangerous for horses and cattle; and useless for agricultural purposes; or there may be endless sheets of "flat-rock" with very little soil to cover it; or lastly the limestone may have been dissolved on a large scale by the action of rain which has left large deposits of red clay, clay coloured by iron, suitable for the cultivation of guinea-grass and coffee, as on the high plains of Manchester.

The thickness of this formation of course greatly varies; Sawkins states that it is sometimes over 2,000 feet; and as for the lapse of time required for such an enormous deposit, he adds that it "cannot be easily realized by the imagination."

As in all limestone formations water finds its way downwards forming subterranean passages and rivers; but in Jamaica these features are strongly marked. In the large maps we constantly see places marked "sink," where a river commences its underground course; at other places rivers suddenly emerge from some cave or other; and it would be interesting to connect some of them if possible. Sometimes a large hollow area is drained by one of these sink-holes; and should it become blocked at the time of flood rains the result may be most disastrous, as occurred at Cave Valley in June 1886.

There are numerous caves in this formation; the finest is that near Dry Harbour; a brief account of the larger caves is given in "The Handbook of Jamaica." Stalactites are formed in these caves; but as a rule the minerals having lime as their base are not numerous; selenite* occurs in considerable quantities on the lower road below Chapelton; and aragonite† occurs among the hills in St. James.

* Crystals of gypsum. † Bundles of long crystals of carbonate of lime.

III. We next come to the YELLOW LIMESTONE formation, a comparatively thin series of gravels, sand, and clays: there is compact stone as well at certain places; and its thickness seems to be about 200 feet. The marked feature of this formation is the large number of fossil shells it contains; they belong to the Eocene formation in the Tertiary system when there was the "dawn" or commencement of the forms of life such as we now find existing; and of course there are many strange forms of shells among the fossils no longer to be found among the shells on the sea shore.

Another marked feature of this formation are the lower beds of clay, for the most part yellow in colour, but blue or purple towards the lowest strata. Reference has been made to the beds of red clay on the surface of the white limestone at certain places; but these yellow beds are below that formation, and the water which percolates through the white limestone cannot pass these beds of clay, and issues at the sides of the hills as springs. This action is well seen at Spring Mount in St. James; after a heavy rain, or rather a succession of heavy rains, the water sinks through the high white limestone of Kempshot until it meets the clays of the Spring Mount yellow limestone below; its course is then diverted, and it rushes out with great force all along the lower mountain side, and the roar may be heard for at least two miles.

The soil on the surface of this formation is very poor, unless indeed it be mixed with the red clays from the higher white limestone, as at Spring Mount; but care should be taken where a considerable depth of soil is required for cultivation.

IV. THE DARK SHALES.—These consist of a series of strata of shales of all colours with interstratified beds of sandstone; "the lowest and by far the most extensive portion of the series is the dark greenish-brown shale which shows a thickness of about 2,000 feet. This shale is very finely laminated, and breaks up into small irregular forms with curved faces; the thickest laminæ seldom exceed one foot, while the thinnest are little thicker than paper. Faults and contortions are of frequent occurrence over the whole area. Veins and thin beds of calcspar frequently traverse it in all directions, occurring chiefly at the top of the series, on which probably the white limestone once rested. Owing to the friable nature of this set of strata the interior roads have from use and from acting as water courses been cut down in places from 10 to 20 feet, so that their sides present a continued section. No fossil shells are to be formed in this deposit, and but few vegetable remains."*

The parishes of Hanover and St. Mary afford good examples of this formation; and the resulting soils are very fertile; the well known Lucea yams are grown in this soil; and the heavy rainfall in St. Mary renders the soil there very productive.

At Dias Hill on the road between Lucea and Savanna-la-Mar the contortions of the strata referred to by Sawkins may be well seen; indeed his description of this formation given above seems to have been taken from that hill.

The vegetable remains referred to are all charred—minute pieces of charcoal: so that in some localities this formation may well be called "carbonaceous shales;" but nothing like coal ever occurs : in some localities they may be called "bituminous;" and any search for rock oil would be interesting from a scientific point of view at least.

