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2. Glacial Geology of the Area between the David and Mawson Glaciers. A Reconnaissance of the Southern Prince Albert Mountains, Victoria Land, Antarctica

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During GANOVEX VI (1990/91) we investigated the area between the David and Mawson Glaciers (Fig. 1). The area, consisting of a large number of nunataks interrupting the enormous ice fields, has not yet been a subject of comprehensive glacial-geological investigation. Reconnaissance flights by helicopter took place from the *Polar Queen,* while fieldwork was carried out from a fieldcamp located at an ice-cored moraine bordering Morris Basin, Ricker Hills. Quartz samples were taken from glaciated surfaces for ^{10}Be exposure dating; soils, when present, were described and sampled for chemical analyses; till samples were taken for chemical, grainsize distribution and microfossil analyses. Undisturbed, oriented till samples were taken for thin section analysis; rock samples were collected for SEM studies of weathered surfaces and saltcrusts, and algae were collected for ^{14}C dating. A bathymetrical map was made of the seafloor south of the Drygalski Ice Tongue with the help of echo sounding on board of the *Polar Queen.*

All this work is aimed to find evidence of the relationship between the Cenozoic mountain uplift and the glacial history of the area (VAN DER WATEREN & VERBERS this vol.).

The relief of the area of investigation rises stepwise in a southwestern direction from 800-1,000 m near the coast to 2,300 m inland (Fig. 1). Parallel to the coast a more or less continuous ridge is formed by nunataks consisting of Granite Harbour Intrusives. In general, these granitic nunataks are glacially rounded but as they show a strongly weathered surface, no striations or crescentic marks could be found.

The eastern flank of Mt. Murray (1,006 m) forms a dry U-shaped valley. This valley, running SW-NE, is dammed by a glacier at the northeastern entrance. The valley bottom is covered with till with a polygonated surface and is interrupted by a series of round lakelets connected by intermittent meltwater streams (SKINNER & RICKER 1968). A series of fossil lake shore lines are found up to 10 m above the present water level of the third lake. We have sampled algae from these elevated shorelines for ^{14}C dating. This will give a date for the high level of the glacier which obviously blocked the entrance of the small valley.

The inland area consists of the remnants of a tableland of Kirkpatrick volcanics and Ferrar sills alternating with Beacon sandstone and is almost entirely buried by ice. The Beacon peneplain, underlying the Ferrar Group rocks, dips a few degrees to the west (WÖRNER this vol.). This results in subhorizontal plateaus and terraces, which are rounded on the edges by the ice.

The plateaus are covered with a thin, discontinuous layer of till, consisting of rounded, sometimes striated, clasts and silty sand. The surfaces show a desert pavement and polygons. Windpolished stones are abundant, although much of the patina has crumbled away by weathering. No obvious erratics were found, the rounded clasts seem to be locally derived. Most nunataks have glacial terraces on the north-northeastern side. They again are covered with a thin till layer showing desert pavement and polygons, but the clasts show a great variety in their weathering degree. They often have a salt crust on the underside.

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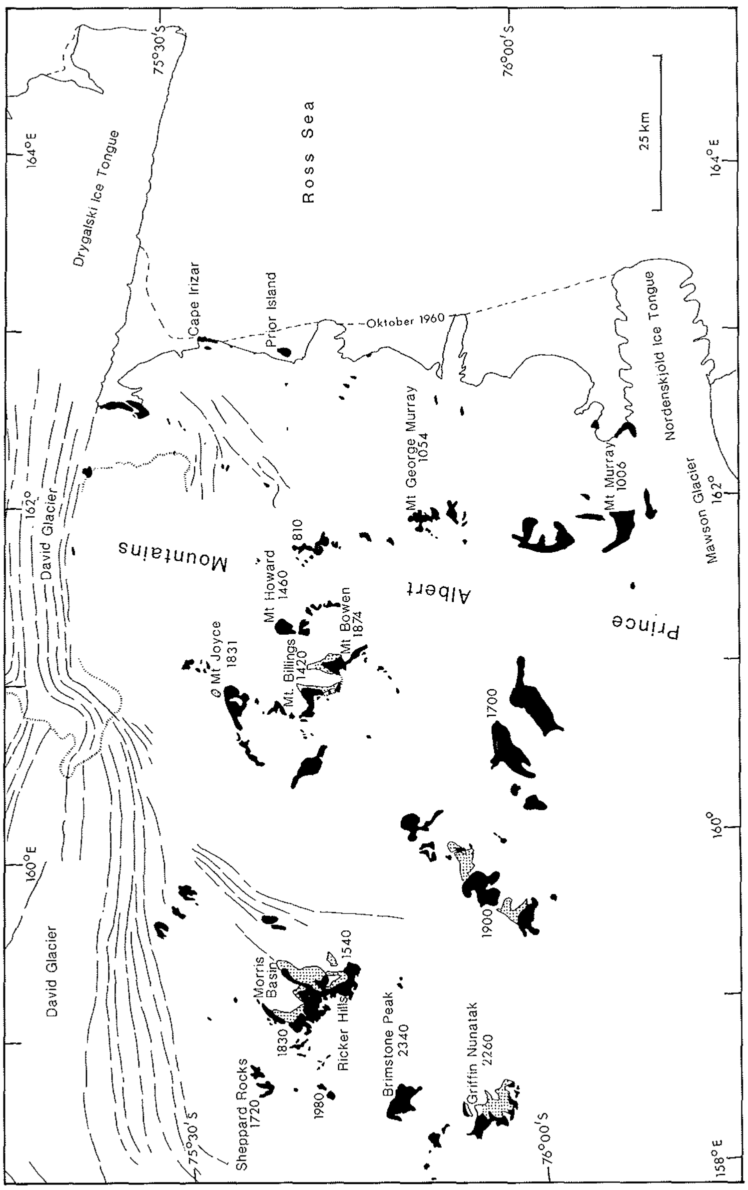

Fig. 1: Location map: black = rock outcrops; dotted = ice-cored moraines.

