

## Two radiocarbon dates from Tunsbergdal

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Mottershead, D. N., Collin, R. L. & White, I. D.: Two radiocarbon dates from Tunsbergdal. *Norsk Geologisk Tidsskrift*, Vol. 54, pp. 131-134. Oslo 1974.

A buried peat is described sandwiched between two tills near the snout of Tunsbergdalsbreen. Radiocarbon dates from the base and top of this peat suggest that between 8000 and 3850 BP the glacier had shrunk to a size smaller than its present one.

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In the summer of 1971 a party from the Department of Geography, Portsmouth Polytechnic, carried out some fieldwork in the vicinity of the Tunsbergdalsbreen. A deposit of peat was found in the proglacial area to yield dates which may be of general interest.

In 1971 the terminus of the Tunsbergdalsbre lay at the upstream end of a rock amphitheatre which contained a lake some 200 m across (Fig. 1). Within the amphitheatre there are several occurrences of peaty material for which an erratic origin is suggested. Small fragments of dried peat, brown in colour, occur scattered throughout the fabric of the moraines on the western side of the proglacial lake (dated from photographs as 1966). At several points on the rock bar peat can be seen forced up into rock crevices, often in association with mineral sediment. The mode of occurrence of the peat suggests that it was emplaced by glacier ice. This would appear to indicate an interstadial period in which the glacier snout receded upvalley to allow the development of vegetation and peat, followed by a readvance of the glacier which transported the peat to its present position.

A more detailed picture of events can be gleaned from a section at the southern side of the lake. The thickness of the stratigraphic units varies as the section is traced over a lateral distance of 100 m or more, but the profile described in detail here can be taken as typical (Fig. 2).

At the base of the section is a pavement of shattered bedrock. It is fragmented by open joints which are strongly developed, particularly in the horizontal direction. This is attributed to dilatation as glacial erosion lifted off the overburden. The pavement is overlain by 1-2 m of till, pale grey in colour and well compacted by comparison with other tills in the area. Traced upwards the till becomes golden brown in colour grading further into a strong dull brown. At this horizon it has a loose sandy matrix, and stones and boulders are capped with fines suggesting a translocation of finer particles downwards. This is interpreted as a weathering profile developed in the grey till. Overlying this basal layer of weathered till is a peat up to

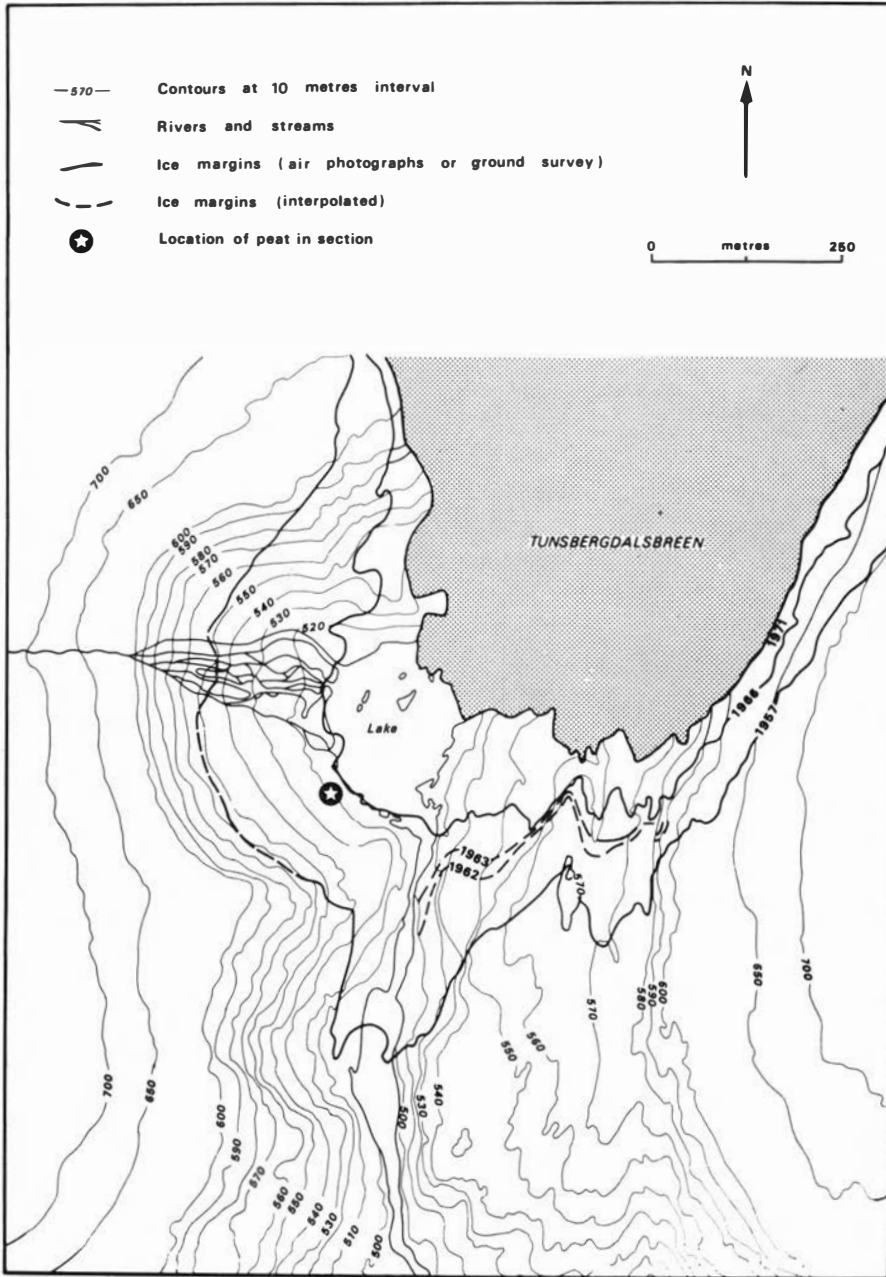


Fig. 1. The proglacial area of Tunsbergdalsbreen.

