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CORRESPONDENCE.

SCANDINAVIAN ICE-SHEETS AND BRITISH GLACIAL DRIFTS.

SIR,—I am glad to see that Mr. Deeley has applied the results of Captain Scott's Antarctic expedition to the supposed extension of a Scandinavian ice-sheet to the British coasts, because it shows that the advocates of this hypothesis are abandoning the policy of "letting severely alone" the difficulty of the Norwegian Channel. Thus I regard his letter as a real advance towards the settlement of a very complex problem. But does not his idea of a floating ice bridge also involve some serious difficulties? Let us assume the sea-level during this part of the Glacial Epoch to have been the same as its present one. We may take the depth of the channel round the southern end of Norway to be from 1,500 to 1,800 feet (see GEOL. MAG., 1899, p. 282, for the variations). But the North Sea is generally not more than 250 feet deep, and occasionally only 50 feet (id., 1901, p. 187); the breadth of the channel is about 30 miles, and the distance from the Naze of Norway to Cromer about 400 miles. Let us suppose the top of the Scandinavian ice-sheet to have been only 100 feet above sea-level at the 'bridge'; then, according to Captain Scott's estimate, its total thickness must have been at least 600 feet, or the bottom of the ice-sheet some 300 feet below the margin of the North Sea plateau. Thus it must either have been forced up and over an undulating floor for over 350 miles before it reached the English coast, or its movement have been practically restricted to the upper layers. The latter hypothesis demands a greater viscosity in ice than seems probable to me, though I always thought Forbes nearer than Tyndall to the truth in their well-known controversy. The former presents several difficulties, a full discussion of which would be impossible in the limits of a letter; so I content myself with saying that we must be cautious in resorting to the Antarctic or even to Greenland for a picture of Scandinavia in the Great Ice Age. The general level of the last country may be higher, and precipitation on it may have been greater, than in Greenland, but it is much narrower; in fact, its breadth

in the part with which we are now concerned is about that of the other country in lat. 64° N., and its watershed (though the snow-parting may have been somewhat east of this) is roughly 80 miles from the west coast. In the Antarctic during that 300 miles journey southwards from Mount Erebus, Captain Scott's party was travelling almost parallel with a mountainous region (generally within a few leagues) ranging from 8,000 to 12,000 feet in height, and their view to the south when they turned back was blocked by a snowy mass nearly as high as Monte Rosa. The mean temperature also in the Antarctic is much lower than we are entitled to assume for Scandinavia in the Glacial Epoch (*Ice Work*, pt. iii, ch. i; the probable minimum limit may be inferred from the statements on p. 237). There are other difficulties, such as the relative sizes of Scandinavian and British ice-sheets, the transport and distribution of boulders, the materials of British drifts and their arrangement, which will have to be considered; but the main one for our present purpose is the inadequate 'ramming' power of the ice from the Scandinavian upland, because by far the greater part of the journey to England would have been over land, not by floating on water. Assuming a lower strand-line increases our difficulties, and a materially higher one will submerge more or less of England.

T. G. Bonney.

Cambridge.
March 15, 1909.

THE TRIMINGHAM CHALK—SOUTH BLUFF.

Sir,—I have recently been convinced that the northern part of the bluff is continuous under the sand with the southern part, and in fact offers a section of the greater part of the 'sponge beds' and of some of the succeeding beds. This was first suggested by the presence of the four-angled variety of *Serpula canteriata*, whose known range is otherwise so rigidly restricted to the 'sponge beds' and immediately succeeding beds. Following up this clue, I saw that the very ill-defined lower flint lines of the northern part could be read into accurate correspondence with the flint lines which even in the admirable horizontal section of the 'sponge beds' afforded by the foreshore are not over well defined, while one of the principal hardened beds on the foreshore could be identified in the bluff. I also saw that the main face of the northern part gave a section practically along the axis of the main fold, while the dips in the southern part, from which I argued in 1900 that if the two parts were continuous *Ostrea lunata* chalk must appear within reach in the northern part, were taken from sections parallel with the axis of the fold but some way down its side. This and a local increase in the rate at which the fold rises, which was shown by the recently cleared end of the southern part, would carry the *O. lunata* chalk of the southern part well out of reach in the northern part, but I judged from the upper flint lines that if I was correctly identifying the 'sponge beds', *O. lunata* chalk should come in at the highest point, and I was able to get near enough to the highest point to scoop away a little chalk in which I found