EARLY DISCOVERERS

In searching among old papers evidence is sometimes found of some discovery which appeared at the time to have little significance because the scientific world was not ready for it, or it may be realized that some observation or new theory, credited to one investigator, had in fact been brought to light by another at some earlier date and had, for some reason, been lost to sight. Other papers again, while making no contribution to present knowledge, may have historical interest. Two examples are given below and the Editors will be pleased to receive notes on similar cases so that a series of articles can be published.

I

THE MOVEMENT OF FIRN AND ICE IN GLACIERS

Pfaff, Fr. Ueber die Bewegung des Firnes und der Gletscher. *Abhandlungen der K. Bayer Akademie der Wissenschaften*, II Cl. 12 Bd. 2 Abth. Munich, 1876.

In a paper read before the Society in 1946 it was mentioned that Pfaff believed he had observed a downward component of flow of as much as 40° in the firn area of the Great Aletsch Glacier in 1875. Pfaff's original paper came into the writer's hands recently. Pfaff, who seemed discontented with the many theories of glacier flow which were being put forward, often by men who had little

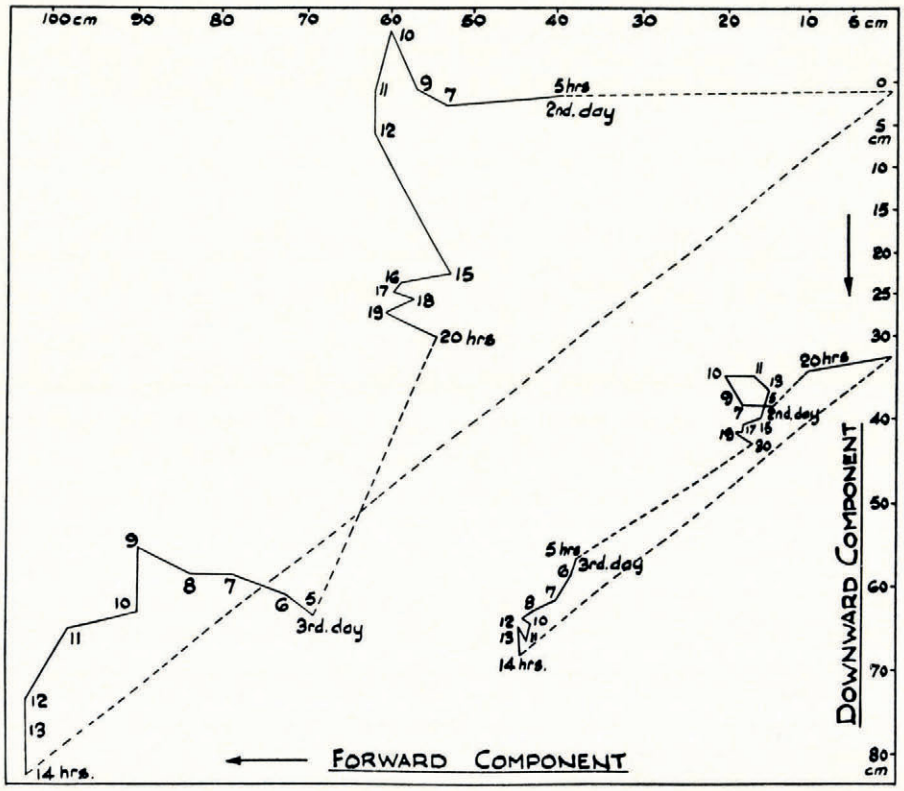

Fig. 1. Pfaff's graphs showing irregular flow of firn. The numbers on the curves indicate the time of day on each of 3 days

or no first-hand knowledge of glaciers, resolved in 1875 to make experiments in the firn area of the Great Aletsch Glacier where he had carried out other tests the year before. These must be some of the earliest investigations of a glacier carried out well above the glacier tongue.

Pfaff chose the lower end of the Grüneggfirn which flows W.S.W. from the Grünhornlücke to the Concordia Platz. He fixed two crosses fitted with horizontal and vertical scales into the firn at 560 m. and 290 m. respectively from its margin. Each was in the field of a telescope with cross-hairs set up on the rock bank above the glacier and sighted onto a fixed point on the opposite side. The telescope, the two crosses and the fixed point thus formed a straight line across the glacier at right angles to its flow. Pfaff took readings at hourly or two-hourly intervals during daylight on three consecutive days. He plotted the two graphs shown (Fig. 1, p. 142) which show a mean angle of sinking of 39° for the cross at 560 m. and 40° for the cross at 290 m. They also show an extraordinarily irregular movement of the firn, sometimes backwards and upwards instead of consistently forwards and downwards. While Pfaff must be credited with the discovery of the vertical downward component of flow in the firn area he does not appear to have taken into account the settling and consolidation of the firn at the surface, a process little known at the time. Below the surface these angles would doubtless be much smaller.

