and Lower Culm strata from portions of the granitic areas in question, but these must be dealt with subsequently. There is, however, one important point to which the writer desires to draw attention—that is, the almost certain fact that the Devonian and Lower Culm strata had been previously disturbed and folded by great earth-crust-movements before the protrusion of the granite. The arrangement and disposition of the strata in relation to the granite certainly favour this conclusion. The great plications and the cleavage of the strata had at least in greater part, if not in whole, been completed before the eruption of the granite had taken place, and also before the conglomerate series of South Devon had been deposited, which latter occurrence, however, the author believes was subsequent to the eruption of the granite. It is extremely probable that these highly acid cores which now represent the granite never were the stumps or roots of great volcanic cones, in the correct sense of the term, as suggested by the late Mr. R. N. Worth,[1] from which proceeded highly basic lavas, but rather that they were the feeders or more central portions of extrusions, parts of which came to the surface as trachyte, forming great dome-like masses after the manner of the Puy de Dôme, near Clermont Ferrand, in Central France.

In conclusion, the author is aware that the evidences here brought forward to sustain his views as to the age and origin of the granite of Dartmoor are not absolutely conclusive; but when compared with the opinions already held they seem at all events worthy of consideration and discussion.

NOTICES OF MEMOIRS.

I.—Neue Beiträge zur Kenntniss der fossilen Radiolarien aus Gesteinen des Jura und der Kreide, von Dr. Rüst. Palæontographica, Band xlv (1898). 4to; pp. 67, pls. i–xix.

New Contributions to the Knowledge of the Fossil Radiolaria from the Jurassic and Cretaceous Rocks. By Dr. Rüst.

SINCE the completion of his important work on the Palæozoic Radiolaria, Dr. Rüst has been revising his earlier monographs on those from the Jurassic and Cretaceous strata. Struck by the close resemblance of the forms in the Upper Jurassic Aptychus-beds of Cittiglio, near Laveno, from which 79 new species were described and figured by Professor Parona[2] some years since, to those which he himself[3] had described from the Lower Neocomian beds at Gardenazza near St. Cassian, the Aptychus shales near Urschlau, and from Kren, and the Tithonian jaspers of the Tyrol and West Switzerland, Dr. Rüst prepared some hundreds of microscopic sections of the nodules of siliceous limestone from Cittiglio, and in these he has discovered no fewer than 212 new species, which, with

[1] Quart. Journ. Geol. Soc., vol. xlv, p. 398, etc.
[2] Bollettino della Soc. geol. italiana, vol. ix, fasc. 1 (1890).
[3] Palæontographica, Bd. xxxi (1885); Bd. xxxiv (1887–8).

some few other new forms from Gardenazza, and from the Lias Coprolites of Ilsede, are fully described and figured in the 19 plates accompanying this monograph. A comparison of the species from the various localities mentioned above leads the author to consider that they belong to one and the same Radiolarian fauna. The only new genus proposed, *Cyclastrum*, is included in the family Porodiscida. A distinguishing feature of the Cittiglio Radiolaria is the large number of forms of the Order Cyrtoidea; some of them, moreover, are of unusually large size—one specimen of *Stichocapse Umberti*, measuring 1·152 mm. by 0·16 mm. in length and breadth, exceeds in size any fossil form of the group hitherto known. Though the siliceous tests in these organisms are now for the most part replaced by pyrites and marcasite, their structural details have been very perfectly preserved, and they can be determined with as much precision as recent specimens.

Thanks to this new contribution of Dr. Rüst, taken in connection with his earlier work and that of Professor Parona, we are now furnished with a fairly satisfactory standard of reference as to the character of the Radiolarian fauna of the summit of the Jurassic and the base of the Cretaceous rocks in the Tyrol, Bavaria, and Northern Italy. G. J. H.

