

Notes

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The occurrence of Permian blocks near Calypsobyen, Spitsbergen and their significance

During the summer of 1978 the writers examined and mapped the upper Precambrian Kapp Lyell tillites near Calypsobyen south of Bellsund (Fig. 1) in the course of a study of the tectonic history of west Spitsbergen. The tillites are quite massive and have been deformed by several tectonic events (Kowallis 1979). During our work we found several large, flat-lying blocks of fossiliferous, silicified limestone near the present terminus of Scottbreen (Fig. 2), resting directly on outcrops of Precambrian tillites. The largest of these blocks measured approximately 2m x 1m x 1m. The blocks contain abundant productid and spiriferid brachiopods, as well as bryozoans, corals, and bivalves. The fossils are similar to those described by Frebold (1937) and Gobbett (1964) from the Permian of Svalbard. The blocks appear to correlate with the Kapp Starostin Formation (upper Permian), as described by Cutbill and Challinor (1965) and Flood et al. (1971).

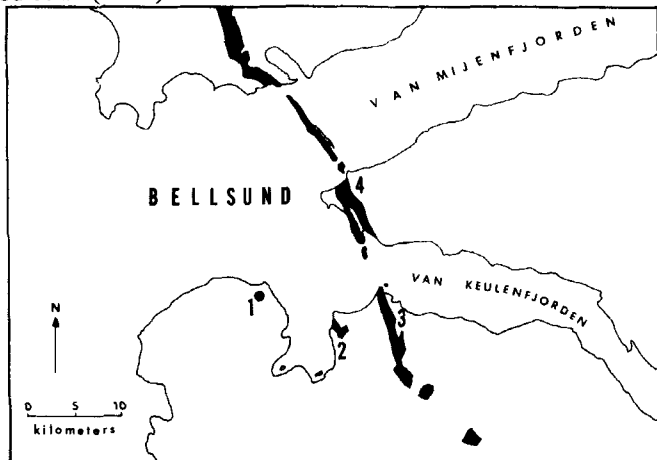


Fig. 1. Relationship of outcrops of eastward-dipping Permian beds to the Permian blocks south of Bellsund on Calypsostranda. Dark areas are Permian outcrops. (1) General location of Permian blocks found during the summer of 1978. (2) Carboniferous and Permian rocks faulted against the Hecla Hoek sequence at Reinodden. This area was studied by the University of Wisconsin group during the summer of 1979. (3) Upper Carboniferous or lower Permian rocks lie unconformably on Hecla Hoek rocks at Ahlstrandodden, also examined during 1979. (4) Lower Permian strata rest unconformably on Hecla Hoek rocks on Midterhukun peninsula. This area was studied by University of Wisconsin geologists during the summer of 1980.

