

CORRESPONDENCE

The Editor,

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SIR,

An exposure of ice on the distal side of a lateral moraine

A brief visit to the Tsijiore Nouve (Zigiore Nove on older maps) glacier near Arolla in Canton Valais, Switzerland, in the summer of 1970 showed the phenomenon seen in Fig. 1. An ice core was protruding through established lateral moraine. The situation of the glacier is seen in Fig. 2 with the position of the revealed ice core at A. The glacier flows north-north-east from high firn fields with the lower part of the ablation area contained by lateral moraines. The left (north) lateral drops to a valley about 80 m below. The glacier has been in almost continuous retreat since the 1920's, though a photograph taken in 1936 by Mr A. E. Lockington Vial shows that the surface of the upper part of the zone contained by the laterals does not appear to have dropped more than about 2 m to the present day.

Walking along the top of the north lateral moraine—which is of "Little Ice Age" (c. A.D. 1600–1900 or Neuzetlich) date—I noticed the slippage of till on a section of the distal side. An area of bare ice about 10 m long and a maximum of 5 m down-slope was exposed here. The top of the ridge had a steep cliff of moraine above the ice, being about 0.5–1 m in height. At the lower edge of the exposed ice the till was wet from the melt water but this died out rapidly down-slope owing to the apparently thickening till cover protecting the ice. It was not possible to find out how much ice there was in a down-slope direction. Laterally, however, there were traces of exposed ice near the top of the ridge on the distal side for about another 10 m each way from the main exposure. At the upper end of this moraine (Fig. 2, point B) there is another area of ice-cored moraine but this is quite clearly the result of the lateral stream



Fig. 1. View north from the lateral moraine showing the exposed convex ice core. The rucksack at the extreme top right on the top of till cliff gives the scale.