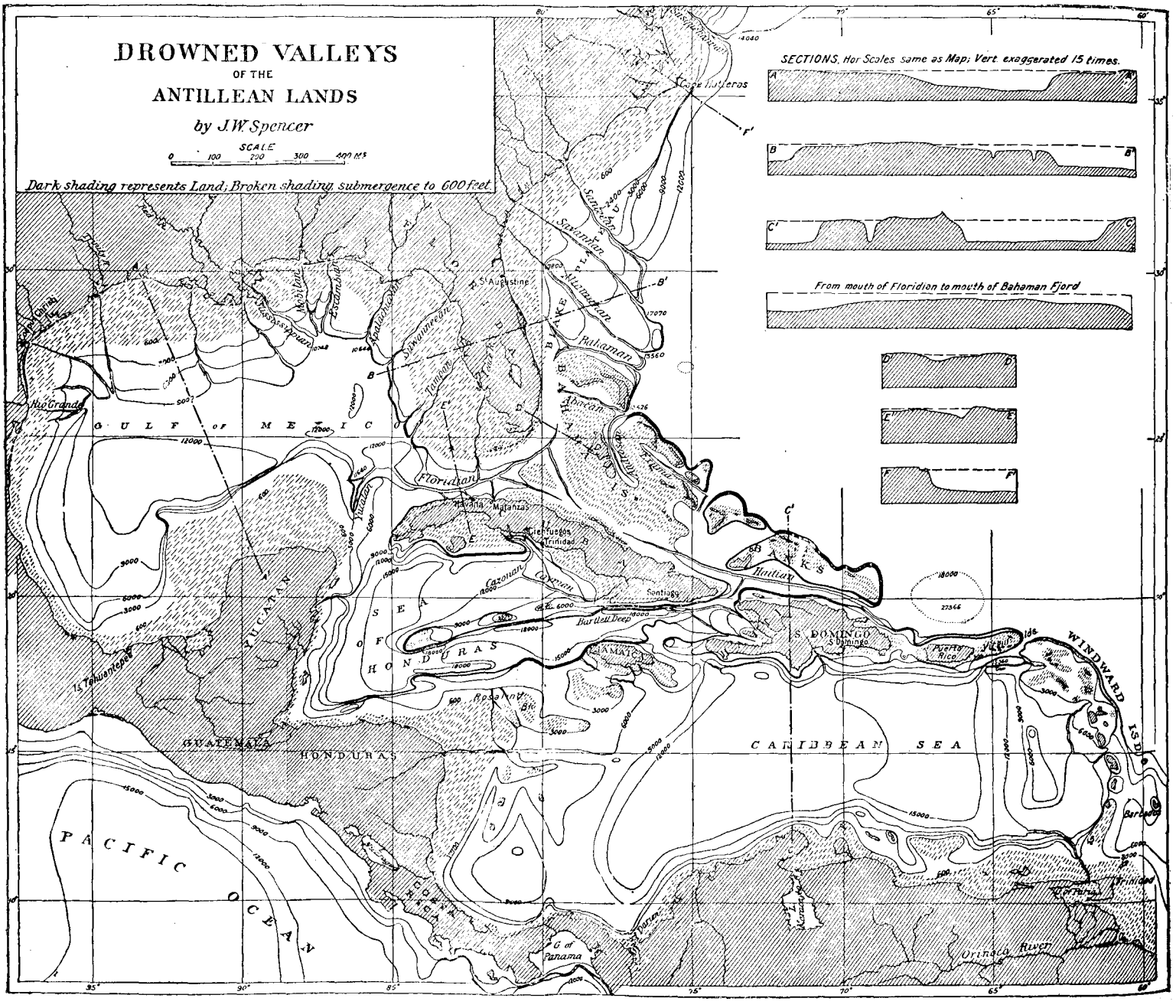
II.—Resemblances between the Declivities of High Plateaux and those of Submarine Antillean Valleys. By J. W. Spencer. (Transactions of the Canadian Institute, vol. v, 1898, pp. 359–368.)

[Communicated by Professor E. Hull, F.R.S.]

THIS paper is a sequel to the "Reconstruction of the Antillean Continent,"[1] as in it the analysis of the slopes of the drowned valleys had not been considered. Both in the land and in the submarine valleys their gradients are of two kinds: (1) Those of rivers which are flowing over continental plains, or upon the surface of high tablelands, where the declivities of the streams are so gentle as to be often reduced to even a foot per mile; (2) where the valleys are descending from higher to lower plateaux, in which case the descent is over a series of precipitous steps, separated by short gradation planes, marking pauses in the elevation of the land. Thus, if the mean descent of such a valley be taken, an average gradient would be entirely misleading. While the mean slope may reach from 100 to 200 feet per mile, it is found that in reality it is composed of perhaps twenty abrupt steps with almost level flats between. Or the steps may reach a height of five hundred feet or more. Such features are seen descending from the Mexican plateaux (of 8,000 feet in altitude) to the Gulf of Mexico. The valleys end abruptly in amphitheatres indenting the floors of the tablelands and dissecting them.

In the drowned Antillean valleys long reaches have been discovered with slopes of only a foot per mile like that of the

[1] Bull. Geol. Soc. Amer., vol. vii (1894), pp. 103–140.



To illustrate Dr. J. W. Spencer's Paper on Changes of Level in Jamaica, p. 515.

https://doi.org/10.1017/S0016756800175429 Published online by Cambridge University Press

Mississippi, or of some plateau valley. These are separated by abrupt steps similar to the succession of those descending from the margins of the Mexican tablelands. This point of analogy between the drowned and land valleys, as well as the occurrence of short amphitheatres indenting the edges of the submarine plateaux, when carefully compared, very greatly strengthens the conclusions drawn in the "Reconstruction of the Antillean Continent," namely, that the valleys traversing the submarine Antillean plateaux were of land origin, and indicate the depth to which the West Indian Continent has sunk, even to a depth of two miles or more.

