The area involved is 100 by 150 miles (160 by 240 km.), but the snow cover probably represents the downstream flow. The only discordant factor on the lower Rhine might be the Main. The Danube, however, has other minor sources downstream. Switzerland has already inaugurated a broad system of snow surveys to supplement its earlier system in the basin of the Lake of Zürich. Like the Andes, the Alps by their altitude prolong their snow melt season from four months, usual in North America, to five months, and by controlling lakes add yet another month to the run-off cycle. Thus the April–July period is expanded to April–September, but the longer period corresponds in seasonal percentage closely to the shorter period on which the above harmony in stream flow is based. In its snow research and water sources Switzerland is the hydrologic service center of Europe.

International snow surveys traversing the Scandinavian peninsula would provide a picture of drifting snow in Norway and Sweden and a broader basis for forecasts of stream flow. Southern Sweden, however, projects below Norway into a belt of earlier melting. Snow surveys are practised in both countries and the late run-off of glaciers is being utilized to prolong the period of dependable power. A national snow survey system has been planned in the Pyrenees to forecast water power supplies on the River Ebro of Spain for occasional dry winters. Systematic forecasting has also been projected for the mountains of Iran, a snow-fed country strikingly like Nevada, where snow surveying was first developed. The distant snow-clad peaks and the filaments of green descending from them through the desert to a broad oasis reveal from the air the intimate relationship between snow cover and vegetation. At present the success or failure of the coming summer is forecast by looking at the snow.

MS. received July 1949

CORRESPONDENCE

The Editor,
The Journal of Glaciology

SIR,

Bismuth and Ice

At the Joint meeting of the Society with the British Rheologists and the Institute of Metals, Dr. C. H. Desch suggested the investigation of bismuth for its analogies with ice. The enclosed leaflet, a reprint of the *Bulletin de la Société Vaudoises des Sciences Naturelles* dated 17 April 1907, shows that this problem did not escape my attention many years ago.

But the experiment was not easy owing to the difficulty of maintaining the metal exactly at the right temperature—267° C., which is a few degrees below its melting point. Another difficulty was its brittleness and the fact that only very small quantities of the metal were available. As you will see I used small rods of bismuth 1 cm. in diameter and placed on them an iron wire 0·3 mm. in diameter, weighted with a weight of nearly 3 kg., giving a pressure of 100 atmospheres. The rods were completely cut through but no regelation of the incision took place. The iron wire was, in places, covered with melting bismuth and traces of local melting were visible during the experiment.

It would be interesting to repeat this experiment with larger quantities of the metal and under temperatures better controlled than was possible for me at the time.

The Growth of the Glacier Grain

Since Hugi over a century ago demonstrated the grain structure of the glacier no definite answer has been given to one fundamental question: has the growth of the crystal in its course from the peaks to the valley been assisted or retarded by the movement of the glacier?

Emden showed in 1880 that the crystals in ice could grow even in the complete absence of movement provided only that the temperature fluctuated around the zero point, which, of course, is the case, too, in the moving glacier.

I should like to take this opportunity of saving from oblivion certain observations I made as early as 1897 at the Montanvers section of the Mer de Glace and which I communicated to the

Société Vaudoise des Sciences Naturelles. I had hoped to supplement these before they were published—an aim which remained unachieved.

I made 14 records of crystal sizes across the glacier by a method suggested by Forel—using a glass plate as a tracing medium with copying ink and taking off "pulls."

The results were as follows:—

Mean area of crystals, 30 m. from right margin of glacier	1·68 cm.^{2}
Mean area of crystals in centre of glacier	0·32 cm.^{2}
Mean area of crystals 25 m. from left margin of glacier	0·83 cm.^{2}

The answer is clear: on average the crystals at the two margins of the stream were about four times larger in area (on the exposed face) than those in the centre and about eight times as large in volume. This seems to agree with the recent researches of Mr. G. Seligman (*Journal of Glaciology*, Vol. 1, No. 5, p. 254–66).

It seemed to me that crystals at the margins owed their greater size to their being more exposed to daily fluctuations of temperature caused by radiation from the banks, and also because they had travelled for a longer time and were therefore older. If on the other hand the flow of the glacier had been the predominant factor of growth the grains ought to have been larger in the centre of the stream where the movement was more rapid.

Lausanne,
14 *September* 1949

P. L. MERCANTON

SIR, *Rate of Movement of Surface Debris in Solifluction Processes*

Little is known of the rate of development of polygonal or "solifluidal" soil patterns or of their rate of down-hill movement—subjects which are of significance to the geomorphologist and to the ecologist interested in the stability of the cover of vegetation.

In 1947, with M. Jean Michaud, I made some experimental studies at Chambeyron near Barcelonnette in the French Basses-Alpes at an altitude of 2700 metres. Selected stones were distinguished by painting them. Two years later some of the stones remained undisturbed, but others revealed clear evidence of movement. The front of the largest "rock glacier" investigated had moved a few decimeters. In another case the increase in the rate of movement from sides to centre was beautifully displayed, being very small at the sides and reaching a maximum of several centimetres at the centre.

In an experiment with polygonal soils in 1947 we intentionally destroyed the surface pattern of some small polygons (20 cm. broad). The pattern had been completely reformed into polygons by 1949. In another case painted stones were placed half-way between the centre and the side of a polygon. After two years it was found that they had moved, mainly outwards, a distance of 1–3 cm.

These experiments are being continued by Jean Michaud.

Laboratoire de Géomorphologie,
École Pratique des Hautes Études,
St-Maur (Seine).

ANDRÉ CAILLEUX

[It would be valuable if comparable experiments were made, preferably by local observers, at localities in Britain, notably the Lake District, North Wales and Scotland on the one hand and under more severe climatic conditions, such as Spitsbergen, on the other.—*Ed.*]

REVIEWS

GLACIAL-METEOROLOGICAL INVESTIGATIONS ON THE KÅRSA GLACIER IN SWEDISH LAPPLAND 1942–1948. CARL CHRISTIAN WALLÉN. Reprinted from papers in *Geografiska Annaler*, Årg. 30, Häft 3–4, 1948 and Årg. 31, Häft 1–4, 1949 and published as *Meddelanden från Stockholms Högskolas Geografiska Institut*, Nr. 75, 1948, 240 pages, tables, diagrams.

THIS work constitutes the inaugural dissertation for the author's degree of Doctor of Philosophy presented to the Faculty of Science of Stockholm University. The investigations discussed may