

Saccamina has been found in the forthcoming Monograph on Carboniferous and Permian Foraminifera by my friend Mr. H. B. Brady, F.R.S., he himself will be surprised at their number.

COLLEGE OF PHYSICAL SCIENCE,
NEWCASTLE-ON-TYNE, 9 Jan., 1876.

G. A. LEBOUR.

THE ORIGIN OF LAKE BASINS.

SIR,—It is not my intention to reply to the detailed arguments produced by Mr. Judd in his attempt to prove that my theory “on the glacial origin of *certain* Lakes” is untenable by persons having an accurate knowledge of ordinary physical geological phenomena. Were I to do so, I should have to repeat old arguments used by me in reply to the objections long ago raised by the late Sir R. Murchison and Sir Charles Lyell, objections very similar to those used by Mr. Judd, and which seemed to me and others easily disposed of. If any one cares to look into that early history of the subject, he will find these replies in the volumes of the *Philosophical Magazine* for 1864 and 1865. To other objectors I paid no attention, partly because the late Professor Jukes and others, of their own accord, did it perfectly well for me, and partly because I can generally employ my time better than in geological controversy.

Two or three points, however, I will notice.

In the first place, from anything that appears in Mr. Judd's paper, the reader might suppose that I attributed the formation of *all* rock-bound lake-basins to the action of glaciers, in spite of a statement, in a note to the original memoir, that “many lie in craters of extinct volcanos, some, no doubt, in areas of special subsidence, and others may be due to causes of which I know nothing.” In the same memoir I also in several places insist on the occurrence of moraine-dammed lakes, and also speak of others dammed up by irregular accumulation of the original drifts of the Glacial epoch.

The same facts are again insisted on in my “Physical Geology and Geography of Great Britain,” with the addition of lakes dammed by eskars; and besides, to prevent all misconception, I mentioned the African lakes, alluded to by Mr. Judd, as probably, in my opinion, like the Caspian, being parts of old sea-bottoms. I should certainly never have been so wild as to attribute the hollow of the Dead Sea to glacial erosion, though Mr. Judd seems to think that some persons may do so, confining myself as I did, and do, to the “origin of certain lakes” in well-recognized glaciated regions.

Secondly, it seems strange to me that Mr. Judd should have selected Lake Balaton as a *crucial test* to the theory of ice erosion. I never knew any one who denied the well-known fact that lakes may be and have been formed by subsidence in volcanic areas. I have seen examples of such, and have read of and believed in many others, both in Europe and America. Earthquake shocks have also been known to produce changes of level that gave origin to lakes, and ordinary landslips do the same. That there are great areas of inland drainage full of salt lakes, some of them below the level of the sea, is another piece of popular knowledge, and I never heard of any one who attributed all of these hollows to glacial erosion.

All these kinds of lakes and many others, "on the origin of which I know nothing," have however no conclusive bearing on the occurrence of such a *vast number* of rock-bound lake-basins in all countries that I have examined which have been covered more or less by large glaciers, and their comparative absence in regions, however much disturbed their rocks may be, which have not undergone glaciation; and I would ask any one who counts all the lakes and lakelets visible from the top of Sulven and other Scotch mountains to ask himself if he can rationally account for them, scattered as they are broadcast over the plateaux, and in the deeper glacier-valleys, on the hypothesis of movements in the rocks of the country, specially suitable for the production of a crowded series of lakes large and small?

It would also be an interesting exercise to count the lakes in Lewes, a great many of which have been proved by a "Scotch geologist" to be rock-bound basins, and to account for them in that low island by one or more special disturbances of the rocks.