III.—Late Formations and Great Changes of Level in Jamaica. By J. W. Spencer. (Transactions of the Canadian Institute, vol. v, 1898, pp. 324–357.)

[Communicated by Professor E. Hull, F.R.S.]

(PLATE XVIII.)

THIS paper is descriptive of the physical features of Jamaica which bear upon the evidence of great changes of level in late geological times, and extends the conclusions set forth in the author's work upon the "Reconstruction of the Antillean Continent."[1]

Speaking in a broad way, Jamaica is a dissected tableland, surmounting another but submarine plateau, extending from Haiti to the Yucatan banks, now submerged to depths of 3,000 to 4,000 feet. These banks have the form of old base planes of erosion, but they are traversed by deep valleys more than 2,000 feet below the summit of the platform. Even within the limit of the submarine plateau mass the channels reach to a depth of 9,600 feet, or more than 5,000 feet below the surface of the drowned plains. Here, as everywhere, when studied, the valleys have in all respects the features of those of the plateau regions of Mexico and other countries. And they head in embayments of the land, receiving as tributaries the principal rivers of the district.

The modern topographic features of Jamaica date back practically only to the middle Miocene period, for the larger part of the island is covered by old Miocene white limestones. But the subsequent denudation has been enormous, for although the formation still reaches a thickness of 2,000 feet in some places, yet in others the dissection of it has penetrated the whole mass. Upon this old Miocene surface no Mio-Pliocene formations occur, until those at the close of the period, showing it to have been one of long-continued elevation.

Upon these white limestones there was a subsequent mechanical deposit of marls with pebbles (made up in part of older fragments), and in other localities there were gravels and loams (according to the source of the materials). These accumulations rise to a height of 500 feet in stratified beds, still nearly horizontal, in contrast to the upturned beds of the underlying white limestone. They contain

[1] Bull. Geol. Soc. Amer., vol. vii (1894), pp. 103–140.

a few shells of modern species. The formations have been found to correspond, in position, with the Lafayette of the continent or the Matanzas of Cuba, which have been provisionally placed at the close of the Pliocene period.

Overlying the Layton beds, where these have not been removed, and other strata formed near the surface of the country, there has been a mantle of stratified loams and gravels laid down. This occurs up to an elevation of 600 feet. It has been named the Liguanea formation, and has been correlated with the Columbia of the continent and the Zapata of Cuba. While no fossils have been found in this fragmental deposit, yet its stratified beds, occurring adjacent to the coast, high above the sea, indicate its origin at sea-level. Thus it appears that the island was submerged to 500 or 600 feet during two distinct epochs since the Mio-Pliocene period.

The paper describes the broad undulating features characterizing the Mio-Pliocene period. These have since been dissected by wide and deep valleys, extending from the land to the submerged plateau, formed subsequent to the Layton epoch; and from the depths to which they reach in the submerged plateau the inference drawn is that the land stood more than 10,000 feet higher in the early Pleistocene period than to-day. The Layton formation during this elevation was enormously degraded, so that in many localities only remnants are found in protected places. Jamaica affords a favourable region for studying the contrast between the undulating topography developed near base-level of erosion during the Mio-Pliocene period of more extensive lands than to-day, and the great and enormously deep valleys of the post-Layton or early Pleistocene epoch. The moulding of the submarine plateau is supposed to have occurred during the Mio-Pliocene period, while the deeply drowned valleys are continuations of those of the land which are of post-Layton age.

In contrast with these two features of erosion, that of the post-Liguanea epoch of submergence has been of small proportions; indeed, the post-Liguanea elevation is so recent that it has not passed beyond the stage of making narrow deep cañons. On account of this formation overlying the remains of the Layton series, the different features of erosion up to an altitude of 600 feet are geologically preserved, while at greater altitudes they are not so easily distinguishable from those produced before the Liguanea epoch; yet when one has become familiar with the features of erosion, the respective epochs are generally recognizable. The post-Liguanea cañon-making epoch was characterized by an elevation of 150 to 200 feet more than at present, for the continuations of the existing rivers are traceable to that depth across the submerged coastal plains. The subsidence which caused the drowning of these valleys reached to an elevation of 10 to 25 feet below the present level; since which time the coral reefs of the coast have emerged to this amount.

Numerous as these oscillations appear, all of them, since the post-Layton elevation, have been of comparatively small and diminishing proportions. These changes of level of land and

sea have occurred on the other West Indian islands and on the continent; and, from the amount of work accomplished, the Pleistocene period seems to have been one of long duration.

