

NOTE ON THE MORPHOLOGY OF BASPA GLACIER, KINNAUR DISTRICT, HIMACHAL PRADESH, INDIA

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ABSTRACT. Baspa Glacier occupies an area of about 35 km² in the south-eastern part of Kinnaur District, Himachal Pradesh, and it is the source of the Baspa River, a major tributary of the Sutlej. It is a longitudinal valley-type glacier with a large cirque area. The field evidence indicates that the glacier has retreated considerably in the recent past.

RÉSUMÉ. Note sur la morphologie du Baspa Glacier, Kinnaur District, Himachal Pradesh, Inde. Le Baspa Glacier occupe environ 35 km² dans le Sud-Ouest du Kinnaur District dans Himachal Pradesh et constitue la source de la rivière Baspa, un affluent majeur du Sutlej. C'est un glacier de type de vallée longitudinale avec un long bassin d'alimentation. Les observations sur le terrain montrent que le glacier a beaucoup reculé dans un passé récent.

ZUSAMMENFASSUNG. Eine Notiz zur Morphologie des Baspa Glacier, Kinnaur District, Himachal Pradesh, Indien. Der Baspa Glacier bedeckt ein Gebiet von etwa 35 km² im Südost-Teil des Kinnaur District in Himachal Pradesh und ist der Ausgangspunkt des Baspa River, eines grösseren Nebenflusses zum Sutlej. Vom Typ her ist er ein Längstalglatscher mit weiten Kargebieten. Feldbeobachtungen zeigen, dass der Gletscher in der jüngsten Vergangenheit stark zurückgeschmolzen ist.

INTRODUCTION

During August 1978 the authors had the opportunity of reconnoitring Baspa Glacier, the source of the Baspa River, while carrying out geological studies in the upper reaches of the Baspa Valley. The snout of Baspa Glacier is situated about 45 km from Rakchham, the nearest road-head. Rakchham is connected with Karchham, which is on the Hindustan-Tibet road, by a 30 km fair-weather road. No studies have previously been carried out on this glacier.

Baspa Glacier (lat. 31° 12' N., long. 78° 42'–78° 50' E.) originates from the southern side of a north-north-west to south-south-east trending ridge and occupies an area of 35 km² (Fig. 1). The glacier extends for 18 km and its width varies from 1 km near the snout to almost 3 km in the catchment area.

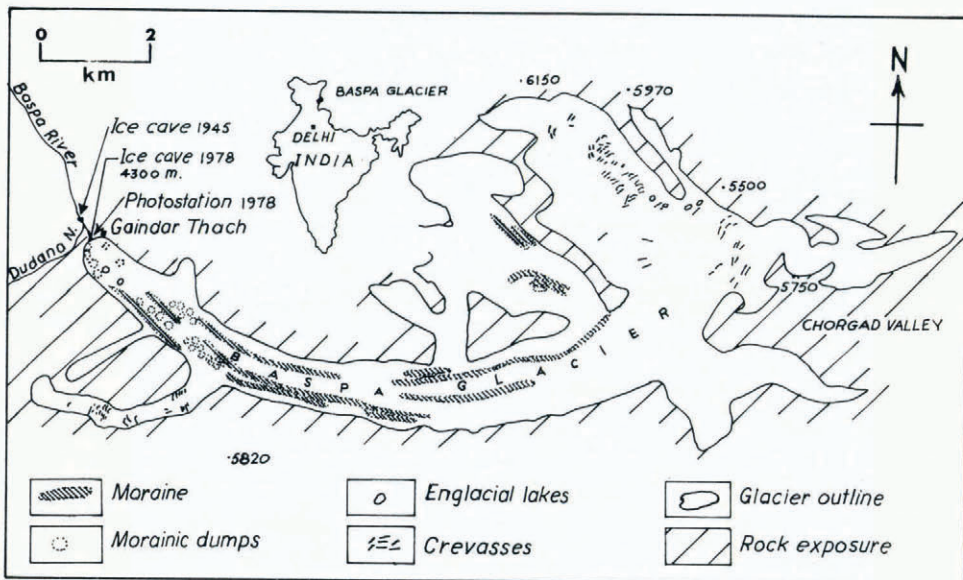


Fig. 1. Sketch map showing the position of Baspa Glacier, Kinnaur District, Himachal Pradesh, India.