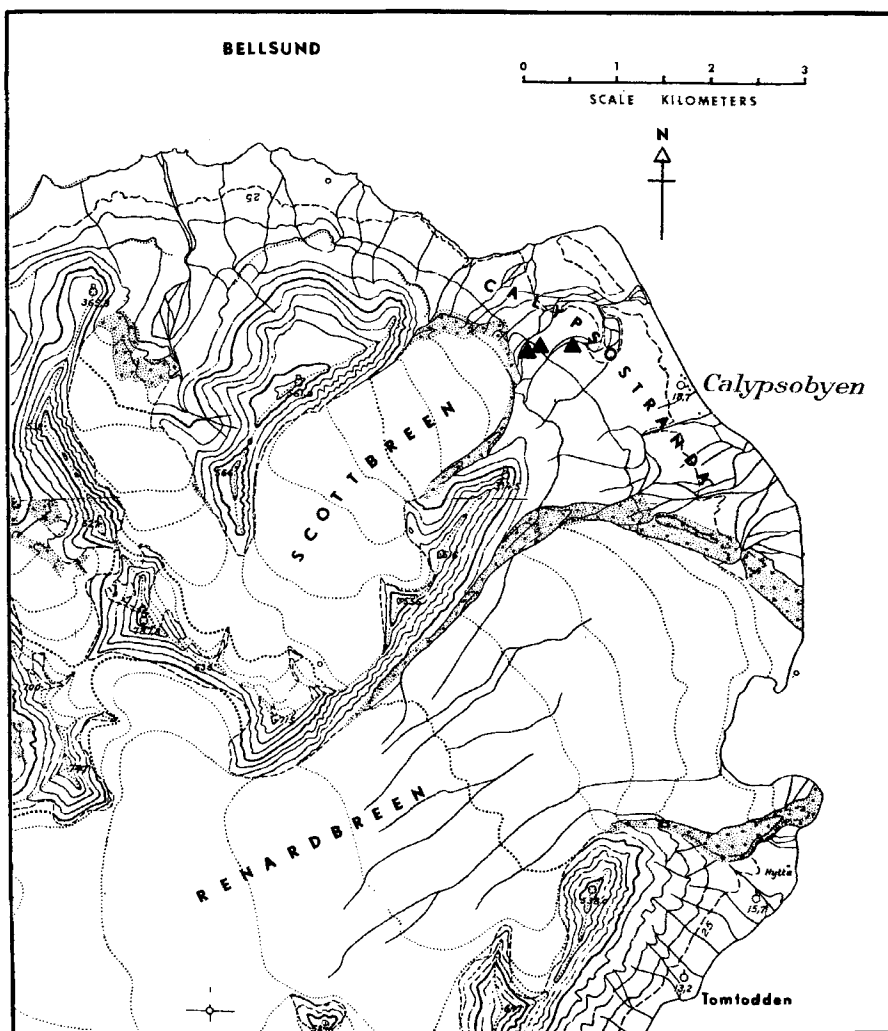


Fig. 2. Location of Permian blocks near Calypsobyen is shown by the dark triangles. Topography is from Norsk Polarinstitutt topographic sheet D11, scale 1:50,000. The University of Wisconsin base camp during the summers of 1977 and 1978 was located at Tomtodden.

The light gray color of the Permian blocks and their general appearance are such that from a distance they are easily mistaken for part of the tillite. The fact that the blocks are concentrated within a small area and have not been found randomly scattered throughout Calypsostranda suggests that they may not be merely glacial erratics, rather, they could represent a remnant outcrop of Permian beds lying unconformably on the upper Hecla Hoek tillite. From our limited observations and study we cannot be certain of the origin of the blocks, but we offer and examine two possible explanations.

Remnant outcrop explanation

Glacial erratics are common throughout Spitsbergen, but some evidence suggests that these particular Permian blocks might not be erratics. As stated above, the blocks were found only within a small area (about 1/4 km²) east of the present terminus of Scottbreen. They are nearly flat-lying and undeformed, in contrast with the tilted and foliated Kapp Lyell tillites. These observations, of course, do not disprove a glacial emplacement of the blocks.

Another line of reasoning is to examine the relationships of the Hecla Hoek sequence with Permian rocks elsewhere in Spitsbergen, particularly in the vicinity of Bellsund. Fig. 1 shows the outcrops of Permian strata near the Calypsostranda site. The interesting thing to note is the variability of the hiatus between the Hecla Hoek sequence and the post-Caledonian Paleozoic rocks. Devonian rocks rest unconformably on the Hecla Hoek in eastern Hornsund, approximately 75 km south of Calypsostranda (Birkenmajer 1975), upper Carboniferous beds overlie the Hecla Hoek at Ahlstrandodden, and lower Permian strata overlie the unconformity on Midterhuken peninsula. This variability along the unconformity attests to vertical movements that were common during Carboniferous times (Harland et al. 1974), in places they appear to have continued on into Permian time (Cutbill and Challinor 1965, Birkenmajer 1975).

The Permian blocks on Calypsostranda lie just to the west of the St. Jonsfjorden trough, a large N-S trending graben which existed during Carboniferous and Permian time (Cutbill and Challinor 1965). The Calypsostranda area could thus have been topographically positive and undergoing erosion until late Permian time when deposition began following the transgression of shallow seas. Birkenmajer (1975) has suggested that repeated transgressions and regressions of shallow seas occurred from Permian through Tertiary times. It would not be unusual therefore, to find upper Permian strata resting unconformably on the Hecla Hoek tillites.

Glacial erratics explanation

Glacial erratics are commonly widespread in glaciated regions, particularly where large ice sheets have developed. Spitsbergen and the Barents Shelf have been part of large ice sheets several times during the last 150,000 years (Boulton and Rhodes 1974, Hughes et al. 1977, Boulton 1979a and 1979b). In the area of Bellsund, the movement of glacial ice during the initial stages of advance would have been from east to west, down Van Mijenfjorden and Van Keulenfjorden and out through Bellsund to the sea. Hughes et al. (1977) show flow from east to west in the Bellsund area within a proposed late-Wurm Arctic ice sheet. With ice movement in this direction, Permian material could easily have been transported from the outcrops along Van Keulenfjorden (Fig. 1), and dropped downstream at Calypsostranda.

Conclusions

Although the Permian blocks found on Calypsostranda may simply be glacial erratics, they might represent a remnant bedrock outcrop. At present we cannot be certain of either origin. If the blocks do represent an in situ outcrop of Permian rocks, they are important in establishing the timing of tectonic events in the Kapp Lyell tillite. The tillite contains two - and in some places three - foliations, and it has been folded and faulted (Kowallis 1979). The Permian blocks, on the other hand, show no foliation other than bedding and are essentially flat-lying. This would imply that the youngest foliation in the tillites is pre-Permian in age.

References

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