FLUCTUATIONS OF A GLACIER TONGUE 1958 - 1978 AT HARE FJORD, N.W.T., CANADA, 1:20,000

(Aerial photogrammetric map)

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1. Location and background

The depicted glacier tongue is situated on Northern Ellesmere Island (Grant Land). Up to now, the glacier has only be shown on the official topographic map "Otto Fjord 340C", 1:250,000 with 500ft-contours, as well as on aerial photographs. On July 31, 1978, D. Terroux, Ottawa, took photographs for the Heidelberg Ellesmere Island Expedition (Barsch and King 1981); this mission included the flight line 31220 along Hare Fjord. The opportunity was taken to produce an earlier version of the map (Römmer, unpublished) showing the variations of an unnamed glacier tongue since the year 1958 (flight line A 16724). The glacier has its origin in the vast icefield covering a mountain range in the western part of Northern Ellesmere Island; the south-western, non-glacierized continuation of this range separates the drainage areas of Otto Fjord to the north and Hare Fjord to the south. The icefield has an area of 7,180 square kilometers and reaches up to 1,747m a.s.l (King 1981), and possesses a large number of outlet glacier tongues. The coordinates of the map center are: 81°8.5'N/83°20'W.

2. Photogrammetric and cartographic work

To show the variation of the glacier tongue in a metric way, a photogrammetric stereo-restitution was done at the Institute for Photogrammetry of the Technical University in Karlsruhe. In the absence of sufficient geodetic ground controls, an aerotriangulation was carried out for the inner part of Hare Fjord using the 1958 photographs (Stockert, unpublished). Based on the calculated stable points bordering the glacier, the compilation was done at the scale of 1:10,000 for each period. The changes in the glacier surface can be presented in different ways, and the map illustrates two possibilities. In the upper part of the sheet, the glacier tongue and the surrounding areas are shown with 20m-contours for the years 1958 and 1978. The map "Flächenänderung zwischen 1958 und 1978" depicts the area changes with colours indicating

an increase (red) or a decrease in area (yellow). The change in the altitude of the glacier surface can be read by comparing the red contours for 1958 with the blue contours for 1978. Note that ice-free rock surfaces and glacier ice completely covered with debris are represented by the same symbol (grey dots). Moraine-covered areas which have markedly decreased in surface altitude are displayed in a grey tone.

3. Glaciology

The investigated glacier has a total length of about 20km and the highest parts of the compound accumulation basin reach about 1500m a.s.l. Based on data from comparable neighbouring glaciers (King 1981), it can be estimated that the maximum ice thickness is around 250m and the equilibrium line altitude is 800 - 900m. Vast slush areas occur above the equilibrium line. The surface of the glacier tongue is deeply cut by many meltwater streams that mainly originate at the confluence of two tributary glaciers. Due to loss of latent heat by meltwater runoff, glacier tongues in the area are supposed to be cold-based. The maximum glacier extent during the 20th century was probably reached in the early 1950's. A surge, similar to the one of Otto glacier (Hattersley-Smith 1969) which originates from the same icefield, may not be excluded. The advance left a series of push moraine ridges that have shown remarkable stability over the twenty years in both the terrestrial as well as the marine environments. On a nearby peninsula, permafrost thickness was measured to be 550m and, hence, subsea permafrost possibly exists.