Its snout is at an elevation of 4 300 m, whereas the glacier's highest elevation is 5 800 m; the glacier mainly occupies the area above its median elevation. The gradient varies from 1 : 1 to 1 : 25 but the overall gradient is about 1 : 10. The steep valley walls are composed of phyllite and quartzite, and they are devoid of any vegetation. Baspa Glacier has a large and well-developed cirque which comprises sharp ridges with prominent peaks of heights 6 150 m and 5 970 m on its northern side. The glacier initially leaves the cirque in a southerly direction 2 km west of height 5 750 m but it gradually takes a north-westerly course 3 km north of height 5 820 m. Considering the regional trends, it can be referred to as a longitudinal valley glacier with an arcuate shape.

Five tributaries feed this glacier. The largest, about 4 km long, joins it from the north about 10 km up-stream from the snout. Its cirque is separated from the main cirque by a north-west trending ridge. The two small tributaries joining from the south and the one from the north near the snout appear to be fed by avalanches.

GLACIER SURFACE

The glacier surface up to 2 km up-stream from the snout is strewn with rock fragments which have fallen from the valley walls as well as by englacial material exposed due to melting of the ice. This gives a muddy appearance to the glacier surface. The colour of the ice is also dirty brown. A cluster of ten or twelve small englacial lakes were probably formed by the collapse of the ice surface in this zone. The large white ice fragments floating in the emerald-green lake water present a magnificent sight (Fig. 2a). The ice in this zone is highly fractured and there is often a gap between the glacier ice and the valley walls, and this is filled with slump material.

Beyond this, for about 8 km, the glacier surface up-stream is covered by three or four well-defined but discontinuous low ridges of lateral and medial moraine. The glacier surface between the ridges is white and is hardly contaminated by scree material. In this zone the following features were observed:

Glacier tables. A number of large rock fragments were observed perched on ice cones (Fig. 2b). Sometimes these tables attain a height of 1.5–2 m.

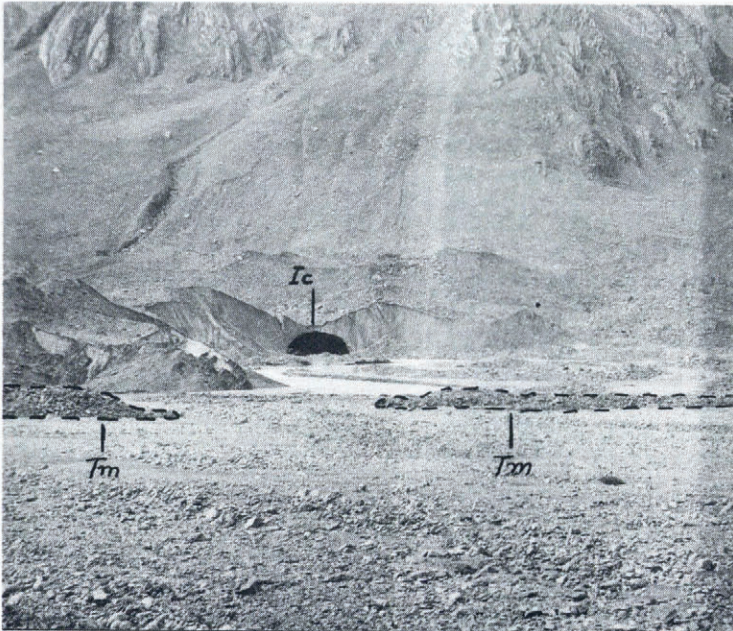
Dust wells. A number of cylindrical holes up to 2 m deep and 1.5 m in diameter are present on the glacier surface. The bottoms of these holes are filled with small fragments of phyllite and quartzite.



a.



b.



c.