Next Pfaff drove four posts into the firn each exactly 20 m. from the cross at 560 m., one upstream, one downstream and the other two right and left across the stream (see Fig. 2 below). In three days he measured the distances again. *Ca* measured 24 cm. more, and *Cc* 5 cm. less, than 20 m.; *Cb* measured 25 cm. and *Cd* 48 cm. more than the original 20 m. Thus *a* and *c* had moved faster than the middle point *C*. He also found that the line joining *bd* no longer cut *C* but passed 15 cm. downstream of it and the line *ac* no longer cut *C* but was 24 cm. nearer to *b*, *i.e.* to

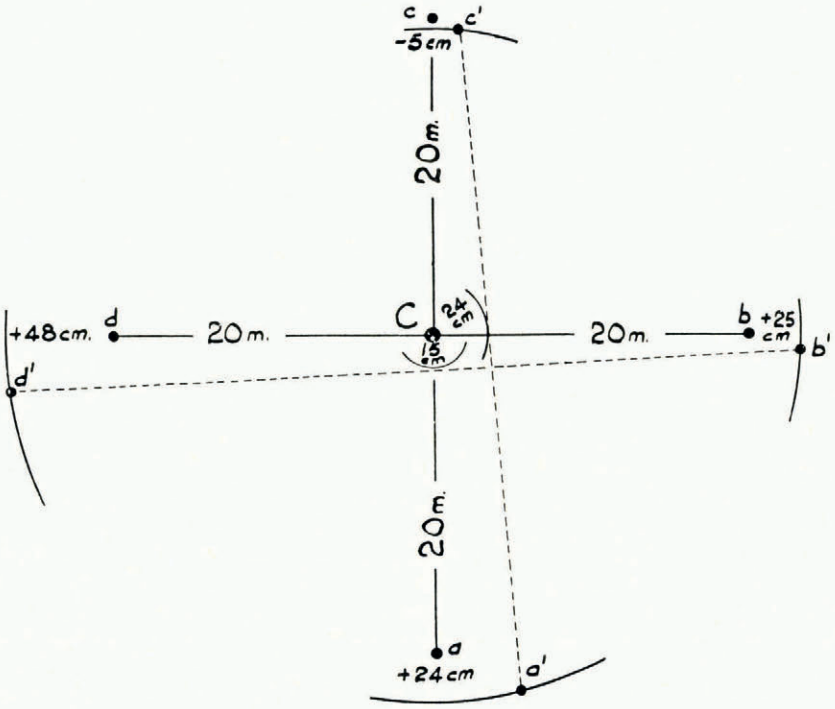

Fig. 2. An attempted reconstruction of Pfaff's differential flow measurements. Original position of posts indicated by a, b, c and d. Final position a', b', c' and d'.

the glacier bank. This diagram is an attempt roughly to illustrate this differential action although Pfaff's description is not full enough to show the exact new positions of the four posts.

Although there is no way of knowing what degree of accuracy Pfaff's methods ensured, these irregular movements seem to have their counterpart in the undulatory motion of the firn as recently noted by several observers and the irregular flow of grain past grain in the surface layers which the Jungfraujoch Research Party recorded in 1938.

There certainly seems to be evidence that the *névé* area moves in a gently irregular manner rather like a slow-motion reproduction of the waves and eddies of a river in spate. G. S.

II

SWISS GLACIERS IN 1668

Extract of a letter written by Mr. Muraltuf *of* Zurich, *to M.* Haak, *a Fellow of the R. Society, concerning the Icy and Chrystallin Mountainf of* Helvetia, *call'd the Gleſtcher. Engliſh'd out of Latin by the Publiſher, as followſ;*

THe higheſt Jcy Mountainſ of *Helvetia* about *Valeſia* and *Auguſta*, in the Canton of *Bern;* about *Taminium* and *Tavetſch* of the *Rhatianſ*, are alwayeſ ſeen cover'd with Snow. The Snow, melted by the heat of the Summer, other Snow being faln within a little while after, if hardned into Jce, which by little and little in a long tract of time depurating it ſelf turnſ into a Stone, not yeilding in hardneſſ and clearneſſ to Chryſtall. Such Stoneſ cloſely Joyned and compacted together compoſe a whole Mountain, and that a very firm one; though in Summer-time the Country-people have obſerved it to burſt aſunder with great cracking, Thunder-like: which if alſo well known to Hunterſ to their great coſt, foraſmuch aſ ſuch crackſ and openingſ, being by the Windſ covered with Snow, are the death of thoſe, that paſſ over them. . . . . .

Thiſ if, what I have obſerved about the Hillſ; What I shall farther learn of the people, inhabiting thereabout, to whom I have written a month ſince, I ſhall impart to you.

In *September* 1668.

(Ref. *Phil. Trans. Roy. Soc. London*, Vol. 4, 1669, published 1670, pp. 932–3.)

WIND SLAB AVALANCHES

A Correction

In my article on wind slab avalanches in the July 1947 number of this *Journal* (p. 70) I expressed surprise at Dr. R. U. Winterhalter's statement that "slab avalanches occur after many snowfalls without wind."

A conversation last summer with Dr. Winterhalter made it clear that I had misunderstood him. He uses the word *Schneebrett Lawine* (snow slab avalanche) to denote an avalanche of snow hardened by any process whatever, whether by wind or other causes, whereas his *Windbrett Lawine* refers exclusively to what we call a wind slab avalanche. In addition to their formation by wind, snow slabs can develop as a result of accelerated crust building caused by sudden heat; also probably by the freezing of melt water in surface layers. Snow slabs can fall as avalanches under the compulsion of their own stresses, or as wet avalanches owing to the lubricating effects of melt water.

Hitherto the term "snow slab" has appeared little in English writings. Lunn in his *Alpine Ski-ing* uses it interchangeably with "wind slab" and I cannot find it mentioned in any other works.

It seems desirable to reconsider our nomenclature on the basis of the generic snow slab and the specific wind slab.

G. Seligman