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## Changes of glaciation in the northeastern Sörkapp Land, Spitsbergen, 1961-1971

**ABSTRACT:** Reduced ice thickness made the glaciers of the northeastern Sörkapp Land occupy considerably smaller area in 1971 than in 1961. Glacial retreat was however more limited in this area than in a remaining part of the Sörkapp Land. Melting of firm intensified processes on mountain slopes.

**Key words:** Arctic, Spitsbergen, Sörkapp Land, photogrammetry, glaciers.

The aim of this note is to compare glaciation of the same area in 1961 and 1971 on the basis of analysed air photos, received from the Norwegian Polar Institute. The authors are grateful for rendering them accessible.

The area is a mountaineous coastal zone in eastern Spitsbergen between headlands of Haketangen and Brotneset, just opposite Hornsund (Fig. 1). The following materials were used: (i) air photos, (ii) topographic map 1: 100,000 (Norge Topografisk Kart...) actual for 1936 and delivering glacier extents. Air photos were done on August 23, 1961 and July 30, 1971; they are vertical and in scale *ca* 1 : 50,000. Photos of 1971, being originals, are of better quality than copies of 1961. The area covered with photos from both 1961 and 1971 was analysed.

The Hamberg Glacier was most widespread in 1936. A glacier tongue was longer in 1971 but also more narrow and wasted (more and deeper crevasses) than in 1961. A bergschrund was wider in 1971. The glacier was much more massive, its ice being more homogeneous in 1961. Water outflow with much suspended material was intensive in 1971 on northern side of the Hamberg Glacier (Fig. 1: sign. 5). It was probably due to lower resistance of bedrock at Kovalskifjella. Ice cliff of the Hamberg Glacier could be noted on the photos of 1961 (Fig. 2). Extent of the glacier front underwent numerous fluctuations due to sur-

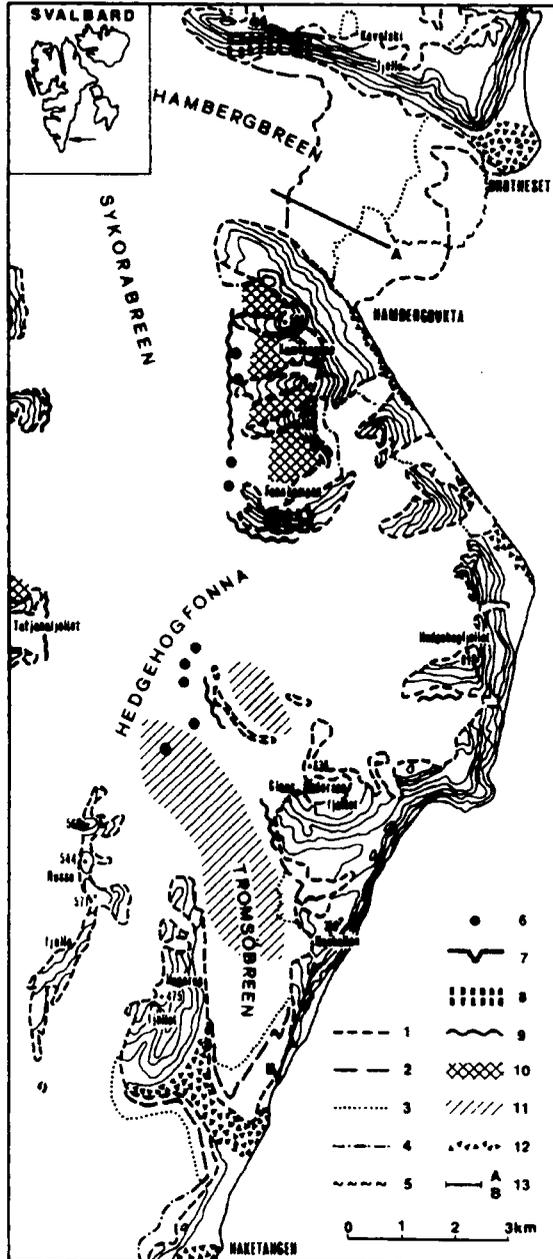


Fig. 1. Main changes of glaciation in the northeastern Sörkapp Land in 1961-1971. Extents of glaciers: 1 - in 1936, 2 - in 1961, 3 - in 1971, 4 - the same in 1961 and 1971; 5 - extent of glacial waters in a sea in 1971; 6 - large draining holes in glaciers in 1971; 7 - incision in mountain ridge; 8 - deep erosion and intensive denudation on mountain slopes; 9 - longitudinal and lateral depressions in glacial ice after 1961; 10 - immense ablation of firn in glacial cirques; 11 - considerable reduction of glacier thickness; 12 - moraines after a topographic map; 13 - morphological sections A (cf. Fig. 2) and B (cf. Fig. 3)



Fig. 2. Morphological section across the ice cliff of the Hamberg Glacier in 1961 (*cf.* Fig. 1)

ges in 1900-1985 (Lefauconnier and Hagen 1991). Positions of the glacier front in 1961 and 1971 were also affected by surges. Hence, reduction of thickness of the Hamberg Glacier has not been reflected by retreat of its front.