2 m thick. The peat consists of several horizons, is strongly compacted and contains many wood fragments. Pollen contained within the peat indicates that during its formation *Pinus* was the dominant tree pollen, with subsidiary *Betula*. Graminae, Ericaceae and *Sphagnum* were abundant in the

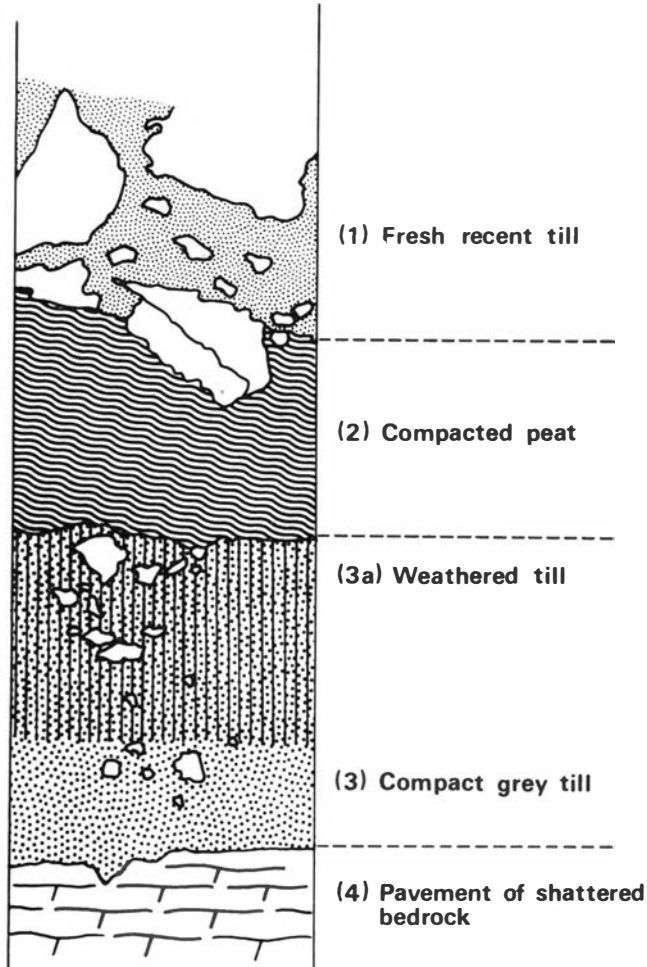


Fig. 2. Schematic representation of the section with buried peat.

ground flora. The peat has clearly been subject to stresses since it is compacted and cut by a large number of planes of fracture in a rhomboidal pattern. Boulders, stones and pockets of gritty till are pressed into it around its margins. It would appear that the section cuts a raft of peat which has been sheared and transported some little distance, and is therefore not in situ. It is thus to be equated with the erratic peat found elsewhere in the amphitheatre. The peat is overlain by up to 4 m of fresh recent till, pale grey in colour and sandy to gritty in texture. It contains angular and sub-angular boulders up to 1 m across. This upper till is clearly a recent deposit, and from photographic evidence was probably revealed from beneath the glacier between 1962 and 1966.

The section can therefore be interpreted as representing the following sequence of events. An early glaciation produced the scoured pavement and

the fragmented rock. During the subsequent retreat phase the basal till was deposited. This became exposed to weathering, and vegetation became established leading to the development of a cover of peat. A readvance of the glacier shifted the raft of peat a short distance downvalley and deposited the recent till on top of it. A radiocarbon date of  $8083 \pm 100$  (SRR-50) from the base of the peat must postdate the earlier recession of the ice. Thus at a point just over 8000 radiocarbon years ago the glacier had shrunk to a size smaller than the present day. This is entirely consistent with the assertion of Liestøl (1969) and Rekstad (1903) that glaciers in Norway wasted away almost completely during the post-glacial warm period. A sample from the top of the peat layer yielded a date of  $3855 \pm 55$  (SRR-87). This suggests that the period of peat formation, just upvalley from the amphitheatre, lasted from 8000 until at least 3850 BP, during which time the amphitheatre must have been free of glacier ice. It may well be that a considerable amount of time elapsed between the date of the upper peat and the readvance of the glacier. It is quite likely that the peat does not represent the complete sequence, in that the upper part may have been eroded off by the readvancing ice. Thus the non-glacial interval may well have been longer.

If the interpretation that the glacier was much reduced in size between 8000 and 3850 BP is correct, then it is difficult to find room here for a readvance during the climatic optimum such as is postulated by Page (1968) from evidence at Svartisen in northern Norway. The evidence described here from Tunsbergdal offers closer support to Liestøl's suggestion that glaciers were regenerated at the beginning of sub-Atlantic time (2500 BP). This subsequent readvance appears to be the one which culminated in the mid-eighteenth century.

Further work is currently being carried out on the analysis of the pollen content of the peat.

*Acknowledgements.* – The fieldwork was supported by contributions from the 20th International Geographical Congress Fund of the Royal Society, and by Portsmouth Polytechnic. The radiocarbon dating was carried out by the Scottish Research Reactor Centre, East Kilbride, Glasgow.

June 1973

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