

REVIEWS

DER HAUSHALT DES HINTEREISFERNERS (ÖTZTAL) (The regime of the Hintereisferner (Ötztal)). O. SCHIMPP. *Veröffentlichungen des Museum Ferdinandeum in Innsbruck*, Bd. 39, Jahrg. 1959, p. 66–138. Universitätsverlag Wagner, Innsbruck, 1960.

O. SCHIMPP has combined the Alpine and the Scandinavian schools of glacier measurement and applied them to the 8 km. long Hintereisferner. The Alpine school consists in the accurate determination of the surface and the rate of movement of glaciers. On the other hand, the Scandinavian school founded by Ahlmann determines the ice regime of glaciers by measuring the accumulation and ablation with the help of stakes. Schimpp measured the spatial ice-velocity, i.e. the horizontal and vertical speeds, in 10 transverse sections. This was done at 5 to 10 points on each transverse section. The measurements were repeated monthly throughout the year. The points of measurement were marked by posts stuck into the ice. At the same time these posts served as stakes and with their help the accumulation and ablation were measured each month at every point.

The vertical velocity components of the ice have shown that: (1) above the snow line in the firn region a firm mass M is submerged yearly; below the snow line an exactly corresponding mass M is brought to the surface by the vertical components of the movement. (2) This mass M corresponds to the amount of ice flowing through every year in the profile of the glacier at the snow line. These observations (1) and (2) apply equally to stationary and non-stationary glaciers (3). The actual firn mass accumulated each year in the firn region and the mass actually melting in the ablation region vary according to the weather conditions in each particular year. The values found by Schimpp in the years 1952/53 and 1953/54 are interesting: The vertical velocity components gave $M = 2,180,000 \text{ m}^3$ of ice. In the firn region in 1952/53 he found a deficit of $1,640,000 \text{ m}^3$, in 1953/54 an excess of $750,000 \text{ m}^3$. These figures are quite normal. Conditions were different in the ablation region. Here there was a large deficit in the two years: of $7,210,000 \text{ m}^3$ in 1952/53 and of $6,220,000 \text{ m}^3$ in 1953/54.

Schimpp discusses this large preponderance of ablation. It lies in the extra-long tongue of the Hintereisferner, which is the remains of the glacier *Hochstand* of 1850. Schimpp calculated the size of the tongue of the Hintereisferner that would correspond to today's conditions. He used the mass M and the current ablation magnitudes. The tongue would in that case be only 2.1 km. , whereas today it is 5.3 km.

Schimpp's results concerning ice velocities are of great interest. They are not constant during the year. The changes are of the order of 40 to 50 per cent. They are caused by a kinetic wave coming down the glacier from the highest firn region to the end of the tongue within a year. The wave starts when melting in the highest firn region starts in May or June.

In a short report¹ I have discussed and interpreted the work of Schimpp and made additional comments on the methods and results of the Alpine and Scandinavian schools of glacier research. In this connection Ahlmann's findings on the 14 July Glacier in Spitsbergen are of interest. There he also found a very large deficit of mass during a year and called it most disastrous for the glaciers. In the case of the Hintereisferner the deficit is of a similar size. By combining the Alpine and Scandinavian research methods it was possible to clear up the origins of the deficit and its relation to the actual real nourishment of the glacier. It is of special importance that in the case of the Hintereisferner the large deficit is not caused by the climatic conditions of today, but by the climate of former times. This result is also of importance for selecting typical glaciers, which react quickly to climatic changes and allow correct conclusions to be reached as to change of climate. Schimpp's results concerning ice movement and

glacier waves seem to be of real importance in connection with Nye's new theoretical investigations on glacier flow.

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REFERENCE

1. Finsterwalder, R. Neue Ergebnisse der Eishaushaltmessung an Gletschern. *Mitteilungen der Geographischen Gesellschaft in München*, Bd. 45, 1960, p. 147-51.

ALETSCHGLETSCHER. 1:10,000. Sheet 3, 1957.

THIS new map, compiled by the Eidgenössische Landestopographie, Wabern-Bern, and the Abteilung für Hydrologie der Versuchsanstalt für Wasser- und Erdbau at the Technical High School at Zürich, covers the lower reaches of the Aletsch Glacier from the Märjelen See on its left bank and the Mittelaletschgletscher on the right, to its present terminus. Incidentally the Märjelen See with its grand and famed scenery had shrunk from 600 m. in 1938 to 110 m. in length in 1957.

Three more sheets will eventually cover the whole glacier to its source. The map shows not only the present extent of the ice, but also by means of red and violet lines, its margins around the *Hochstand* of 1860, and during the Würm stage, respectively. During the Daun substage, the snout may have lain some 8 km. or so lower than at present—that is to say right into what is now the Rhône Valley. During the maxima in the Ice Age the Alpine glaciers covered most of Switzerland, but the present ice cover cannot be regarded as just a recession from that glacierization. There have been warm periods when the ice cover was less than today. On the other hand, early in A.D. 1600 the glacier snout lay some 2 km. further down than it does now, and it again reached this point in the middle of last century when the ice was about 300 m. thick where the snout now lies; even in 1927 it was still very thick at this point.

A note from the producer of the map rightly suggests that this survey will provide a comparison with the earlier states of the glacier and serve as a basis for co-ordinating numerous individual observations, particularly those of the last 20 years. It will also provide the basis for future investigations of the glacier. For years the accumulation along the main glacier has been recorded by means of snow and precipitation measurements, and the wastage determined by ablation measurements (highest values about 16 m. per annum), by measurements of the absolute change in elevation of the surface along control profiles and by stream-gauging measurements. The surface velocity (maximum about 200 m. per year) has also been extensively measured. In addition, the ice thickness (maximum about 800 m. at the Konkordiaplatz) is known from seismic measurements at a number of places.

This new map of the longest and best-known ice stream in the Alps thus offers many possibilities for research, both in regard to its past fluctuations and for comparison with other glaciers. This, of course, is facilitated by the convenience afforded by the Research Station at the Jungfrauoch.

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NINE GLACIER MAPS: NORTHWESTERN NORTH AMERICA. [With pamphlet of same title. [v, 37] pp.] *American Geographical Society, Special Publication No. 34*. New York, American Geographical Society, 1960. \$3.00.

The nine glaciers are:

The Lemon Creek Glacier
The Blue Glacier