

THE OCCURRENCE OF RIFTS IN THE LARSEN ICE SHELF NEAR CAPE DISAPPOINTMENT

By M. FLEET

WHILE travelling on the Larsen Ice Shelf in the vicinity of Cape Disappointment (east coast of Graham Land) during 1962-64, the writer observed several rifts close to Cape Disappointment. The excellent view of the more southerly rifts from the summit of Cape Disappointment suggested the reason for the formation of the rifts and also a method of estimating the thickness of the ice shelf.

Rifts are a common feature of the Larsen Ice Shelf; Nordenskjöld and Andersson (1905, p. 226-27) described "canals" in this region, but they were probably referring to the pressured ice east of Cape Disappointment. Mason (1950) also described rifts, especially in the area where the Larsen Ice Shelf becomes narrower towards the south. The rifts described here are distinctive in that they occur many kilometres from the ice-shelf edge and therefore cannot be related to calving, which is the usual cause of many large rifts (or tension re-entrants).

Cape Disappointment (Fig. 1), a snow and rock dome about 300 m. high, is connected to the mainland of Graham Land by a low snow col about 10 km. long. Punchbowl, Jorum, Crane, Mapple, Melville and Pequod Glaciers flow into the large embayment to the north, Exasperation Inlet, which is bounded on its north side by Foyn Point. South of Cape Disappointment, Starbuck and Stubb Glaciers flow eastwards into the Larsen Ice Shelf, which is 70 to 80 km. wide here. The height of the ice-shelf surface above sea-level in this area is now believed to be about 25 m., which is somewhat less than suggested by Mason (1950).

Fig. 1 also shows the ice streams on the Larsen Ice Shelf, which have been sketched in by continuing the direction of flow from each glacier mouth until they meet another ice stream, when the change in direction is inversely proportional to the size of each ice stream. There is some doubt whether the ice stream formed by Mapple, Melville and Pequod Glaciers joins the Crane Glacier ice stream. However, it is now believed that it does, because the rift does not continue all the way to Delusion Point (as shown on some older maps), as it surely would if the ice stream formed by Mapple, Melville and Pequod Glaciers passed to the south of the rift.

From Fig. 1, showing the ice streams, it can be seen that there is an area of stagnant ice north of the Cape Disappointment col and bounded by the rift to the north-east. This rift, which consists of a series of north-north-west to south-south-east *en échelon* fractures in the ice shelf, is similar to one described by Gould (1935, p. 1374) from the Ross Ice Shelf. It therefore seems that this rift is a simple shear zone between the rapidly moving ice streams to the north and the area of stagnant ice shelf.

South of Cape Disappointment there are three rifts, each trending approximately north-south. The westernmost rift (Figs. 2 and 3), the only one carefully investigated, has a regular elongated lozenge shape, being about 80 m. across at its maximum width and about 7 km. long. Its walls are clean-cut and vertical, and the bottom consists of broken brash ice which is at a constant level throughout the length of the rift. The two rifts to the east are not so well formed; they have probably degenerated after forming at the site of the western rift and then moving eastwards. The cause of these rifts is tension set up as the Starbuck Glacier ice stream flows parallel to the south side of Cape Disappointment. It is similar to the "herring-bone" crevassing commonly seen on glaciers, the difference in scale being due to the fact that the ice is floating.

It is believed that the bottom of the western rift is almost at sea-level, and it appears to be remarkably level in spite of the fact that it is composed of brash ice. No discoloration of the ice was observed, although no active cracks would be expected because there is no relative tidal movement between the two rift sides and the floor. D. A. Arduis is of the opinion (personal communication) that this rift is very similar to those in the Brunt Ice Shelf near

