

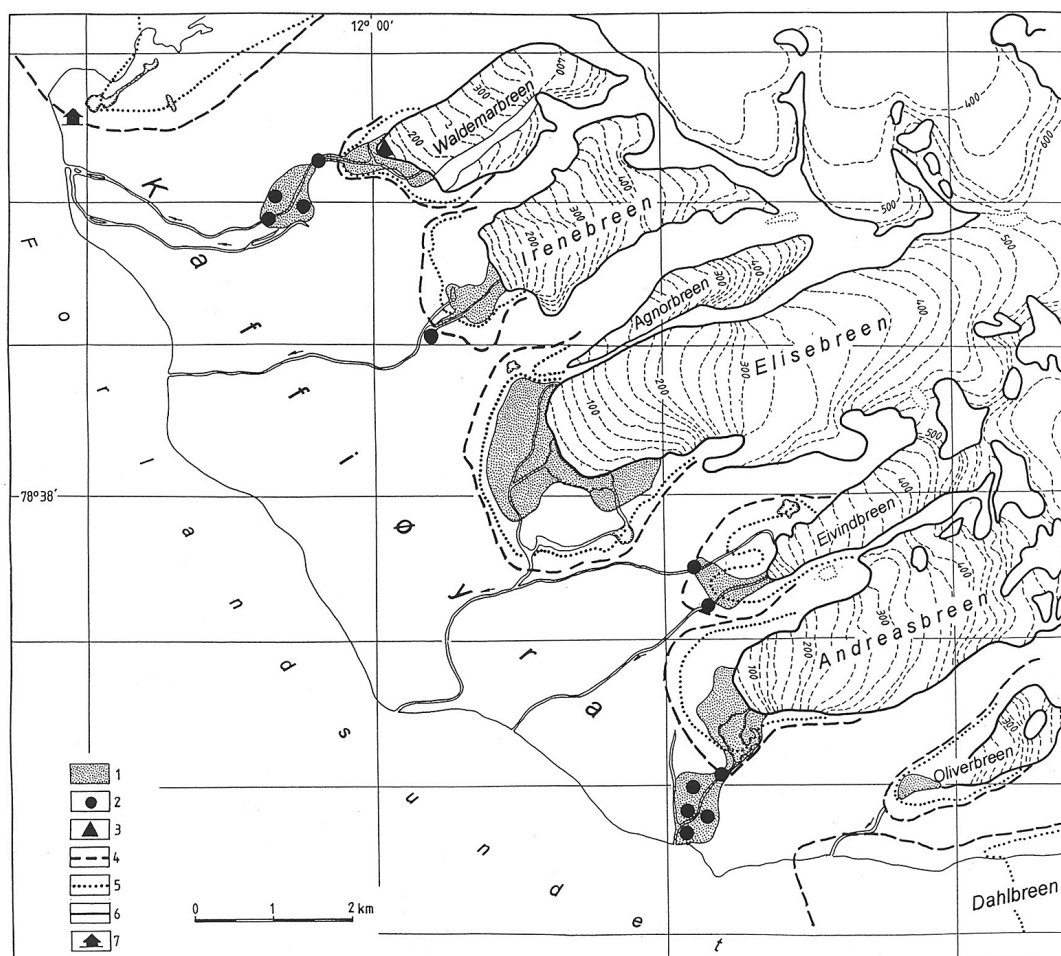
## Naledi of the Kaffiøyra

Marek Grześ\*

Department of Cryology and Polar Research, Institute of Geography, N. Copernicus University, Toruń, Poland

Most studies into the naledi of a glacial origin in the Svalbard were conducted to the summer season, that is when the naledi subject to greater disintegra-

