

glaciation), in illustration of which he refers to Siberian rivers now receiving the remains of the extinct mammoth and living reindeer alike.

Penetrating fissures in the rocks, this material has formed the amorphous Cave-earth of the districts beyond where the moraine has reached; and the author pointed out that, stalagmite being due to percolation, none could form while the subsoil was thus permanently frozen, which is the reason why the Cave-earth is devoid of it, though always covered by it and sometimes underlain by it, such underlay probably showing that the caves where this occurs were not submerged at the commencement of this minor glaciation.

After giving various reasons which appeared to him to show that the passing away of the minor glaciation took place while Lancashire was still submerged up to an elevation of from 20 to 30 feet, but when the east and south of England was at a somewhat higher level than at present, he described a bed of flattened stones which cover all anterior beds alike in the limestone districts of the south of Lincolnshire, and some gravel with flattened fragments of hard chalk in North Lincolnshire and Holderness which appear to him to indicate a flooding of the country after the termination of this glaciation. The author then offered some remarks on the co-existence of arboreal vegetation with the land-ice of the first or great glaciation at the time when it uncovered the plateaux of Norfolk and Suffolk, appealing for the probability of this to the condition of South America, where the inland ice passes in glaciers to the sea in the Straits of Magellan and adjoining channels through dense forests. He also pointed out that the evidences of the Newer Pliocene period, as traced by him, lend no support to the climate-theories of Dr. Croll, Mr. Wallace, or Mr. Murphy, but, on the contrary, conflict with them, as do the respective extensions of the areas of glaciation in Western Europe and Eastern America, while they are equally repugnant to any theory of climate based on changes in geographical conditions; and he concluded by insisting on the British origin of all the ice connected with either glaciation in England, and on the existence of an open north sea throughout.

CORRESPONDENCE.

J. P. LESLEY ON HIGH-LEVEL DRIFT.

SIR,—I notice the following on page 186, No. 214, GEOLOGICAL MAGAZINE:—"The author [D. Mackintosh, Esq., F.G.S., paper entitled, "Additional Discoveries of High-level Marine Drifts, etc.,"] begins with remarks on the importance of the marine drift-area, . . . especially as regards its great extent, and the absence, so far as yet known, of similar high-level drifts (between 1000 and 1350 feet above the sea) in Continental Europe, Asia, or North America."

The annual reports published by Professor Geo. H. Cook, State Geologist, give the information which Mr. Mackintosh finds wanting. The vignette to the pamphlet report of 1877 is a Map of the State, showing its northern part wholly covered with drift. The line of the terminal moraine is drawn, and lists of striæ with magnetic directions. These tables are continued in the report of 1878, and

the striæ and drift deposits are described as covering the high lands of the State. The line of moraine mounds and hollows, with large boulders, crosses Schooley's Mountain at an elevation of between 1200 and 1300 feet. Back from this, to the N. and N.E., the mountain ranges are drift-covered as well as the valleys, but the mountain crests are nearly destitute of drift, although boulders are perched upon them. A large glacial map of New Jersey accompanies this report. The report of 1879 gives a still larger coloured geological map of the State; and this also shows the drift-covered area. The report of 1880 describes the terminal moraine in great detail, with a table of elevations (highest in Waterloo township, 1250' A.T.); moraines of recession; modified drift; transported drift; preglacial drift; drift dams and ponds, etc. The report of 1881 gives the heights of Hamburg mountain as 1488'; Scotts mountain 1277'; the Schooley mountain range as varying from 900' to 1500'; the Kittatinny (Schawangunk) mountain as 1474' at the Delaware water-gap, and 1800' at the New York State line, the highest ground in the State.

