

The objections in principle which, it seems to me, will be raised to Mr. Ball's system are, 1st, that he has paid no attention to words of *known* meaning, but relies on etymologies of names which he compares without distinction with Aryan and Turanian languages, and with mixed languages like Armenian. 2nd, that in comparing Cypriote and Cuneiform he compares *late* forms, which are always misleading, and does not adhere to one epoch (which should be the *oldest* known), and places his Cuneiform emblems erect or prostrate, as suits the comparison, instead of adhering to the oldest erect forms. 3rd, that when emblems which differ occur in groups with emblems the same in the groups compared, the different emblems are regarded as equivalent. Prof. Sayce has done the same, but there is no safe ground for such a supposition any more than if we were to find C. A. B. on one text and C. O. B. on another, and should argue that therefore A. is the same as O. There are only about 130 known Hittite emblems, of which about 50 (probably phonetics) are very common. The presumption, therefore, is that these (as in Medic and other syllabaries) had each a distinct sound, and not that two or more had the same sound, and were used as equivalents. 4th, that he has made no exhaustive study of any single emblem as regards its position in the texts; and 5th, which is also a matter of principle, that he reproduces in many cases the work of others without any acknowledgment.

C. R. C.

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#### NOTE ON MR. I. C. RUSSELL'S PAPER ON THE JORDAN ARABAH AND THE DEAD SEA.

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I HAVE been very much interested in reading Mr. Russell's two communications published in the "Geological Magazine" for August and September last.<sup>1</sup> The analogy which he draws between the history of the Dead Sea valley and that of some of the lake valleys in the western part of North America is instructive as showing how similar physical features can be accounted for on similar principles of interpretation over all parts of the world. Mr. Russell very properly draws attention to the paper by his colleague Mr. G. K. Gilbert on "The Topographical Features of Lake Shores," in which principles of interpretation of physical phenomena are laid down applicable to lakes both of America and the Jordan-Arabah valley.<sup>2</sup> With some of Mr. Russell's inferences regarding special epochs in the history of this valley I am very much disposed to agree; more particularly in reference to the mode of formation of the Salt Mountain,

<sup>1</sup> "The Jordan-Arabah Depression and the Dead Sea," "Geol. Mag." Aug. and Sept. 1888, pp. 337-344 and 387-395.

<sup>2</sup> Gilbert, Fifth Annual Report U.S. Geological Survey (1883-84).

Jebel Usdum ; or rather, of the salt-rock which forms the lower part of its mass. If this interpretation be correct, it removes the difficulty of understanding why the rock-salt is confined to one small corner of the lake, which, at the time the salt was in course of formation, was vastly more extensive than at present.

The case of the arm of the Caspian known as Kara Bughaz, which Mr. Russell cites, seems remarkably apposite to that of the Southern bay of the Dead Sea ; and I feel obliged to the author for his suggestion. In reference to Mr. Russell's statement that "we ought to look for an unconformity between the upper and lower lake beds due to the erosion of the lower member," I wish to take this opportunity of referring again to the peculiar structure in the rock-salt near the northern end of Jebel Usdum, where the white laminated marls, forming the upper part of this plateau, are seen resting horizontally on a mass of rock-salt, having an oblique structure ; that is, traversed by planes sloping southwards at an angle of about  $20^{\circ}$ - $25^{\circ}$ . I made a sketch of this part of the cliff in my note-book, but from inability, through lack of time, to examine into the phenomena with more care than can be done from horseback, I thought it prudent not to refer to the matter in the "Geological Memoir,"<sup>1</sup> further than to notice it.

My special purpose in this communication is to offer some additional information to that already given on the question whether or not the Jordan-Arabah valley originally communicated with the ocean through the Gulf of Akabah. Mr. Russell is not satisfied with the information already before him regarding the nature of the watershed of the Arabah. I have, therefore, referred back to my notes, which are rather full on this very subject, though I did not consider it necessary to give them *in extenso* in the "Geological Memoir," or in "Mount Seir." On referring to the large Map of the Arabah Valley in the "Memoir" (facing p. 137), it will be seen that the watershed (Lat.  $30^{\circ} 10'$  N.) is formed partly of a limestone ridge called Er Rishy, and partly of "gravel of the Arabah." This gravel extends for several miles down both slopes of the watershed, and is sometimes overspread by blown sand, or else by alluvium. On the west side it is bounded by the steep, often precipitous, cliff of the rocks forming the eastern border of the Desert of the Tih (Badiet et Tih), and on the east by those of the Edomite hills and escarpments ; and at its lowest part rises about 700 feet above the level of the Mediterranean and Red Seas,<sup>2</sup> and therefore nearly 2,000 feet above the present surface of the Dead Sea. On approaching the watershed, or saddle, from the south, it appears as a level line stretching from the northern end of Er Rishy to the foot of the rugged hills of Edom, and about half a mile in length. It is formed of

<sup>1</sup> "Memoir on the Physical Geology of Arabia-Petræa and Palestine," p. 84 (1886).

<sup>2</sup> M. Vignes' determination is 787 feet (240 mètres) ; that of Major, now Colonel Kitchener, is 660 feet ; and that of Mr. Reginald Laurence by aneroid 650 feet.

sand and gravel of considerable thickness overlying the limestone which rises from beneath on the eastern side, and which is broken off by the great Jordan-Arabah fault against the granitoid and other crystalline rocks, which here form the base of the Edomite range. This gravel has all the appearance of a fluvialite, or alluvial, deposit, formed by the streams which in flood time descend from the hills to the east; and it is well laid open to view in one of these streams, which ultimately joins the River Jeib. Between this watershed and the first of the terraces which can, with any degree of certainty, be referred to a lacustrine origin, there is a distance of over twenty miles, and a vertical fall of about 700 or 650 feet; and as our party was scattered over the valley, we could not have failed to detect remains of such lacustrine deposits, if any such existed, above the level of those we encountered at our camp of the 12th December, 1883, at Ain Abu Werideh: at a level approximately that of the Mediterranean, and 1,292 feet above that of the Dead Sea.<sup>1</sup> These horizontal beds of white marl with shells, sand, and shingle, was an entirely new feature to us all; and no doubt remains on my mind that they indicate the highest level to which the waters of the ancient Jordan-valley Lake formerly rose.

An admission on my part that the waters of the Jordan valley ever were in connection with those of the outer ocean through the Gulf of Akabah can only be made from the point of view that, during the formation of the Jordan-Arabah line of depression by the displacement of the strata along the great fault, and when the whole region was rising from beneath the waters of the ocean in Miocene times, some such connection existed for a limited period of time; but this epoch in the history of the valley was separated by a long interval from that of the present Dead Sea, even when standing at a level of 1,300 feet above its present surface. From the time that the outer waters of the ocean were dis severed from those of the Jordan-Arabah lake by the up-rise of the land, there is no evidence that there was ever any subsequent connection by means of a stream flowing down from the North into the Gulf of Akabah. The closest approximation which, according to my view, these inner and outer waters ever made towards each other is represented in the sketch-map of that whole region in page 72 of the "Geological Memoir," where a tract of ground of about 40 miles in length, and rising to 700 feet in height, is represented as intervening between their respective borders.

<sup>1</sup> "Mount Seir," p. 99; "Geological Memoir," p. 80.

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