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RECENT GLACIOLOGICAL INVESTIGATIONS IN SWEDEN

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SUMMARY

The Swedish glaciers have been in recession during the last decades.

The Karsa Glacier (1,95 km²), situated on 68° 20′ N and 18° 20′ E, is the only one which has been measured since the beginning of this century. After surveying and introductory investigations in 1925-26 according to Ahlmann's principles (Ahlmann, London, 1948), the studies were continued by C. C. Wallén in 1942-46 by an enlarged programme.

The mean annual recession of the glacier was in 1909-39 3,4 m and in 1939-47 7,7 m. The lowest part — between 800 and 900 m above sea level — has decreased from 0,15 km² in 1925 to 0,04 km² in 1944.

The decrease in volume of the glacier has been estimated as 1,2 mill. m³ of water per km² per annum between 1926 and 1943.

The regime of the glacier appears from the following table (all figures in mill.m³ of water) :

Budget year	Accumulation	Ablation	Total regime	Net loss
1941-42	2,3	3,9	6,2 (= 3,1 pr km²)	1,6 (0,8 pr km²)
1942-43	3,7	4,1	7,8 (= 3,9 » »)	0,4 (0,2 » »)
1943-44	3,6	3,9	7,5 (= 3,3 » »)	0,3 (0,2 » »)
1945-46	3,5	—	—	—

The studies have mainly dealt with the relation between ablation and different meteorological factors. During all periods of investigations (involving four periods in the beginning of the ablation season, three during the middle of the summer and one in early autumn) the total insolation, ablation, temperature, humidity and wind have been recorded. Furthermore, observations series exist for the variation of temperature, humidity and wind in the air layer nearest the snow surface.

It has been stated that the variation with height of the different meteorological factors is much more complicated over a small glacier like the Karsa than over a plateau glacier like Isachsen Plateau in West Spitsbergen where the same problem has been previously studied by Sverdrup (Sverdrup 1935). The wind and temperature vary over the snow surface according to different laws, and the temperature gradient is dependent on the local weather conditions as well as on the character of the airmass to a much greater degree than was previously surmised. It is, therefore, necessary to adopt new interpolation formulas for the variations in temperature and wind, when calculating the transportation of heat to the snow or ice surface.

Preliminary studies have given the following results :

Time	Melted owing to radiation income	Evaporated owing to radiation income	Melted owing to convection	Melted owing to condensation
17.5-11.6 (snow)	61%	2%	33%	4%
20.6-10.7 (snow)	49%	0%	36%	15%
19.7-17.8 (snow)	30%	0%	48%	22%
19.7-17.8 (ice)	51%	0%	33%	16%

It should be emphasized that the figures for the radiation have probably to be lowered by a few percent, and those for the convection and condensation raised, but this will have no influence upon the general results. It is interesting to find that the evaporation is small.

We have also been able to show how the importance of convection and insolation changes with different types of air mass.

In general the convection must have the greatest importance for the ablation and thus for the recession of the glaciers during the last decades.

The results of these studies will be published in 1948 or 1949.

The Stor Glacier (3,3 km²), facing eastward in the Kebnekaise massif, situated on 67° 50′ N and 18° 30′ E has since 1945 been systematically investigated under the direction of V. Schytt, and in accordance to Ahlmann's principles (Ahlmann, London 1948).

The mean annual recession was in 1922-44, 8 m; in 1945-46, 17 m and in 1946-47, 22 m.

The decrease in volume between 1922 and 1946 is estimated as being 70 mill. m³ of water, or on an average 2,8 per year (= 0,8 per km²).

The accumulation amounted in the budget year 1945-46 to 3,5 mill. m³ of water, in 1946-47 to 3,2 mill. The latter figure is based on a great number of shafts and on more than 1000 soundings.

The regime of the glacier was (in mill. m³ of water) :

Budget year	Accumulation	Ablation	Total regime	Net loss
1945-46	3,5	5,5	9,0 (= 2,7 pr km²)	2,0 (= 0,6 pr km²)
1946-47	3,2	9,6	12,8 (= 3,9 » »)	6,4 (= 1,9 » »)

The rate of movement is determined by 30 stakes bored into the snow or ice. On the axis of the middle part of the glacier tongue the values was 14 m from August 1946 to August 1947; the winter figures here were 50 percent less than the summers'.

The air temperature was recorded on the uppermost part of the glacier (1480 m above sea level), on the side of its margin (1140 m) and at 680 m. About 200 ablation values, varying between 1 and 12 cm of water per 24 hours, from different parts of the glaciers will be correlated with the temperature on the respective parts, varying between 3° and 11° C.

The course of the temperature in the snow cover has been examined for determining the coefficient of heat conductivity, the recrystallization and redeposition of fluid water in the snow. Apart from melting occuring on the snow surface there is probably also an internal melting.

The Rabot Glacier (4,4 km²) facing westward in the same massif, had a decrease in volume between 1922 and 1946 of about the same magnitude as that of the Stor Glacier, but its annual regime is less.

The Kebnekaise massif is crested with a small, ridgeshaped glacier, forming the highest point in Sweden. This glacier has also diminished; its top from 2123 m above sea level in 1902 to 2114 m (or possibly less) in 1947.

The investigations in Kebnekaise are planned to be considerably enlarged in 1948.

Literature

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