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ABSTRACT

Icebergs are one of the most important physical forms of ice around the Antarctic continent. During the present expedition the appearance of solid icebergs was noticed at 59°S latitude. Onwards from this spot continuous occurrence of icebergs was logged and several distinctive physical forms of bergs were identified.

For detailed examination of the iceberg the authors landed on an iceberg on 10 1 1983 which was adrift at a location fixed as 59°53'12" S latitude and 11°46'18" E longitude. A shallow borehole was drilled by a portable power driven machine and a complete core was obtained upto a depth of 4.62 m. Physical appearance, location and nature of stratification indicate that this iceberg has been generated by calving of the main shelf of the Princess Astrid Coast.

INTRODUCTION

Icebergs are one of the most important physical forms of ice around the Antarctic continent. Before encountering the bergs, small floes of ice drifting in waters around 55 to 58°S latitude are noticed. These floes are remnants of the icebergs that have disintegrated and diminished in size while floating northwards. First appearance of a solid iceberg was noticed at 59°S latitude. South of this spot, continuous occurrence of icebergs is witnessed. Before entrance to polynya, near the shores of Antarctica, scattered icebergs are present, while within the polynya there are clusters of icebergs. Nearing the coastline of Antarctica icebergs stranded within the pack ice were noticed. When aligned, the latter give from a distance a deceptive appearance of coastline.

PHYSICAL CHARACTERS

The icebergs that were encountered during the cruise to the base camp were of different shapes and morphological characters, showing evidences of wasting by weathering and destructive wave actions. Antarctic bergs of various dimensions measurable from 30 to 50 km in length have been reported. The ones which the authors observed did not exceed 4 km in length about 100 m in height. Different icebergs showed evidence of different origin, some derived from shelfice and others from glacier tongues. Several distinctive physical forms of icebergs that were encountered are described below.

Tabular icebergs These are the most dominant type and are characterised by flat top and vertical faces. Rectangular in shape, they give a fascinating reflection when resting in polynya without wave disturbance (Fig 1). Two types of these bergs were noticed in the antarctic waters. One type lacked strong stratification, appearing as a homogenous white 'island' within the water. It showed a strong white lustre under sunlight. The other type showed discernible stratification with alternating bands of blue or green and white colour, occasionally showing white coloured dirty layers. The former type appears to have originated from an ice-shelf and the latter type from the glacier-tongues reaching the sea.



Fig.1. Photograph showing tabular iceberg.

Tilted iceberg Wave action and wind may result in calving and wasting away of a portion of the iceberg. This disturbs the equilibrium of the iceberg and results in its tilting (Fig 2) and sometimes even overturning. Such bergs bearing a tilted and hummocky surface and bearing furrows and ribs on the sides were noticed at many places. Obviously the ice strata of these bergs dip one or the other way. The water line is characterised by caves and spurs.

Weathered icebergs These bergs are in an advanced state of desiccation and are deeply furrowed by crevasses or water channels formed in course of drifting towards the lower latitudes. They generally occur in isolation and keep on drifting.



Fig. 2. Photograph showing tilted iceberg

Stranded icebergs Within the pack-ice an iceberg may get more or less immobilised because of restricted movement. Various icebergs were observed to be held in position within the dense pack ice.

DRILLING OF ICEBERG

On 10th January, 1983, the authors landed on an iceberg in Antarctic waters, the position of which at that time was $59^{\circ}53'12''\text{S}$ and $11^{\circ}46'8''\text{E}$ (Fig 3), about 12 km north-west of the Base camp on the shelf. The iceberg measured 4 km by 3 km and 80 m above the water level, as computed from sextant observation from the ship which was anchored in the vicinity.

The vertical faces of the iceberg showed a dull stratigraphic banding. Wave action had cut channels and caves. The dripping water formed long icicles. The upper most part of its northwesterly face showed a cornice-type projection, probably as a result of the prevailing wind.

The iceberg showed a nearly horizontal surface, disturbed to some extent by small humps or long but shallow cracks. The entire surface was replete with small cusps giving it a pitted appearance. On the surface, the ice was soft and crunchy and the leg would sink knee deep.

The wind, which blew easterly, was of higher speed than that felt at the Base camp, probably due to open surroundings. The albedo of the surface was strong enough in intensity.

STRATIGRAPHIC PROFILE

A shallow borehole was drilled by CRREL portable hand-drill upto a depth of 4.62 m and complete core obtained. Stratigraphic details of core are depicted in Fig 4. The profile shows alternating layers of firn and ice/depth hoar. The former range in thickness from 2 to 80 cm and the latter 1.5 to 16 cm. The density varies in the former case from 0.35 to 0.70 gm/cm^3 and in the latter

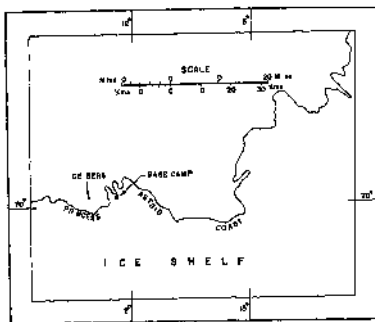


Fig 3 Location of the iceberg studied during the Second Antarctic expedition

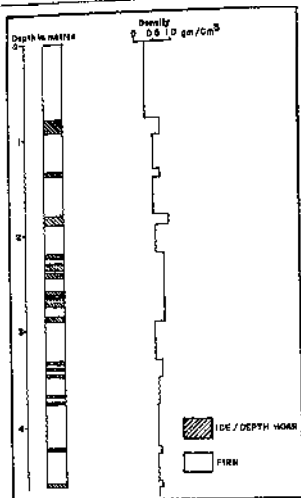


Fig.4. Stratigraphic and density profile of an iceberg studied in Antarctic water

from 0.70 to 0.80 gm/cm³. In the present borehole 18 bands of ice were noticed in the stratigraphic column. It is difficult to say at the present stage whether all these bands represent annual data or a few represent percolated and refrozen ice glands.

The physical appearance, location and nature of stratification indicate that this iceberg has been formed as a result of calving of the main shelf of the Prince Astrid Coast and does not bear any relation with the glacier ice *sensu stricto*.

CONCLUSIONS

This work being the first of its kind carried out by the Indian glaciologists in Antarctic waters, can be further substantiated in future, by more detailed studies incorporating there in the mechanism of their origin and also monitoring their tracks and thereby finding their speed which could be undertaken during subsequent expeditions.