

THE HIGH-LEVEL GLACIAL DRIFT AND THE LAND-ICE  
HYPOTHESIS.

SIR,—The prevailing conception with regard to the manner in which the famous high-level shelly gravels have been transported, according to the land-ice hypothesis, may be fairly indicated by the following quotations:—

“It is difficult to understand how the ice could climb out of such a basin as that of the Irish Sea, and ascend such steep slopes as those of the Welsh hills up to a height of at least 1,350 feet.” (Sir Archibald Geikie, *Text-Book of Geology*, vol. ii, p. 1319.)

“Even if the thickness of the ice cap over the Dumfries and Kirkcudbright hills had been about 2,500 feet, that, with every allowance for viscosity, would hardly give us a head sufficient to force a layer of ice from the level of the sea-bed to a height of nearly 1,400 feet above it, and at a distance of more than 100 miles.” (Professor Bonney, Presidential Address to British Association, Sheffield Meeting, 1910.)

The advocates of the land-ice hypothesis apparently do not resent this rendering of their views. On the other hand, as far as one can judge from their utterances, they seem to regard it as the inevitable statement of their case.

Though in favour of the land-ice view, I find it impossible to believe that a thick ice-sheet can plough up beach material with its front, and climb or rather be pushed bodily up steep and lofty hill slopes to heights exceeding 1,000 feet. On a small scale, with comparatively thin masses of ice and low hummocks, this may be a feasible operation; but if not physically impossible, it is an improbability of a very high order with a thick sheet of ice, when heights of from 500 to 1,500 feet have to be scaled. But is such a view necessary?

Thrusting and shearing are well-recognized factors in ice movement. Contortions accompanied by upward overthrusts have been observed by Chamberlin in the Bowdoin Glacier of Greenland; and in a photographic illustration which he has given of these, some of the fracture-planes are seen to be very oblique (“*Glacial Studies in Greenland*”: *Journal of Geology*, 1897, p. 235). In this upward overthrust action we have a rational explanation of the manner in which beach material may be raised by land-ice to fairly lofty altitudes.

The tendency of this upward thrust-action would be to translate the bottom ice with its infrozen ground moraine to higher and higher levels as the ice moved onwards; and this tendency would become more marked where the ice-sheet encountered a hill, or had to force its way through a narrowing valley.

Is it not already admitted that the ground moraine can traverse an ice-sheet obliquely and finally reach the surface by this up-thrusting action in the ice; and why should not shells be permitted to reach the surface in this way? Is it not, moreover, by this means, rather than by a simple and bodily lifting of its sole, that a thick ice-sheet heaps itself to some extent against ‘nunataks’ which oppose its movement? Beyond such comparatively slight heaping of the ice, there appears to be no need to assume, on behalf of the land-ice

hypothesis, that there was any bodily elevation of the ice-sheet on the slopes of Moel Tryfaen or the other hills on which the shelly drift occurs.

T. CROOK.

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OBITUARY.

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CHARLES BIRD, B.A., F.G.S.

BORN JANUARY 20, 1843.

DIED APRIL 11, 1910.

MR. CHARLES BIRD, whose death took place in April last at Strood, had been for thirty years Head Master of the Mathematical School in Rochester. At an earlier period, after graduating at the University of London, he was appointed Second Master at the Bradford Grammar School. There he took considerable interest in geology, and communicated to the Proceedings of the Geological Society of the West Riding (1875) a paper "On the Red Beds at the Base of the Carboniferous Limestone in the North-West of England". In 1881 he published *A Short Sketch of the Geology of Yorkshire*. During his long residence at and near Rochester he devoted much attention to the local geology, the fruits of which were published in the *Rochester Naturalist* from 1883, in papers on the Medway muds, the North Downs, and the Water Supply of Hoo. He likewise assisted in conducting excursions of the Geologists' Association to Burham, Aylesford, Frindsbury, and Upnor. He was President of the Rochester Naturalists' Society during four years between 1883 and 1899, and was author of a work on *Elementary Geology* published in 1890 and of *Advanced Geology* issued a few years ago.

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WILLIAM HARMON NILES, LL.D.

BORN MAY 18, 1838.

DIED SEPTEMBER 13, 1910.

MR. W. H. NILES, who had studied under Louis Agassiz, was professor of geology and geography at the Massachusetts Institute of Technology from 1871 to 1902, president of the Boston Natural History Society from 1892 to 1897, and had been head of the department of geology at Wellesley College since 1888.

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MISCELLANEOUS.

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UNIVERSITY OF BRUSSELS.—Mons. Maurice Leriche, who has up to the present been "Maitre de Conférences" at Lille University, has been appointed Professor of Geology at the University of Brussels. He has lately issued in the Memoirs of the Royal Natural History Museum of Belgium an important monograph, "Les Poissons Oligocènes de la Belgique." Professor Dollo remains at the University as Professor of Palæontology, and will still continue Conservator of the Department of Vertebrates, Living and Fossil, of the Brussels Museum.

UNIVERSITY OF OXFORD.—Dr. Arthur Vaughan has been appointed lecturer in geology at the University of Oxford.

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