Outside of Jamaica the geological features of that beautiful island would not be of special interest, except that here we find additional evidence, both upon land and in the adjacent sea, supporting the theory of the high continental conditions of the West Indian region in the early Pleistocene period, when the land stood more than two miles above the present altitude, uniting North and South America, as is set forth in the "Reconstruction of the Antillean Continent."

IV.—British Association for the Advancement of Science. Sixty-eighth Annual Meeting, held at Bristol, September 8–13, 1898.

List of Papers read in Section C, Geology.

W. H. Hudleston, M.A., F.R.S., F.L.S., F.C.S., F.G.S., President.

The President's Address. (See Geol. Mag., p. 458.)

Professor C. Lloyd Morgan.—Some Notes on Local Geology.

E. B. Wethered.—On the Building of Clifton Rocks.

A. Strahan.—The Revision of South Wales and Monmouthshire by the Geological Survey. (See Geol. Mag., p. 488.)

H. Bolton.—The Exploration of two Caves at Uphill, Weston-super-Mare, containing remains of Pleistocene Mammalia (*by the late E. Wilson*).

Thomas H. Holland.—The Comparative Actions of Subaërial and Submarine Agents in Rock Decomposition.

H. B. Woodward.—On Arborescent Carboniferous Limestone from near Bristol.

Report of the Committee for collecting Photographs of Geological Interest in Britain.

Report of the Committee for collecting Photographs of Geological Interest in Canada.

Professor O. C. Marsh.—The comparative value of different kinds of fossils in determining Geological Age.

Professor J. F. Blake.—Aggregate Deposits and their relations to Zones. (See Geol. Mag., p. 481.)

T. Groom.—The Geological Structure of the Malvern and Abberley Ranges.

——— The Age of the Malvern and Abberley Ranges.

J. R. Dakyns.—The probable Source of the Upper Felsitic Lava of Snowdon.

E. Greenly.—On the occurrence of Arenig Shales beneath the Carboniferous Rocks at the Menai Bridge.

——— On an Uplift of Boulders at Llandegfan, Menai Straits.

W. L. Addison.—On the Comparative Dimensions of some Atoms.

L. J. Spencer.—Leadhillite in ancient Lead Slags from the Mendip Hills.

———— Supplementary List of British Minerals.

A. Somervail.—On the Age and Origin of the Granite of Dartmoor, and its Relations to the adjoining Strata. (See GEOL. MAG., p. 509.)

Professor T. Rupert Jones.—Report of the Committee on Fossil Phyllopoda.

E. J. Garwood.—Report of the Committee on Life-Zones in the British Carboniferous Rocks.

R. Etheridge, F.R.S.—On the Relation and Extension of the Franco-Belgian Coalfield to that of Kent and Somerset.

Dr. Marsden Manson.—On the Laws of Climatic Evolution.

Professor E. Hull, F.R.S.—On the Sub-oceanic Physical Features of the North Atlantic.

W. H. Hudleston, F.R.S.—On the Eastern Margin of the North Atlantic Basin.

R. D. Oldham.—The Great Earthquake of 1897.

Professor A. P. Coleman.—Report of the Committee on the Flora and Fauna of the Interglacial Beds in Canada.

J. Lomas.—On Worked Flints from Glacial Deposits of Cheshire and the Isle of Man.

E. Greenly and *A. B. Badger.*—The Glacial Sections at Moel Tryfaen.

C. W. Andrews.—On some Dinosaurian Remains from the Oxford Clay of Northampton.

Professor H. F. Osborn.—Restoration by Charles Knight of the Extinct Vertebrates—*Brontosaurus, Phenacodus, Coryphodon, Teleoceras.*

E. Wethered.—The Work of Encrusting Organisms in the formation of Limestone.

W. H. Wheeler.—The Action of Waves and Tides on the Movement of Material on the Sea Coast.

Rev. G. C. H. Pollen.—Further Exploration of the Ty Newydd Caves, Tremeirchion, N. Wales.

T. Plunkett.—Further Exploration of the Fermanagh Caves.

P. C. Kermode.—Report of the Committee on the Remains of the Irish Elk in the Isle of Man.

Report of the Committee on the Erratic Blocks of the British Isles.

Professor J. Milne, F.R.S.—Report of the Committee for Seismological Investigation.

Report of the Committee on the Fauna of Caves near Singapore.

Report of the Committee on the Structure of a Coral Reef.

M. Laurie.—Final report on the Eurypterids of the Pentlands.

Papers bearing on Geology read in other Sections:

Professor O. C. Marsh.—On the Families of Sauropodous Dinosauria.

F. A. Bather.—On the Classification of the Pelmatozoa.

C. W. Andrews.—On Christmas Island.