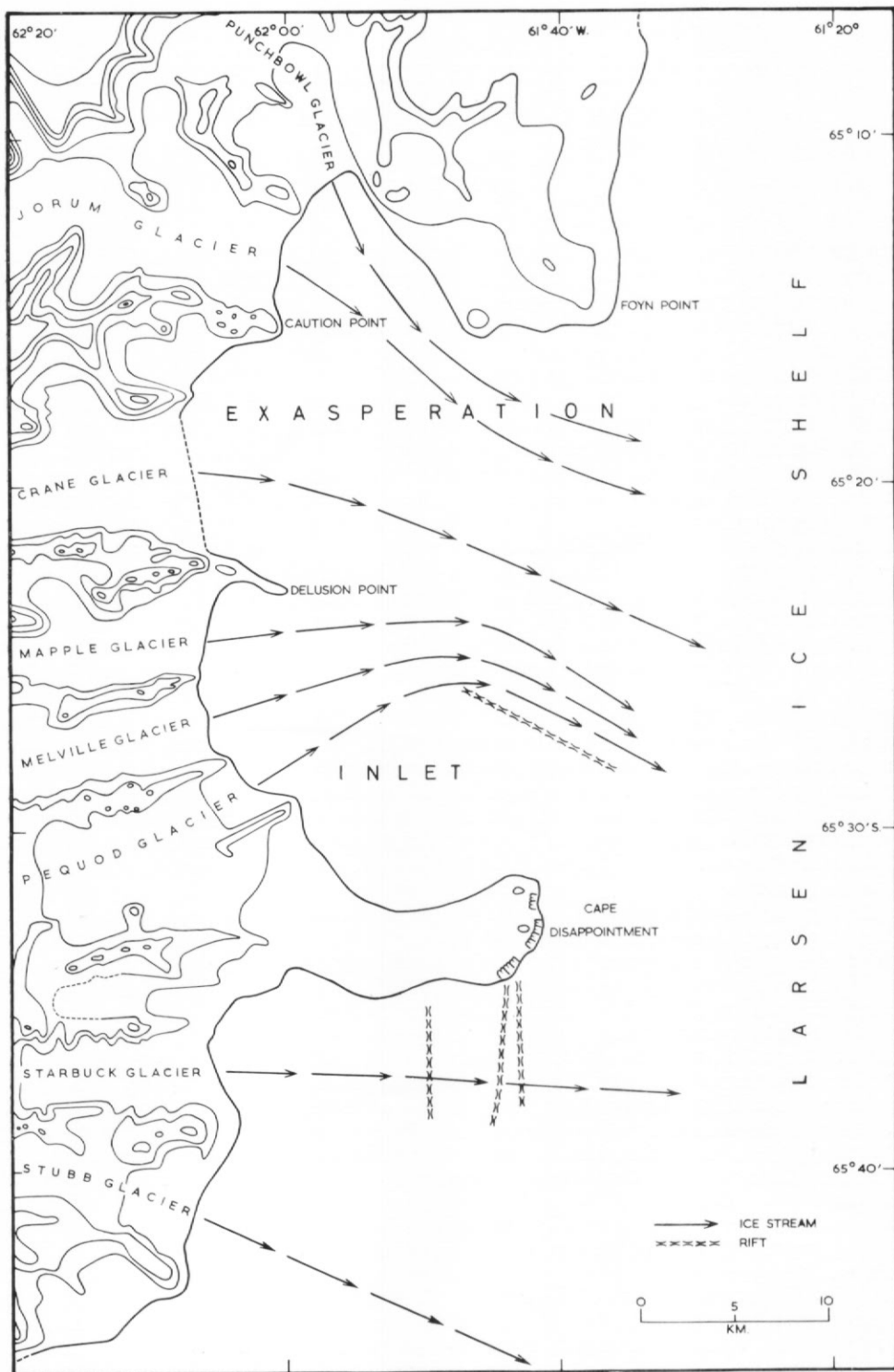


Fig. 1. Sketch map of the east coast of Graham Land, showing ice streams and rifts in the Larsen Ice Shelf in the vicinity of Cape Disappointment. The contours are at 500 ft. (152 m.) intervals.



Fig. 2. The northern part of the western rift south of Cape Disappointment, showing the clean-cut vertical walls and brash ice on the floor. The dome of Cape Disappointment is in the middle distance.



Fig. 3. The southern part of the western rift south of Cape Disappointment, showing the slope towards the rift and the termination on the right-hand side of the photograph. The level floor of the rift and the size of the brash ice can be clearly seen.

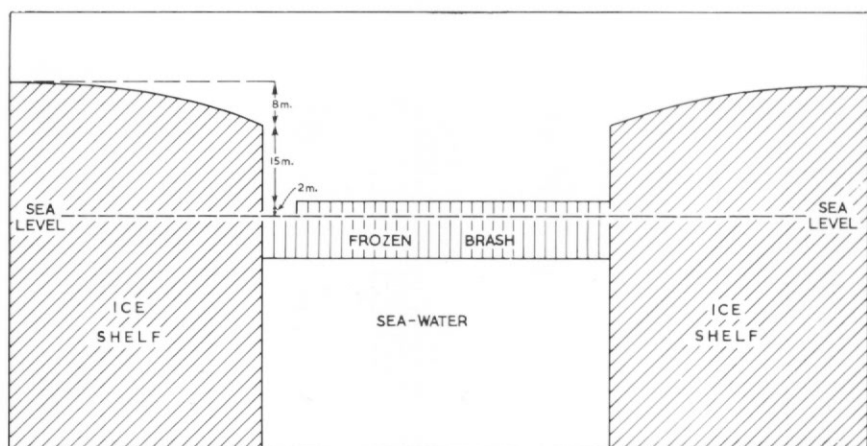


Fig. 4. West-east sketch section across the western rift south of Cape Disappointment.

Halley Bay which are floored by sea ice. If this is so, the cross-section of the rift would be as shown in Fig. 4 and the height of the ice-shelf surface can be estimated as follows:

Height of rift wall	m.
	15
Thickness of frozen brash above sea-level (estimated from the size of fragments)	2
Extra due to slope at the edge of the rift	8
Total	25

This gives a value of 25 m. above sea-level. From this, the thickness of the ice shelf can be calculated as approximately 100 m. (Robin, 1958, p. 113). However, this value of 25 m. does not agree with either Mason's (1950) estimate of 91–122 m. above sea-level or P. Kennett's estimate (personal communication) of 66 ± 12 m. above sea-level (calculated from an aneroid traverse from Stonington Island). Since both earlier estimates were made a great distance from the nearest check against sea-level, considerable accuracy could not be expected.

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