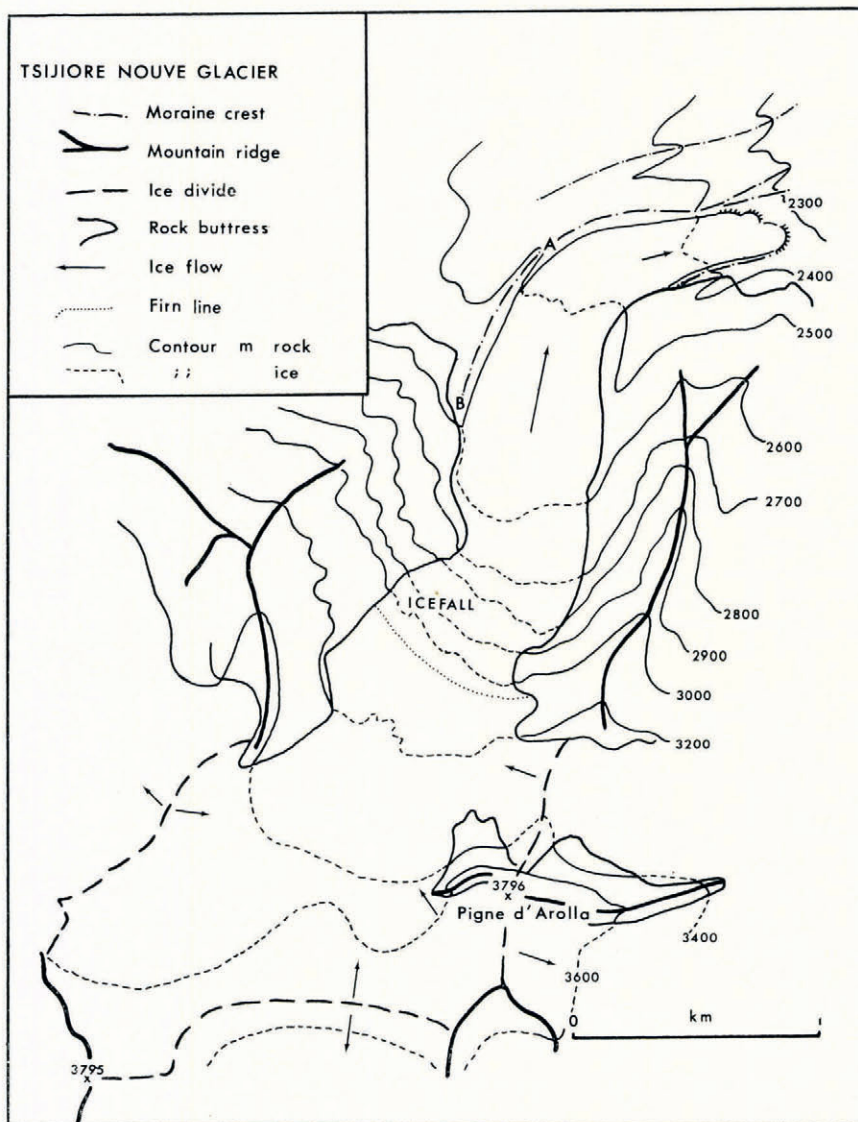


Fig. 2. Map showing the position of the glacier in relation to the moraine.

of surface debris covering up the glacier ice. The same is not true of the newly discovered ice exposure as the till surface is well covered with plants. From the tension cracks on the proximal side of the ridge and the fact that the activity of the material sludging off the small distal cliff, it is presumed that the exposure is of recent origin. I have been unable to find a record of a similar occurrence, either on this glacier or on others.

It was not possible to visit the site in 1971 but photographs kindly taken in September 1971 by Mr Bruce Irving show the exposure to be slightly smaller in area—probably due to melting and lowering of the moraine crest.

Because this was active, apparently glacier ice, I presume that it is related to the condition of the glacier at this point. It may be no coincidence that it is at this section of the lateral moraine that the glacier is turned about 45° to the east. An increase in flow velocity and thickness, perhaps caused by the

passage of a kinematic wave might be expected to have some effect on the moraine here. However, it was not possible to discern any evidence for the existence of a wave on the glacier.

It is likely that at least the top section of the lateral moraine at this point had a small ice core and that this—once distinct with respect to the flow of the glacier—has now become “re-activated” by the glacier. An initial raising of the moraine crest by the glacier would tend to thin the debris and allow till to slide down the moraine, thus increasing the ablation below the protective till cover and expose the ice.

It is worthwhile noting a little of the history of the glacier. Kinzl (1932) said about it: “through its great mobility and swift reaction to climatic changes it has been known for a long time”. Haefeli (1955–56) described it as the “enfant terrible” of the Swiss glaciers as in the 1879–93 advance it reached a frontal velocity of 100 m year⁻¹ in 1892–93, while Forel (1889) noted that the snout advanced 50 m in 1888–89. Paschinger (1963) has calculated a “potential index” and a “sensitivity index” for a number of glaciers to investigate their small-scale fluctuations. He concluded that the indices for the Tsijiore Nouve glacier are consistent with the known activity of the glacier.

If the above assumptions are correct, then it should show in an advance of the snout position in perhaps 2 or 3 years from now.

*Institute of Arctic and Alpine Research,
University of Colorado,
Boulder,
Colorado 80302, U.S.A.
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W. BRIAN WHALLEY

Addendum

I should like to add to my letter of 24 November 1971. The prediction of an advance of the Tsijiore Nouve glacier has subsequently been borne out. A net advance of 11 m was recorded between 7 October 1971 and 10 October 1972. Measurements are made annually by the Inspection Cantonal des Forêts du Canton de Valais for the Commission des Glaciers de la Société Helvétique des Sciences Naturelles. In May 1972 the glacier had just started to overlap the confining moraine a little way down from the exposed ice. The rapid response of the Tsijiore Nouve suggests that other glaciers may soon show advances.

I should like to thank Ing. Peter Kasser and Dr Hans Röthlisberger for supplying this information.

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