

THE STRUCTURE OF WORDIE ICE SHELF, ANTARCTIC PENINSULA

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ABSTRACT. The structure of Wordie Ice Shelf has been interpreted from a multispectral Landsat satellite image obtained in February 1979 in conjunction with radio-echo sounding data. The ice-shelf structure is dominated by six major glacier units in which the principal structure is that of longitudinal foliation, which is formed as the glaciers drain from the Palmer Land ice sheet. Although this structure persists to the western ice front, a set of crevasse traces and crevasses is superimposed. The structure is affected further by the presence of 20 ice rises and ice rumples. This combined structure dictates the shapes and sizes of icebergs which calve from the ice shelf. A triangular-shaped zone of chaotic ice with an area of about 52 km² divides the ice shelf into two parts. Should the ice front recede east of Napier Ice Rise in response to the current climatic warming, the southern part of the ice shelf may deteriorate rapidly.

INTRODUCTION

Wordie Ice Shelf (Fig. 1) has had three airborne radio-echo sounding surveys undertaken over it in 1966/67, 1969/70 and February 1975 (Swithinbank, 1968; Smith, 1972; Crabtree, 1983). In January 1974 a Landsat multispectral Scanner (MSS) image of the ice shelf was obtained (E-1532-12325-7; 6 January 1974) which was used subsequently to provide the basis of a map of the area at a scale of 1:250 000 (Marguerite Bay, Graham Land; BAS 250P, sheet SR 19-20/2, edition 1-DOS 1978). In February 1979 another Landsat MSS image (30335-12253-7) was obtained of the same area, part of which is reproduced as Fig. 2. The later image has provided considerably more detail of the ice shelf than the earlier one, due principally to improvements in the routine image processing of Landsat 3 data compared with that of the Landsats 1 and 2.

This paper describes an interpretation of the 1979 satellite image undertaken in conjunction with ice-shelf isopleths determined from the radio-echo sounding. The analytical method follows that employed by Crabtree and Doake (1980) for the Ronne and Filchner ice shelves and, more particularly, that of Reynolds and Hambrey (1988) for George VI Ice Shelf, in which ice structures were inferred from features seen on satellite imagery. It will be demonstrated that not only does the satellite image provide information about the ice shelf itself, but also about the calving of icebergs into Marguerite Bay.

GLACIER FLOW UNITS AND STRUCTURES

The ice shelf had an area of 1060 ± 20 km² in 1979, with an average length of 53 km north-south and width of 20 km east-west. The 81-km long ice front appears to be pinned by Buffer, Napier and Linchpin* ice rises. The ice shelf receives an ice input from local glaciers from Palmer Land across 130 km of the 148 km landward edge of the ice shelf, with some 16 km adjacent to Mount Balfour which does not contribute actively to sustain the ice shelf. Between February 1972 and January 1974,

* Linchpin Ice Rise: suggested by Dr G. Hattersley-Smith, Antarctic Place Names Committee.

