

The Editor,
The Journal of Glaciology

SIR,

Glaciers of Jan Mayen

Since the last issue of the *Journal of Glaciology* was published, my attention has been drawn to Professor R. F. Flint's excellent description of Sørbreen (South Glacier) of Jan Mayen in Miss Louise A. Boyd's *The Coast of Northeast Greenland*. This detailed account was written in 1938 from observations made in the summer of 1937. I would like to point to two features mentioned in this, which I failed to observe in 1938. West of Sørbreen near its snout, Flint records a striated rock surface and other indications of early extension in that direction and also an old lateral moraine north of Kapp Fishburn (Cape Fishburn) east of the outer lateral moraine of my description. This evidence suggests that Sørbreen also suffered the earlier phase of retreat that Kerckhoffbreen (Kerckhoff Glacier) and certain other glaciers underwent.

Lt. Bobrik von Boldva noticed the absence of any mention of Sørbreen in a seventeenth-century Dutch description of Jan Mayen. Flint recalls this and regards it as furnishing "a possible minimum time for the entire series of South Glacier deposits." However, von Boldva shows how unreliable the Dutch accounts are with reference to other glaciers on the island. Moreover, William Scoresby, Jnr., failed to describe Sørbreen at the beginning of the nineteenth century. Thus this negative argument can hardly carry much weight.

It is of interest also to hear from Professor P. L. Mercanton, of the Commission helvétique des Glaciers, that he measured the rate of movement of Sørbreen in 1921 at 0.5 cm. a day. This slow speed agrees with the Austrian measurement in 1882 and the retreat phenomena of the glacier.

Department of Geography,
University College, Leicester.
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J. N. JENNINGS

SIR,

Boulder Clay Fabric

As none of the reviews (including that in Vol. 1, No. 4 of the *Journal of Glaciology*) of Professor R. F. Flint's invaluable new book *Glacial Geology and the Pleistocene Epoch* (New York, 1947) have drawn attention to its tacit acceptance of the new "lodgement" hypothesis of boulder clay formation I should like to make the following comments.

The hypothesis that boulder clay has mostly accumulated during the active movement of an ice sheet was introduced by C. D. Holmes (Till fabric, *Bulletin of the Geological Society of America*, Vol. 52, 1941, pp. 1299-354) to account for the differential orientation of stones of various shapes in the boulder clay sections investigated by him in New York State. So far as I can discover there has been no further important published work bearing on this problem of till fabric. In view of the fact that the statistical validity of the results for some of the smaller shape-groups may be questioned, and that there is some evidence of bias (unconscious bias in favour of round numbers in taking readings) which affects some of the results, it seems premature to accept Holmes's findings with regard to preferred orientations, let alone the resulting theory.

However, C. D. Holmes's work is valuable pioneering in a field which has been seriously neglected in this country. There is no doubt that a clear understanding of the way in which boulder clay is formed will make possible big advances in Pleistocene stratigraphy. Two lines of inquiry are open: (i) observation on existing ice sheets, (ii) the study of till fabric.

With regard to the latter it is clear that any clue to the parallel orientation of stones of particular shapes may arise in one or more of the following ways: (a) orientation during deposition beneath flowing ice as envisaged by Holmes, (b) orientation within the flowing ice preserved on the melting of the ice, (c) orientation during settling of the moraine on the melting of the ice. It is clear that the mode of melting of the ice must affect structures due to (b) and (c).

In Europe it has generally been assumed that the settling of the stones on the melting of an ice sheet has tended to produce lack of structure. To account for the preservation of structures inherited from the ice Carruthers's theory of bottom melting is designed to reduce the importance of settling. German authors tend to meet the same problem by envisaging ice to be so encumbered with moraine that movement on settling has been limited by lack of elbow-room. Such ice must have become stagnant before melting. However, it should surely be borne in mind that the settling process may not have been purely negative and destructive, but may have had a positive effect and produced its own structure.