Fig. 2. a. Englacial lake about 1 km up-stream of the snout of Baspa Glacier. b. Glacier table (Gt) and perched boulders (Pb) 4 km up-stream of the snout of Baspa Glacier. c. Ice cave (Ic) and terminal moraines (Tm) of Baspa Glacier, photographed on 11 August 1978 from a point about 100 m down-stream on the right bank (see Fig. 1).

The ice exposed in the walls of these holes is pale bluish in colour. These holes have formed by the gradual sinking into the ice of rock fragments heated by the sun, a process opposite to the one responsible for the formation of the glacier tables.

Morainic cones. Steep cones of loose rock fragments occur on the glacier surface and these attain a height up to 3 m. These have probably been left undisturbed by the slowly melting ice which enveloped them originally.

Beyond this zone the glacier surface is very clean and snow-white in colour. Small englacial lakes, transverse joints, and southerly facing seracs characterize this zone.

Gaping joints. Both longitudinal and transverse joints occur in this part of the glacier. The longitudinal joints are generally a few centimetres deep, except for those along which surface water flows, and these have been cut down to a depth of 2 m. The transverse joints are also surficial and are convex down-stream.

SNOUT AND ICE CAVE

The snout of Baspa Glacier is situated about 300 m south of Gaindar Thach at an altitude of 4 300 m. It is about 250 m wide and has a tongue-like protrusion on its northern side; it has a 10 m high ice wall. In the upper part, the ice has alternating brown and light grey bands which are corrugated in outline. A few embedded rock fragments are also present. But in its lower part the ice is light grey in colour. The ice is highly fractured at the snout, where the upper surface is covered by fresh morainic material.

A well-developed ice cave (Fig. 2c), which is semi-circular in shape, occurs in the central part of the glacier snout and is the outlet of the main subglacial melt stream. This cave is 4.5 m wide, 2.5 m high, and 4.0 m deep. The ice in the interior of the cave is blue in colour and less fractured than elsewhere on the glacier. There are two other slit-like ice caves, 1 m wide and 20–25 cm high, 10 and 12 m north of the main cave; these are undoubtedly the sites of minor subglacial melt streams.

MORAINES

Englacial, lateral, medial, and terminal moraines are associated with Baspa Glacier.

The englacial moraines are partially exposed near the glacier snout due to melting of the ice. The exposed rock fragments are fresh, angular, and vary considerably in size.

The right lateral moraine is very well developed and can be traced for over 700 m down-stream from the snout. Farther away, the Gaindar Khad has affected it. The rock fragments are compactly packed with sandy material in the interstices. In places, patches of grass roots have been observed in the morainic material. The left lateral moraine has been obliterated by the strong currents of the Dudana Nala and by the right lateral moraine of its glacier. Here, fragments of the phyllite and quartzite forming the Baspa catchment are mixed with well-rounded boulders of the granite which forms the catchment of Dudana Glacier.

GLACIER RECESSION

It is difficult to reach any definite conclusions about glacier recession since no earlier reference is available. However, the following features suggest a retreat and shrinkage of the glacier during recent times:

- i. In all, seven terminal moraines have been recorded up to 700 m down-stream of the glacier snout.
- ii. The terminal moraine about 5 m down-stream of the glacier snout is a pile of fresh morainic material under active denudation by the Baspa River.
- iii. The right lateral moraine is present as an embankment for a considerable distance down-stream.
- iv. Loose morainic material is perched 5–6 m above the glacier surface on the northern valley wall.
- v. A large number of glacier tables, often 1.5 m high, occur on the glacier surface.
- vi. There is extensive polishing on a dip slope exposed on the left bank of the Baspa River about 2.5 km down-stream of the glacier snout.

DISCUSSION

Baspa Glacier is a longitudinal valley-type glacier with a large cirque at its head. The position of the snout of Baspa Glacier has been shown on the earlier Survey maps (surveyed prior to 1945) down-stream of the confluence of the Dudana Nala with the Baspa River (Fig. 1). If this is correct, then the present position of the glacier snout indicates a retreat of 700 m during the last 33 years; this is in accord with the general features of retreat observed in the field.

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