felspar crystals from specimens of rhomb porphyry from Laurvig in the Natural History Museum.

Now for two personal matters:—Mr. Deeley says I have misquoted two letters of Professors Bonney and Hughes. The letters were private letters, written to myself, and are on my table. How anyone but myself and the writers can know what they contain I know not. All I know is that Prof. Bonney, in regard to the Lofodens, and Prof. Hughes, in regard to the shipwrecked stones on the East coast, absolutely confirm my statements of fact. The inferences are my own.

Secondly, Mr. Deeley says I sneer at official geologists. In my case to do so would be like parricide and fratricide. I have learnt a great deal of what I know from them, and have received unbounded courtesy from them. What I do object to, and shall continue to protest against, is the notion that geologists, official or otherwise, any more than any other scientific men, have a right to publish and discuss great issues *until they have read what other people have written about them.* It does further seem preposterous to me that a number of men should be told off to map so-called glacial deposits, and to write memoirs—*not* on the facts, but on a glacial explanation of the facts—who have never studied the mechanics of ice in the laboratory, and, what is more strange, have never seen a glacier at all.

Lastly, I suppose no other science but long-suffering geology would tolerate the absurdity—may I say the impertinence?—of a public advertisement from a casual visitor to Switzerland, that, having gone to Mont Blanc in the year of grace 1894, he proposed to settle the great question of the different action of *névé* and ice. Why, the question is a century old, and there was a whole library written upon it before either Mr. Deeley or myself was born!

VI.—The Yumuri Valley of Cuba—A Rock-Basin.

By J. W. Spencer, M.A., Ph.D., B.A.Sc., F.G.S.

NEAR the city of Matanzas, in Cuba, there is a beautiful valley called the Yumuri, of which the good people of the region are justly proud. Its interest to the geologist is unsurpassed in the island. At its entrance there is the most complete section of Tertiary rocks observed by me in Cuba. This valley is a record of the great erosion of the land during most of the Pliocene period, at the close of which it was partly refilled. The valley was re-excavated during the earlier days of the Pleistocene period, and suffered other changes, but it is the closing of the valley into a rock-basin in almost modern days of which I write.

Upon the northern side of the ridges, of which Pan de Matanzas is the highest point (1277 feet above tide), there are the remains of a former plain, which extended five or six miles to near the sea-shore, with an elevation of about 450 feet. Out of this plateau the Yumuri Valley has been excavated with a breadth of about three miles, and length of five or six miles, with a further rugged extension of one

of the tributary valleys to the foot of Pan de Matanzas, as shown on Map (Fig. 1). The floor of the basin rises from near tide-level to considerable elevations in its upper part, where there are low ridges produced by the unequal washings of the tropical rains. The floor of the lower part of the basin has been silted up so as to be

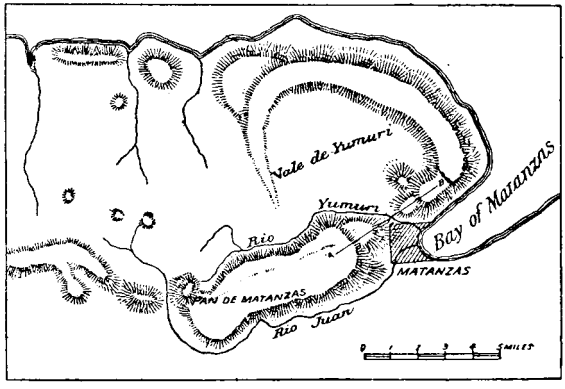

Fig 1

FIG. 1. Map of the Yumuri Valley, A B, position of section shown in Fig. 3.

level, and it is bounded by steep wave-washed banks indicating its former lacustrine character. The floor of the basin is underlaid by Cretaceous sands, decaying serpentine rock, or Tertiary limestone, which have been very extensively removed so as to expose the other and older named beds. The original valley was excavated out of the upturned beds of Miocene and Eocene limestones. During the following submergence, at the close of the Pliocene period, the valley does not appear to have been completely filled with the later calcareous rocks (Matanzas limestone of the author[1]), which contain, mostly, living organisms. During the long epoch of the earlier Pleistocene elevation and erosion, the Yumuri Valley was again excavated, and in some parts enlarged, so that only fragments of the Matanzas limestones are found on the sides of the valley. The south-eastern end of the basin is about three miles wide, and is divided by a hill into two lobes. The basin is cut off from the bay (or rather fjord) of Matanzas (with an increasing depth of from 1000 to 1500 feet) by a barrier ridge, whose base is about a mile wide, and whose height is from 250 to over 450 feet above tide (see Fig. 3). The Miocene and Eocene strata dip at from 20° to 30° S. 20° E., whilst the overlying Matanzas marls dip at 10° or 12° N. 20° E.; and these last are succeeded by modern coral-reefs on the seaward side of the ridge. The outlet of the broad valley is a *cañon* with vertical walls (below and sloping above) rising 250 feet above the water, and with a breadth of only 300 feet, like many other