The reports of progress of the Second Geological Survey of Pennsylvania describe much higher drift-covered areas. I am putting through the press Report G 6 (by Prof. I. C. White) on Pike and Monroe counties, which border on the north line of New Jersey. Through these counties ranges the high plateau of the Catskill mountains (Devonian), from N.E. to S.W., cut by the long cañons of the Delaware and Lehigh rivers descending from the north. In New York State this plateau averages 3000' above tide, with peaks (measured by Guyot) Overlook 3600', Monk 3880', Blackhead 3965', and others up to 4052', 4179'. But in Pennsylvania the average height of the plateau is under 2000'. The Delaware and Lackawanna railway crosses it with a summit grade of 1681'. Near this lies Elich's pond in a kettle of glacial drift at 1754'. The front edge of the escarpment (a horizontal conglomerate 100 feet thick) ranges at about 2000' A.T. From this front edge the plateau slightly declines north-eastward, with outlying fragments, such as North and South Knobs (2010' A.T.). But northwards it maintains its elevation; the railway summit grade being 1955' next south of the Tobyhanna creek, and 1970' next north of it. This Tobyhanna creek flows under the railway bridge at 1932' A.T. through a very shallow valley of drift.

Pocono Knob projects eastward from an angle of the escarpment (where it turns north), and is about 2000' A.T. The notch behind it which isolates its summit from the rest of the plateau is 1681' A.T. Another Knob on the brow of the escarpment reaches 2225' A.T. The terminal moraine creeps up the escarpment, encircles Pocono Knob at two-thirds its height (from base to top, say 1000'), and reaches the plateau level from behind. From this point it stretches off N.W. across the plateau at a height of 2000' A.T. in the form of a mound-wall about 100' high. Long Pond has been created by it, obstructing a preglacial valley with its trash.

The entire area of the plateau behind the terminal moraine, *i.e.* the whole of Monroe, Pike, Wayne, and Susquehanna counties lying to

the north-east of it, is an unbroken sheet of Drift, with the usual aspect of Till, with loose boulders, striæ on exposed outcrops, drift dams, buried valleys, reversed drainage, and innumerable drift inclosed ponds and lakes, the elevations of which above tide are given by Mr. White in his report; the lower ones like Nichecrouk and Silver Lakes, 1150' and 1250'; the higher ones like Lakes Belle and Ernest 1750', Lake Laura 1800', Elich's Pond 1754'.

In Mr. White's Report, G 5 (1881) on Wayne and Susquehanna counties, lying next the New York State line, similar descriptions and tables of elevations of striæ, drift ponds, etc., are given; and the exact uppermost limit of ice action is there to be seen, on the sides of isolated peaks. The highest striæ on Mount Ararat being 2200' above tide. The elevation of the whole region may be gathered from the fact that the lowest summit that the Jefferson Branch Railway could find for its grade is 2023' A.T. Hundreds of morainic ponds and lakes dot the whole map.

I hope to put to press shortly the special report of Prof. H. C. Lewis, whom I directed to trace and study the terminal moraine throughout its whole line, a distance of about 450 miles, *i.e.* from where it crosses the Delaware and enters our State from New Jersey, near the Water Gap, to where it leaves the State to enter Ohio west of Pittsburgh. In this report Mr. Lewis maps the moraine as ascending and descending our mountain sides, crossing narrow and wide valleys, ascending the Alleghany mountain plateau and traversing the highest lands in Northern Pennsylvania.

The report of Mr. Ashburner on McKean county, and that of Mr. Carll on the Oil Regions, treat largely of our high-level drift and the astonishing changes it has effected in our topography. There is, therefore, no lack of data for Mr. Mackintosh to use; data, be it said moreover, of the most precise and complete kind.

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J. P. LESLEY.

THE SO-CALLED HYPERSTHENITE OF CARROCK FELL.

SIR,—I can fully confirm Dr. Trechmann's statement as to the absence of hypersthene from the Carrock Fell rock. Some few years since, feeling suspicious, I had a slide cut from one of two or three specimens in my collection, and saw at once that the mineral was only a form of pyroxene. The hornblende, I conjecture, is of secondary formation, *i.e.* more or less uralite—a change especially frequent in gabbros. As regards the late Mr. Clifton Ward's identification, I have always suspected that he had identified the Carrock Fell mineral with hypersthene by its general appearance (which however is not very characteristic), and not by optical tests. His analysis, with its small quantity of magnesia, shows the improbability of the mineral being hypersthene. Indeed, I doubt whether the mineral has yet been really identified in Britain. Certainly, as Zirkel has shown, and as Prof. W. H. Miller informed me more than ten years since, the ordinary mineral in the Skye hypersthene is pyroxene. One or two instances have been quoted from Wales, but I do not credit them.

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