This formation seems to have been composed of the finely ground up materials of the next large and important formation of Igneous rocks which form the basis of the Island, of course deposited by means of water, which also affects the still lower deposits, and cannot fail to lead to important geological conclusions.

But all these features are marked so distinctly that we have separated the dark shales from the great Blue Mountain series of Prof. Hill, who included it and the two next formations under that term.

V. THE OLD VOLCANIC SERIES.—Most of our readers are no doubt well acquainted with the formations already described under familiar names long used in Jamaica; but care has now to be taken in describing the Igneous series where immense quantities of volcanic materials have been piled up, forming the Blue Mountains, the Port Royal Mountains and other mountains along the central parts of the Island.

The materials consist of rounded stones and boulders embedied in volcanic tuff more or less friable, conglomerates, and porphyritic débris, which give the scars and land slides on the mountains their reddish colour.

These stones and boulders are chiefly composed of endless combinations of felspar and hornblende; but of course quartz and other igneous minerals frequently occur in their composition.

Now when we can get a good view of a vertical section of this series, as we can often do on the road between Chapelton and Frankfield, it will be seen that the water-worn stones and boulders are embedded in the tuff in layers, as in the case of other stratified formations, and the matrix in which they are embedded is often merely the ground-up materials of the stones and boulders themselves. The road mentioned lies in the valley of the Rio Minho, and these strata may be merely due to the action of the river in ages past; but there are indications elsewhere that these strata may be found higher up and out of the way of any river.

The smaller rounded stones and boulders are at the top of this series, and the boulders become larger and larger towards its base; its thickness has been estimated between 3,000 and 5,000 feet.

The soils are of course very fertile; but the steepness of the ridges, and the denudation by water, have to be taken into consideration from an agricultural point of view.

One of the most interesting features of this formation is the occurrence here and there of beds of Blue limestone containing fossils of the Cretaceous period of Geology; these beds cannot be mistaken, the blue colour is well marked, and the marine fossils are abundant; among them hippurites occur—fossils not to be found in the Cretaceous system of the British Isles—the lower shells of which resemble a horn, but of marvelous internal texture.

Varieties of quartz minerals, such as agates, chalcedony, jasper, etc., may be found on the surface of this formation, especially in the central part of the Island; and from Upper Clarendon they seem to have been washed down over the alluvial plains of Vere.

Lastly in this formation occur various metals, and specimens of copper, lead, zinc, manganese, iron,

* Sawkins' report page 253.

etc., may be obtained here and there; but copper is abundant at places in the hills of Upper Clarendon between the Bull-head mountain and the properties known as Retreat and Kays, where mining operations on a large scale have been conducted since 1906 with considerable commercial success.

VI. THE PLUTONIC ROCKS.—Our most important plutonic rocks are porphyry, syenite, diorite, and granite; which in a semi-fluid condition have often been forced from below upwards through the volcanic series, the dark shales, the yellow limestone, and into the white limestone; these intrusive masses, often in the form of walls or "dykes," have by their great primitive heat changed the condition of the strata through which they were forced; this "baking" process may often be seen in Upper Clarendon where clay and gravel have been burnt into a brick-like mass. These altered conditions form the metamorphosed rocks of the "Reports on the Geology of Jamaica," which may be most frequently met with in the volcanic series already described.

In the map accompanying these notes the chief features only have been given; Prof. Hill's map shows varieties of White limestone and Alluvium, and Coast limestone here and there; we have however retained his Bowden beds, which he showed to be of the Miocene formation, and thereby corrected all former work.

Difficulty occurs in getting the chief features correctly drawn among our roads and mountains, both having been omitted in Prof. Hill's map, and the latter in Sawkins' map; and in this respect there is ample room for improvement in the future.

MAXWELL HALL.

Halfway Tree,
April, 30th, 1913.

Alluvium			Yellow Limestone
White Marl			Dark Shale
Bowden Marl and Gravel			Conglomerate and Tuff
White Limestone			Syenite, Granite, etc.