

knowledge of the climatic conditions in the unglaciated areas in Britain during cold phases in the Pleistocene has demonstrated the extreme severity of the climate with very low mean temperatures, such as would produce perennially frozen ground to depths of possibly as much as 200 ft. (61 m.).\* The absence of local ice in the regions of ice wedge formation suggests that the snow line was kept relatively high in southern England by low precipitation, possibly due to dry winds blowing outwards from the ice sheets to the north. The recent recognition of ice wedge features in the plateau area of the Cleveland Hills (G. W. Dimbleby, *Journal of Soil Science*, Vol. 3, 1951, p. 1-19) implies a severe climate and so in the absence of glaciation is possibly to be attributed to low precipitation of snow. Dimbleby's evidence suggests that the ice wedges described by him date from a cold phase earlier than the last glaciation of north-east England, but there is sufficient evidence of severe cold in the south of England contemporaneous with the Newer Drift glaciation of more northern areas to justify reasonable assumption of a severe climate for the Cleveland area at that time. It seems to me to be difficult to envisage the existence of large glacier lakes as coincident with low mean temperatures at the maximum of that glaciation in this area. Indeed it seems worth while considering whether the large body of water, which is considered to have occupied the Vale of Pickering (at the maximum) and was dammed by ice at both ends, was really contemporaneous with the maximum. It seems more likely that in this depression accumulating summer melt water would be frozen, and by the addition of possible winter snow would be built up to a mass of more or less stagnant ice which would melt out during the earlier stages of the glaciation.

Dimbleby's recognition of two suites of erratics, one preserved in the boulder clay of the infilling and one spread across and later than the infilling, is of major importance. The discussion of its significance would be out of place here but the existence of these erratics emphasizes the danger of relying upon the negative evidence of absence of foreign drift. Nevertheless, the highest channels are not really critical. The absence of "foreign" drift remains the criterion in such a case.

One interesting possible application of the morphological evidence for unglaciated enclaves such as the existence of "tors" arises in the case of the craggy outcrops of the Charnwood Forest.

Would it be reasonable to assume that they did not exist at the times of the older glaciations of the area and have been exposed by subsequent denudation (possibly largely by removal of Triassic sediments) or do they constitute an example of Professor Linton's unglaciated topography?

*Department of Geology,  
University College, London  
9 April 1952*

\* S. E. Hollingworth and F. A. Bannister, *Mineral Mag.*, Vol. 29, 1950, p. 14-16; H. L. Hawkins and discussion, *Abstr. Proc. Geol. Soc.*, No. 1481, p. 22-26; G. A. Kellaway and J. H. Taylor and discussion, *Abstr. Proc. Geol. Soc.*, No. 1483, p. 40-50.

## COMMENTS ON PROFESSOR S. E. HOLLINGWORTH'S NOTES

By D. L. LINTON

PROFESSOR HOLLINGWORTH entirely expresses my own views when he states that melt water channels "mark the ice margin at their time of operation." The melt water channels of north-east Yorkshire that drained into and out of Lake Pickering were in operation when the ice of the Vale of York stood along the Escrick and York moraines in front of which the outflow channels (now marked by the courses of the Foss Beck and the Derwent) are situated. The Escrick moraine is the extreme limit hereabouts of the Newer Drift ice, and may be taken to represent the "maximum encroachment" of the Newer Drift glaciation. Its constitution was taken by Kendall and Wroot as implying deposition in and beneath water. Moreover within the hill country the terminal moraine at Nelly Hay Force marking the furthest penetration of ice in Wheeldale is clearly contemporary

with the initiation of the great Newtondale overflow—and was still the ice margin when the intake of Newtondale had been lowered at least 50 feet, and the Moss Slack was cut across the end of Two Howes Rigg. In north-east Yorkshire therefore, the evidence suggests an abundance of (summer) melt water at the time of “maximum encroachment.”

Professor Hollingworth further remarks that it is “not unreasonable” to consider “a snow-line in the Cleveland area at the time of the Newer Drift glaciation of, say, 1000 to 1200 ft. O.D.”

Regarding this assumption three points may be made:

- (i) Evidence of ground-ice wedges or of permanently frozen ground is not evidence of a low snow line, even during the period of their formation, as descriptions of central Alaskan conditions have long made clear. It is perfectly consistent both with a high snow line (with low precipitation) and with abundant summer movement of thaw water.
- (ii) In any case since Lakes Eskdale and Pickering and the associated channels are below the assumed snow line the assumption does not carry the corollary that the channels would not have functioned each summer. The snow line is surely by definition the level below which summer ablation exceeds winter precipitation.
- (iii) The assumption of a low snow line in the Cleveland Hills does not permit us to assume that the margin of the extraneous ice would mount higher against the hills since the position of that margin depends principally on precipitation conditions in areas of ice dispersal. It thus does not aid our understanding of the erratics mentioned by G. W. Dimbleby.

Finally there is mention of the possibility that the “craggy outcrops” of Charnwood are tors—*i.e.* residuals left underground by deep chemical weathering in a pre-glacial (or inter-glacial) cycle and spared by the ice, since they were exhumed as the result of a falling base-level. The hypothesis deserves consideration but as I have no recent acquaintance with Charnwood I am not able to answer Professor Hollingworth's question. But it would give me much pleasure to join him in seeking an answer on the ground.

*Department of Geography,  
University of Sheffield  
24 May 1952*

## SECOND GLACIOLOGICAL CONFERENCE, NEW YORK, 1951

This Conference was held on 16 and 17 January 1951 in New York under the auspices of the Arctic Institute of North America, the American Geographical Society and the Research Committee on Glaciers. The proceedings have been circulated in mimeographed form. A copy is available in the Society's Library. Further copies may be obtained from the American Geographical Society, 156th Street and Broadway, New York 32, N.Y.

The following is a list of the prepared statements and comments:

P. D. BAIRD: “The Baffin Island Expedition, 1950.” DR. RICHARD P. GOLDTHWAIT: “Formation of moraines of Barnes Ice Cap, Baffin Island.” ROBERT F. BLACK: “Comments on glaciological research as related to studies of permafrost.” DR. WALTER G. BUCHER: “Deformation of bay and shelf ice in the Bay of Whales, Antarctica.” DR. ROBERT L. NICHOLS: “A discussion of Arctic ‘Ice Islands.’” COLONEL BERNT BALCHEN: “Ice islands.” DR. RICHARD FOSTER FLINT: “Glacial history and radiocarbon.” P. D. BAIRD: “Recent developments in Canada.” WALTER A. WOOD: “Project Snow Cornice.” MAYNARD M. MILLER: “The Juneau Ice Field Research Project.” DR. JAMES L. DYSON: “Glaciers of the American Rocky Mountains.” WILLIAM O. FIELD, JR.: “Program of the Research Committee on Glaciers.” GEORGE O. GUESMER: “The Snow, Ice and Permafrost Establishment.” DR. PAUL A. SIPPLE: “The Arctic from the military viewpoint.” DR. LOUIS O. QUAM: “The interest of the Office of Naval Research in basic research.”

The previous Conference was reported in the *Journal of Glaciology*, Vol. 1, No. 6, 1949, pages 336–37.