Authority in matters of faith, whether geological or otherwise, is a most important element, and the authority of all "the distinguished geologists in Germany, Switzerland, France and Italy," "with one solitary exception," is adduced to show that "the hypothesis of the glacier-erosion of the basins" of the Alpine lakes is "both unnecessary and inadequate." I presume that solitary exception to be my distinguished friend Gastaldi, who, after holding an opposite opinion for years, at length adopted my views in a frank and courageous manner. But that high authority is not a "solitary exception." I could name another Italian geologist of weight, who years ago adopted my views with regard to the Alpine lakes, and there may be more of them for aught I know to the contrary. As yet, however, such avowed authorities are scarce on the Continent of Europe; but years ago I was told by a well-known Swedish geologist, that he never understood the meaning of many of the lakes of that country till he read my paper. English geologists will probably soon have an opportunity of reading more upon the subject from another Scandinavian geologist, who lately wrote to me, that the mode of formation of such lakes and the basin-shaped inner depths in Fjords, on any other hypothesis than mine, reduced the subject to "mere chaos."

Mr. Judd writes of "the strenuous efforts which have recently been made to resuscitate the doctrine of the erosion of lake-basins by ice." The doctrine not only did not die, but it did not even fall asleep. First, it was immediately accepted by Jukes, Tyndall, and Huxley, fifteen years ago, and since then my adherents have constantly increased. Among them I may count Dr. Newberry and others in the United States, a result that in some cases was probably helped by the unsolicited republication of my original memoir in *Silliman's Journal* in 1863. Next came the late Sir Wm. Logan, and the well-known geologists in New Zealand, some half dozen in number; also, one of the best geologists in India, if not more; and more geologists in Britain than I care to count, the names of some of whom are widely known wherever geology is cultivated. In fact, I have every reason to be more than satisfied with the progress of what

Mr. Judd calls a hypothesis, and I call a theory. It never occurred to me that even in number they could be designated "an inconsiderable minority of geologists," and I think I am justified in calling them a *considerable* number, not only considered as an aggregate of units, but also in one of the dictionary senses of the word considerable, "worthy of respect or attention." That the already considerable number is still growing is not disagreeable to me, and it was with pleasure that not long ago, in debate on one of Mr. Ward's papers at the Geological Society, I heard my always courteous and consistent opponent Mr. Bonney yield the question, as I understood him, as far as the Cumberland lakes are concerned, though he reserved those of Italy.

It is now eleven years since I replied to the objections raised to my theory by Sir Charles Lyell. It is quite contrary to my ordinary habits to indulge in scientific controversy, or to trouble myself about objectors and objections, feeling sure that if a theory be good, it will in the long run speed well; if bad, it will die. I also believe that opposition at first, and a subsequent slow and growing accretion of adherents, is far better and more durable than hasty acceptance; and I would not have written this letter, had it not been that I am weary of every now and then being accused of attributing the origin of all rock-bound basins to glacial erosion, or of its being left to inference, that I may be one of those who believe, "that all the existing lake-basins are to be assumed to have been produced by ice-erosion."

After a careful reading of Mr. Judd's paper, I feel, with others, that his arguments are very far from having "*demonstrated* that the basins of the largest lakes in our own islands, in the Alpine regions of Europe, and in equatorial Africa, respectively [this last no one that I know ever supposed], *could not possibly* have been formed by the supposed excavating power of ice." Some persons may also perceive that a definite erosive power, whether adequate or not, was in my case cited in given regions in which no one denies the former existence of that power; whereas in the other case of rock-bound lakes in old glacier non-volcanic regions, disturbances of rocks have to be assumed without the possibility of special demonstration, at all events in a prodigious number of cases. ANDREW C. RAMSAY.

Postscript.—The matter seems to me to bear a resemblance to the long celebrated case of Touchstone *versus* "a certain courtier," in *re* "the cut of a beard." I assert that my lakes are very "well cut." The objector replied in the terms of "the third degree," and thus "he disabled my judgment." In our case the altercation may stop here without any danger of its being continued as far as "the seventh degree." Mr. Judd's argument seems to allow that there is "much virtue in *if*." Lake Balaton was formed *so*, and *if* so, then the presumed glacier-scooped lakes were in his opinion formed more or less like Lake Balaton. What I said I said clearly, and made certain reservations. Mr. Judd, satisfied with his judgment, as I am with mine, makes no reservations of any value in my favour, and I shall be well content to let the matter rest there. Let it be hoped that we have "measured (s)words and parted."—A. C. R.

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