[1] Described in a paper read before the Brooklyn Meeting of Am. Assoc. Ad. Sc. as an advanced notice of an unfinished paper.

recent *cañons* along the streams in Cuba. After seriously considering the untenable hypothesis of the origin of the basin as due to solution, I found that the explanation of the basin with modern insignificant outlet was due to recent dislocation, as was shown in the fault exposed in the longitudinal section of the *cañon*. The

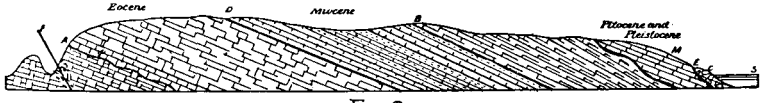

Fig 2

FIG. 2. Longitudinal section through the *cañon* of the Yumuri, at right angles to the strike; S, sea-level; C, raised coral-reefs; M, Matanzas limestones; B, slight unconformity between Miocene limestones and Miocene sands; D, base of Miocene; A, undulations in Eocene limestones; F, fault whose dip is 60°, general dip of strata varies from 20° to 30°.

Matanzas limestones have a thickness of about 150 feet; the Miocene 790 feet; and the Eocene above the fault 760 feet, but after making allowance for the dislocation along the fault, the total thickness of the Eocene may reach to 1200 or 1500 feet in the section along the side of the valley beyond the limit of Figure 2. The vertical elevation produced by the fault varies from 250 to nearly 400 feet, as shown in Figure 3. The valley had formerly extended in two lobes round an island to the Matanzas Bay, but

Fig 3.

FIG. 3. Section across the end of Yumuri Valley (same as section A B, Fig. 1). Broken shading represents the barrier raised in front of the valley; A and B, the former extensions of the two lobes of the valley; and C, the site of the *cañon*. The broken shaded section is about three miles long, and the maximum height about 450 feet.

with the elevation of the ridge to the named height the basin was produced. The plain of uplift has been preserved and exposed in the fault, shown at the inner end of the *cañon*, or on the side of the barrier-ridge facing the basin. The plain of the fault dips 60° with the adjacent strata crushed, the only structure of the kind seen in the whole section.

The discovery of the fault settled the origin of the basin, and the occurrence of late Pliocene beds in the uplifted mass brings down the date of the dislocation, after the erosion of the valley, into the later part of the Pleistocene period, or later, as would be suggested by the newness of the walls of the *cañon*.

After the earlier Pliocene elevation, there was a subsidence somewhat below the present altitude of the land, when the Zapata (mid-Pleistocene) formation was deposited.[1] At other places in Cuba these accumulations obstructed the drainage of the earlier Pleistocene valleys, and caused streams to cut across the last made

[1] This formation was described at the same time as the Matanzas.

limestones, as the land rose from the Zapata subsidence, although it has subsequently been slightly depressed again. These *cañons* are all alike, and date only from the elevation following the mid-Pleistocene deposits constituting the Zapata and gravels, and perhaps marls, of about the same date as the Columbia formation of the American coastal plain.[1]

There are other basins in Cuba where subterranean passages carry off the drainage, and those amongst the mountains are more striking than the numerous lime-sinks of Florida. But the Yumuri basin would have defied explanation had its outlet followed some other course than across the faulted ridge (which had barred the ancient drainage), and not exposed the dislocation. Some of the harbours along the extended coast may be found to be of the same origin as the Yumuri basin, and some of the valleys, such as that of Trinidad on the southern side of the island, have been more or less affected by late faulting.

VII.—A Reply to Sir H. Howorth's Paper on "Recent Changes of Level."

By Mark Stirrup, F.G.S.

In a paper published in the Geological Magazine, September, 1894, Sir Henry Howorth expatiates on recent changes of the relative level of land and sea in support of his views on the Mammoth age and his diluvial catastrophe, in which there seems to me some very extraordinary confusion in the matter of geological chronology and sequence of events. The first paragraph reads as follows:—"In some recent papers published in the Geological Magazine, I have endeavoured to show that at the *close* of the Mammoth age there was a very considerable dislocation of the Earth's crust, and that a consequence of it was the upheaval of some of the highest masses of land on the earth, including the massive mountains of Asia and the American Cordillera. I now propose to show that (as is *a priori* probable) there was a concurrent collapse or sinking of the ground over large areas, which, as in the corresponding upheaval, was *very rapid*, if not *sudden*" (the italics are mine). The suggested relationship of these various events and their alleged catastrophic character, induces me to again enter this ever-expanding field of controversy.

In support of his thesis Sir Henry first refers to the subsidences which resulted in the separation of England from the Continent, and consequent extinction of the Mammoth.

Assuming that the course of things was as stated, when it is further suggested that this event was *contemporaneous* with great dislocation of the Earth's crust, resulting in stupendous upheavals of mountain ranges in Asia and America, he attempts more than can well be proved. Sir Henry proceeds, in the development of his argument, to the evidence offered by the remains of submerged forests which exist at various points around our coasts, and attributes their

[1] The Lafayette Formation, by W. J. McGee, 12th Report U.S. Geol. Survey.