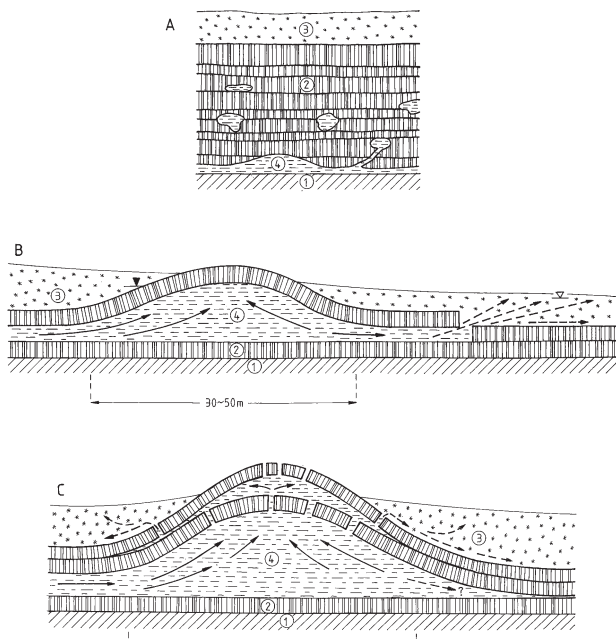
tion or warnnging. The research focusec upon a morphogenetic role of the naledi.



**Fig. 1.** Naledi of the Kaffiøyra

1 – areas occupied by naledi, 2 – icing mounds, 3 – supraglacial naledi, 4 – extents of glaciers In the 18th/19th centuries, 5 – extents of glaciers in 1936, 6 – extents of glaciers in 1995, 7 – Nicholas Copernicus University Polar Station. The naledi map was made on the grounds of the map of glacier extents by K.R. Lankauf (1999)

\* e-mail: gmark@geo.uni.torun.pl



**Fig. 2.** Naled drainage schemes  
 A – Typical naled cross-section, B – Cross-section of a closed icing Mount, C – Cross-section of an open icing Mount; 1 – bedding, 2 – naled ice, 3 – snow, 4 – water

The present investigations were carried out in the forefields of six glaciers in the Kaffiøyra., in the north-west of Spitsbergen.

The observation have been carried out since 1975, during spring time (April–May) and summer time (July–August). All the the glaciers were found to be accompanied by naledi.

However, it is only in the case of the Waldemar and Andreas glaciers tht the naledi partially covered the outwash plains (see map). The studies explained this was related to the capacity of accumulating glacier waters in the marginal zone. The phenomenon was defiined as the marginal zone capacity and was found to depend upon its configuraion. It must be assumed that at the time of the glacier progressing recession, naled cannot be formed in the extra-marginal zones.

It is very difficult to determine the area of the naledi precisely. They are mantled with a snow cover which plays decisive role in the migration of the outflowing water from the glacier. It was found that sesonal changes in the area of the naledi amounte to 15–20% front of the particular glaciers. The results of the investigations in the Kaffiøyra led to a conclu-



**Fig. 3.** Naledi (photo I. Sobota)

sion that the naledi of a glacial origin reached the larges sizes in the winter and spring protected by a warmer and humid summer seasons

Every spring the naledi of the Kaffiøyra reached the area of approximately 4.5 km<sup>2</sup> on average.

The comparison of values, that bigger galciers are accompanied by bigger naledi.

The volume of a naledi ice should be taken into consideration while making these estimates. It is complicated to establish the plume of a winter discharge from glaciers on the grounds of the naled ice. This results from a huge portion of water saturated snow (up to 80%). At the time of a naled-formation there are two systems of water migrations in them: free (gravitational) and forced (under pressure). Ice mounds are characteristic elements of a naled surface configuration.

One supraglacial naled was found on the Waldemar Glacier, but it was seasonal winter outflow only. It has had a conserdable influence upon the course of the glacier retreat. Very important problem concerning the volume of water trapped in naledies. In May 1998 it was equal to about 0.5 mln m<sup>3</sup>. The average winter outflow from the Waldemar Glacier was estimated to 0.024 m<sup>-3</sup> s i.e 1 km<sup>-2</sup> (Grześ, Sobota 2000).

The wanning of the naledi was not the subject of the authors investigations. It was concluded, however, that the intensity of this phenomenon was determined by the disintegration of the naled sheets, division into smaller fields. This disintegration can occur in sub-naled and in-naled channels of winter drainage.