

CORRESPONDENCE.

ON THE DEPRESSION OF ICE-LOADED LANDS.

SIR,—To any one who believes in a yielding condition of the earth's crust, the depression of a tract of country upon its being loaded with any adventitious accumulation of matter appears an inevitable consequence. But I prefer to argue that the depression, which seems invariably to occur under such circumstances, shows that the crust, irregular though its surface be, nevertheless has a form appropriate to its equilibrium, and that there must be a plastic, if not a liquid, substratum to allow of the observed changes of level, when the load is freshly distributed.

So obvious is the connexion of these conditions, that it must occur to every one who has had his attention drawn that way, that any region when loaded with ice must sink. But since the question of priority in making this suggestion has been raised by Mr. Gardner, I would point out that, as long ago as in 1865, Mr. Jamieson wrote as follows: "It has occurred to me that the enormous weight of ice thrown upon the land may have had something to do with this depression. Agassiz considers the ice to have been a mile thick in some parts of America; and everything points to a great thickness in Scandinavia and North Britain. We don't know what is the state of the matter on which the solid crust of the earth reposes. If it is in a state of fusion, a depression might take place from a cause of this kind, and then the melting of the ice would account for the rising of the land, which seems to have followed upon the decrease of the glaciers."¹

I have discussed this and kindred phenomena in my *Physics of the Earth's Crust*; and have there shown that, if the crust yielded freely to the added weight, using certain probable assumed densities for the crust and substratum, it would require a thickness of 2310 feet of ice to depress the land, so that on its emergence the old shore-line should be found at an altitude of 700 feet, at which height raised shell-beds occur in Scandinavia.

The subject of mountain attraction, referred to by Mr. Jamieson, in the October number of this *MAGAZINE*, is also discussed in chap. xi. of my book.

With respect to the yielding of the crust, I think we cannot but lament, that mathematical physicists seem to ignore the phenomena upon which our science founds its conclusions, and, instead of seeking for an admissible hypothesis, the outcome of which, when submitted to calculation, might agree with the facts of geology, they assume one which is suited to the exigencies of some powerful method of analysis, and having obtained their result, on the strength of it bid bewildered geologists to disbelieve the evidence of their senses. Such appears to most of us the conclusion, that the earth is excessively rigid from its centre to its surface. For we know that down to quite a recent period it has yielded freely to pressure.

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¹ *Journal of Geological Society*, August, 1865, p. 178.