



Fig. 2. Vertical and horizontal cross-sections of the Grand Moulin of the Mer de Glace from the 6-7 November 1986 survey.

utility, down to depths of 100 m beneath the snout of the Mer de Glace. The diameter of these galleries was reduced by two-thirds the initial value in 3 weeks (Charpentier and others, unpublished). Therefore, to explore further into the pothole galleries, expeditions have to be launched at an earlier date, ideally near the beginning of September, but it would also be necessary to deal with the higher water-flow rates encountered at that time of the year. The exploration of such large glacial potholes is an exploit of wide and highly varied interest. In addition to the opportunity it presents to caving enthusiasts in their never-ending search for new and more difficult challenges, and to talented filmmakers in their quest for images of rare beauty, it offers glaciologists the opportunity to determine several characteristics of the flow of water within the ice and the depth to which the fissures and faults allowing this flow may extend. Furthermore, such investigations provide a description of the composition of the ice (foliation, crystallography, etc.) and its variation with depth, results which otherwise could only be obtained by working in a large-diameter bore hole.

It is true that there is little hope of reaching the glacier bed, which is at a depth of about 300 m according to seismic soundings carried out in 1966 (Gluck, 1967); however, there is a very good chance of extending such explorations farther and deeper than ever before.

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SIR,

Basal water and high-pressure basal ice

An unfortunate set of circumstances prevented certain improvements from being made to my paper "Basal water and high-pressure basal ice" (*Journal of Glaciology*, Vol. 32, No. 112, p. 455-63) before its publication. These improvements had been suggested by one of the reviewers, who pointed out that in unpublished work Charles F. Raymond had also considered the problem addressed in my paper. The purpose of this note is to draw attention to Raymond's work which was not possible for me to do in my published paper.

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SIR,

The 1985 surge and ice dam of Glaciar Grande del Nevado del Plomo, Argentina

Glaciar Grande del Nevado del Plomo, which trends in an almost west-east course, is one of the glaciers in the most glacierized area of the Río Mendoza basin (Corte and Espizúa, 1981). In this glacierized region originates the Río del Plomo, which is the main tributary of the Río Tupungato. It flows into Río Mendoza but does not form it alone.

This glacier is situated at lat. 33°08'S., long. 70°01'W., occupies a large cirque south-east of Nevado del Plomo (6050 m), and flows down to 3550 m a.s.l. (after surging 3165 m a.s.l.). This area was very well mapped at a scale of 1:25 000 by Helbling, using terrestrial photogrammetry, during his field work with Reichert in 1907-12. More recent Argentine and Chilean maps only reproduce Helbling's map, with some errors (for instance, Nevado del Plomo is incorrectly referred to as Cerro Juncal). Since 1912, the glaciers at the head of Río del Plomo have receded considerably, the different tributaries becoming distinct. Therefore, there was no totally correct map of this area until the 1983 and 1985 1:10 000 photogrammetric interpretation of the 1974 air photographs by the Instituto Argentino de Nivología y Glaciología (except for Corte and Espizúa's sketch map without names or contour lines).

Glaciar Grande del Nevado del Plomo had surged in 1934, when a flood caused by the outburst of an ice-dammed lake with a calculated volume of $60 \times 10^6 \text{ m}^3$ produced many disasters (Helbling, 1935; Razza, 1935; Lliboutry, 1956). There is also evidence that during the eighteenth century it could possibly have surged (Prieto,

1986), though there is no certainty about the exact date on which this occurred.

Through Andinists, we knew that in April 1984 the glacier could have been in exactly the same position that we had observed a year before, that is, within 4 km of its 1934 position, where the glacier, after crossing the Río del Plomo valley, had reached a rock wall named "Roca Pulida" thus forming a lake. Satellite imagery showed that in September 1984 Glaciar Grande del Nevado del Plomo had advanced, and that in November–December an ice-dammed lake had formed. The glacier's snout rested against "Roca Pulida", and its surface exhibited the typical features of a surge, i.e. a chaotic mass of crevasses and ice pinnacles.

Access to this area is only possible by mule or by helicopter, because there is no track for vehicles; it is 55 km from the village of Punta de Vacas on the route to Chile and in one of the highest parts of the Andean Cordillera.

Our first knowledge of the surge was due to the fact that the whole area was flooded by two sudden peaks in the normal flow of Río Tupungato, which occurred on 14 and 22 February 1985 and each lasted about 12 h. On each occasion, the flow rate was over $250 \text{ m}^3 \text{ s}^{-1}$, whereas the mean annual average over 31 years is $21.560 \text{ m}^3 \text{ s}^{-1}$; February's mean, maximum, and minimum are respectively 45.27, 127.60, and $25.14 \text{ m}^3 \text{ s}^{-1}$ (information from Agua y Energía Eléctrica).

With the assistance of the government of Provincia Mendoza, a scientific and technical party from the Instituto Argentino de Nivología y Glaciología and Agua y Energía Eléctrica was left in the area to study the local situation. On 28 February, the following data were obtained: mean height of the glacier above the lake: 70 m; length of glacier crossing the Río del Plomo valley: 820 m; approximate volume of the ice dam: $27 \times 10^6 \text{ m}^3$; length of the lake: 1494 m; width of the lake against the glacier: 703 m; perimeter of the lake: 3.84 km; area of the lake: $616 \times 10^3 \text{ m}^2$; daily mean increase in height of the lake: 7.0 cm h^{-1} ; mean daily inflow of the river into the lake: $11 \text{ m}^3 \text{ s}^{-1}$; estimated volume of the lake: $12.1 \times 10^6 \text{ m}^3$; difference in present height of the lake and its maximum

level (14 February 1985): 39 m; maximum volume of water stored in the lake: $55 \times 10^6 \text{ m}^3$.

On 10 March there was another outburst from the lake but this time it was initially through a moulin in the glacier's snout; in early April the lake disappeared, because its waters had drained through a small subglacial tunnel carved naturally beneath the glacier. In December 1985, this was the situation due probably to the poor winter snow accumulation and also the fact that the surge had terminated. Unfortunately, we were not present during any of the drainages of the lake.

This is a summary of the results of the party's field work and other papers which are to be published. Part of this information will be included in a future publication.

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