Denudation is distinct on Kovalskifjella (Fig. 1: sign. 8). Gullies formed by occasional waters were slightly cut in slopes in 1961. They were much bigger and included less weathered debris in 1971. In a firm field, these incisions were shaped particularly well (*cf.* Fig. 1: sign. 7), being deeper, wider and filled with less weathered debris in 1971 than 1961.

The Sykora Glacier was strongly supplied with lateral glaciers in 1961. It was thinner in 1971 because of smaller supply with lateral glaciers. The holes, through which water got down to the glacier bed, were well visible on air photos of 1971 (Fig. 1: sign. 6). Lateral glaciers, and especially their firm fields in cirques of Kamtoppane-Fonnkampen, were much smaller too (Fig. 1: sign. 10). A lateral depression down-glacier, *ca* 500 m wide, was formed due to partial ablation of the Sykora Glacier in 1961-1971 (Fig. 1: sign. 9). Similar changes occurred at foot of some other massifs too.

A glacier on eastern slopes of Kamtoppane-Fonnkampen reached a sea coast in 1936, but it was significantly shorter in 1961-1971. In spite of similar extent, its thickness was smaller in 1971 than in 1961. Erosion on slopes and top of the mountain massif was very active during these ten years (Fig. 1: sign. 8). Surface of the Sykora Glacier was covered with ancient snow in 1961. Ice crevasses occurred regularly and not deeply under a snow. In spite of mantling by fresh

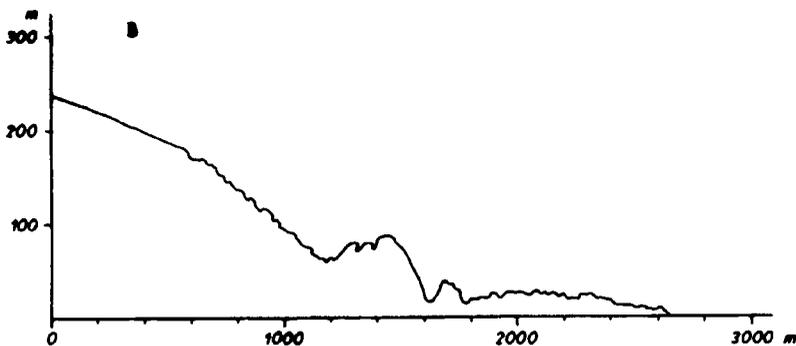


Fig. 3. Morphological section along a mountain ridge in southern part of Havkollen (*cf.* Fig. 1)

snow in 1971, the ice surface was strongly wasted and cut by big crevasses and holes (*ca* 50 m in diameter).

Reduction in thickness of the Tromsø Glacier and widening of the lateral depression in glacial ice was noted at western foot of Claus Andersenfjellet (Fig. 1: sign. 9). There was much less snow in this area than further to the north, both in 1961 and 1972. Absence of intensive erosion could result from resistance of bedrock, similar also in Hegerupfjellet but greater than in other massifs.

Retreat of the Tromsø Glacier, which still reached a sea in 1900, was slow and progressive *i.e.* 0.5-1 km in 1900-1985 (Lefauconnier and Hagen 1991). A moraine between the Tromsø and the Vasiliev glaciers was only slightly eroded in 1961-1971. Snouts of these two glaciers nearby have changed insignificantly. In spite of that, there was a clear decline in thickness of the Tromsø Glacier in 1961-1971 (Fig. 1: sign. 11). Small quantity of suspended material, carried by waters from the Tromsø Glacier to a sea, was due to deposition in a marginal lake, considerable resistance of bedrock and stagnation of the glacier. The coastline was stable there. Clear traces of ancient erosion, caused by a glacier that overpassed a ridge, occur in southern part of Havkollen (Fig. 3).

Finally, volume of glaciers, their thickness and filling of firn fields considerably decreased in 1961-1971. Glacial surges determined changes of ice cliff positions of the Hamberg Glacier without a progressive retreat, in spite of reduction of its volume.

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## Streszczenie

Przedstawiono zmiany zlodowacenia wschodniego wybrzeża Spitsbergenu od Haketangen do Brotneset w latach 1961-1971 (fig. 1-3), opracowane na podstawie interpretacji zdjęć lotniczych otrzymanych z Norweskiego Instytutu Polarnego. Najważniejsze z nich to: wyraźne zmniejszenie miąższości lodowców (zarówno jezorów jak i pól firnowych), skurczenie ich zasięgu, wewnętrzna destrukcja zachowanych lodowców przez ablację, zdenudowanie dużych ilości materiału zwietrzelnego ze stoków, znaczne zerodowanie stoków i grzbietów skalnych. Północna część analizowanego obszaru została zmieniona bardziej niż południowa.