approach to the physical conditions of Scotland during the glacial epoch.

After the reading of these papers the following discussion took place [1]:—

Mr. JAMES SMITH [2] referred to the evidence of the upper and lower marine beds along the coast of Scotland, and to the arctic character of the marine shells.

Mr. WHEWELL felt in a dilemma owing to the difficulties in accounting for the glaciers. Either a decrease of central heat, which has since returned—a supposition at variance with all the known laws of physics—or a different distribution of land and water in the northern hemisphere [must be supposed]. Granting the change of climate, where would be the Alps from which to suspend the glaciers of Scotland? They could not have descended from such isolated peaks as Schiehallion or Ben Nevis.

Mr. DE LA BECHE spoke of the changes of conditions necessary for the existence of glaciers in Scotland, and of the recent date of elevatory movements.

Mr. LYELL explained the distribution of superficial *débris* in a portion of Scotland. Three distinct covers: (1) *universal*, composed of fragments of the subjacent rocks with a slight admixture of foreign matter; (2) *Till*, unstratified drift clay, with boulders, covered by (3) stratified gravel. The first, supposed to have been distributed by sheets of ice spreading all over the country; the second by glaciers; and the third *remanié*, by melting of glaciers &c.

Mr. JOHN PHILLIPS examined the question of the Shap Fell granite boulders and their distribution over Stainmoor, across a valley twelve or fourteen miles wide, to Darlington &c.

M. AGASSIZ advocated the origin of gravel from glacial action and not from marine currents, from the fact of the numerous lakes of Scotland in which there was no gravel. Had marine currents formed the Till it would have filled all these hollows. On the glacial hypothesis they would be filled with ice and thus preserved. Recommended the same caution to his opponents in making objections as had been so strongly urged upon himself in generalising.

Dr. DAUBENY referred to the wide extent over which the grooved surfaces are found in America &c., and to the difficulties attending the degree of cold necessary.

Mr. GREENOUGH argued against the recent elevatory movements. The decreasing level of the Baltic he attributed to the clearing of the forests and consequent smaller supply of water, and to the widening of the entrance which promoted its escape (see p. 131).

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[1] As noted in MS. by S. P. Woodward.

[2] James Smith, of Jordanhill, near Glasgow, F.R.S. (1782–1867), was author of 'Researches in Newer Pliocene and Post-Tertiary Geology,' 1862.