

high ground separated from Wasdale Crag by a watershed, Wasdale Crag (or rather Wasdale hill), from which, I believe, most of the boulders were dispersed, is only 1,479 feet above the sea-level. An ice-stream, such as that supposed by Mr. Croll, with a surface low enough to have received fallen blocks of granite, could scarcely have been 100 feet thick on Stainmoor pass. Could such a thin layer of ice have persisted in moving over the pass, so as to keep the ice-stream on the other side supplied with blocks? and in what way did the eastern ice-stream receive or acquire a motion sufficient to enable it to ignore not only minor or subordinate ridges, but hills in E. Yorkshire more than 1,000 feet in height?¹ If we suppose Mr. Croll's ice-stream to have pushed the blocks from Wasdale Crag along its bed (a theory which, of the two, would best accord with the fact that many of the blocks are more or less rounded, and often imbedded in drift), the question arises, how could the supposed ice-stream have acquired a power of shoving so many large boulders up a steep slope nearly 1,000 feet in vertical height?²

Dispersion in different Directions.—Mr. Croll has justly remarked that ice-streams may have varied their directions as their surfaces stood at different levels; but a stream of land-ice impinging on Wasdale Crag at a level which would have given it a direction towards Tebay would certainly have sent it along the valley of the Lune, in which valley no blocks of granite have been found. No one, I suppose, would presume that a local ice-stream could have flowed up this valley so as to check the glacier from Wasdale Crag. The existing configuration of the ground is likewise inconsistent with the idea of local ice-streams flowing north and north-east from Wasdale Crag. But the main difficulty in the way of accepting Mr. Croll's theory is to be found in the fact that Wasdale Crag boulders have been carried *south* in the direction of Kendal over a pass traversed by the Kendal road, which approaches Stainmoor pass in altitude. To the north of Kendal they are found in considerable numbers, imbedded in drift as well as appearing at the surface. During what stage in the lowering of the 2,000 feet ice-sheet were these boulders carried southwards?

Mr. Croll seems to think that radiating dispersion can be more easily explained by land-ice than by floating-ice. That land-ice could have dispersed boulders in various and often opposite directions from detached or semi-detached hills of moderate elevation appears to me almost impossible. The advantages possessed by the floating sea-ice (not iceberg) theory, over the land-ice theory, consist in the fact, that coast-ice may be dispersed by variously-directed winds blowing off the land; by drift-currents arising from these winds; and by ebb-tidal currents. Through these mediums it may find its way into the courses of great tidal and other currents, and these may change their directions with changes in the form of the shore or sea-bottom, produced by the sinking or rising of the land, and by denudation.

D. MACKINTOSH.

THE BLUE CLAY IN THE WEST OF ENGLAND.

SIR,—Allow me through your pages to convey to Mr. De Rance my sincere regret for having erroneously attributed the authorship of his paper "On the Glacial Phenomena of Lancashire and Cheshire," to Prof. Hull. I never met with the paper in full, and therefore avoided quoting its views. With regard to the thickness of the blue clay near Llandudno, the reference is to a paper in your November number, by Mr. H. F. Hall (not Mr. Hull, as by a misprint it appears in your correspondent's letter). My impression, on reading the statement, was that it was excessive, but I would not

¹ The land-ice theory is rendered still more improbable by the facts, that Wasdale Crag granite has found its way as far as the mouth of the Humber; that from a narrow neck on Stainmoor it has expanded over an area forty miles in breadth (from Ripon and York to the sea-coast); and that Liasic drift from the N. Yorkshire hills (over which the granite must have passed) has been dispersed over the plain of York. *Gryphaea incurva* have been found in Boulder-clay as far west as Keighley.

² Blocks of Permian breccia have been moved up a neighbouring slope to a vertical extent of 1,000 feet, and this, I think, can be sufficiently explained by the progressively upward movement of coast-ice during a subsidence of the land.

oppose a mere unsupported recollection to an opinion formed upon the spot by, probably, a more competent judge. I therefore gave Mr. Hall's figures, stating that the thickness assigned was "unusual."

I think these are the only points in Mr. De Rance's communication requiring a reply. The rest of his letter appears to refer to the paper regarding the authorship of which I have made so unfortunate a mistake.

CHARLOTTE EYTON.

BIDDULPH, CONGLETON, January 5th, 1871.

ON THE SUPPOSED PHOLAS-BORINGS IN MILLER'S DALE.

Notwithstanding the statement we inserted in our last number (p. 40), that Mr. Bonney had submitted to us his specimen from Miller's Dale, which is *beyond doubt limestone*, and perforated in the way described, we have received another letter from Mr. Edwin Brown on the subject. He is still firm in the belief that no such borings exist in the limestone where indicated in Mr. Bonney's diagram, and he states that the roadway in question has been cut in a bed of *toadstone*, and at so recent a date as not to be laid down in the Ordnance Maps. He invites geologists to visit the spot and to judge for themselves. We think it will be better not to discuss this subject further. The specimen is still in our possession, and those who feel interested may examine it at any time. The locality described is of course equally open to those who may have the opportunity of visiting Miller's Dale (see Mr. Bonney's paper, *GEOL. MAG.*, Vol. VII., 1870, p. 267).—*EDIT. GEOL. MAG.*

A NEW LOCALITY FOR *LEAIA*.

SIR,—At page 219 of No. 71 of the *GEOL. MAG.* are some notes on the little bivalved Entomostracan *Leaia*, and its distribution, South Wales having then (May, 1870) yielded numerous individuals of this rare genus to the researches of Mr. Wm. Adams, F.G.S.

Thanks to Mr. C. W. Peach, the veteran geologist, of Edinburgh, I am enabled to add another locality, and the most northern yet known, for this genus, as I have had the opportunity of examining an easily determined, though somewhat crushed, pair of valves in a piece of ironstone from near Edinburgh. They do not offer any new specific characters. Like the others already met with (excepting a Lower Permian form from Neunkirchen, in Germany), Mr. Peach's specimen is from the Carboniferous formation.

Mr. Peach tells me that "the clay-ironstone nodule containing this *Leaia* is from the Lower Carboniferous Shales of Wardie, on the Forth, near Edinburgh. The nodules from these shales (flatish in shape, with rounded outlines) contain coprolites, fishes, plants, etc. The shales also contain similar organisms; in fact, they are very rich indeed, and have been a famed hunting-ground for palæontologists. Agassiz long ago described six species of fish from these beds; and since then others have been discovered. Full particulars may be found in the *Memoirs of the Geological Survey of Great Britain: the Geology of Edinburgh; Map 32 of Scotland*, 1861, pages 30 and 31."

T. RUFERT JONES.