Abb. 1: Übersicht über das Arbeitsgebiet. Schwarz = Gesteinsvorkommen, gepunktet = Moränen mit Eiskernen.

Because of strong weathering of the bedrock, hardly any striations and crescentic marks have been found. The vast majority of rounded clasts on the surface of the glacial terraces seem to be of local origin, e.g. Ferrars, but also Beacon sandstones and volcanic rocks transported from elsewhere were found. Only on Mt. Billings we also found granites. Loose quartz pebbles and quartz crystals from granite erratics were collected for ^{10}Be exposure dating, as the bedrock does not contain any quartz crystals.

These glacial terraces are incised by cirques. Some of the nunataks are flanked by vast areas of ice-cored moraines. Glacial plateaus were found at Griffin Nunatak, Ricker Hills, Mt. Billings and at Mt. Bowen. The latter has a terrace morphology, but, like the higher plateaus, lacks erratic rocks. The glacial terraces occur 100 m to 400 m below the level of the glacial plateaus, e.g. at Mt. Bowen 100 m, at Mt. Billings 210 m, at Mt. Joyce 300 m and at Ricker Hills 200 m to 400 m.

The terrace at Mt. Billings has a horseshoe shape of which the sidewalls are terraced, due to mass movement. At the deepest part, in the middle of the terrace, a small frozen lakelet is situated. At the open, eastern side large erratic granites and sandstones occur. Till at the eastern side is coarser than till from the middle part.

The till at Ricker Hills contains fragments of coal from the Beacon formation, Ferrar dolerite and other volcanic rocks, with amygdales and agates. The latter originate from rock outcrops west of Ricker Hills, from Sheppard Rocks in the north up to Brimstone Peak in the south (WÖRNER this vol.). This indicates a flow direction from the southwest, which is confirmed by striations and crescentic marks (O 45°).

The northern spurs of Ricker Hills surround a blue ice tongue which flows into Morris Basin. On top of the blue ice, rounded and scratched erratics, e.g. Ferrar dolerites, coal and fine-grained erratics, were found.

At the western side of Morris Basin, abutting the ice, a peculiar till was found. It is a very firm yellowish till with rounded Ferrar dolerites on top of a Beacon sandstone outcrop.

The ice-cored moraines (1,050 m), bordering the blue ice tongue in Morris Basin contained the already mentioned stones, and also large crystals of zeolites from the amygdoidal volcanics to the west and petrified wood. This wood so far has only been found in situ in a rock outcrop between Brimstone Peak and Ricker Hills and belongs to the Exposure Hills Formation (WÖRNER this vol.). This, too is an indication for an ice flow direction to the north east. On the eastern side of Griffin Nunatak and north of Ambalada Peak a large ice-cored moraine occurs, partly with a dead-ice topography, and partly showing several shear moraines.

With the help of the echo sounder (SIMRAD ED 161) on board of the *Polar Queen*, the bathymetry of the seafloor between the Drygalski Ice Tongue and Prior Island was mapped (Fig. 2). At a speed of about 3 knots we moved

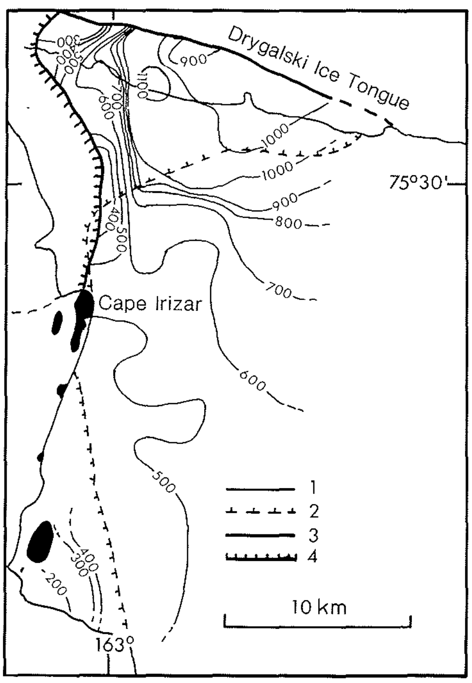

Fig. 2: Preliminary bathymetry of the area between Drygalski Ice Tongue and Prior Island. Contourlines in m; 1 = margin of Drygalski Ice Tongue as of 1960; 2 = pack ice border as of 1960; 3 = margin of Drygalski Ice Tongue as of 1991; 4 = pack ice border as of 1991.

Abb. 2: Bathymetrie zwischen Drygalski-Eiszunge und Prior Island. 1 = Drygalski-Eiszunge 1960; 2 = Packeis-Grenze 1960; 3 = Drygalski-Eiszunge 1991; 4 = Packeis-Grenze 1991.

along a grid between Longitudes 162° 49' E and 163° 22' E and Latitudes 75° 26' S and 75°42' E. The morphology shows a very irregular surface with deep and steep valleys. Along the coast the depth is about 250 m, sloping gently to 400 m in the southern part and very steeply to 1,000 m in the north. In general the depth increases to the north, but surprisingly the deepest part of the sea floor is not directly near the Drygalski Ice Tongue, but is separated from it by an elevation. The general picture sketches a situation as if its former flow direction has been further to the south. This is in contradiction with the expectations, as a deviation to the north, caused by the pressure of the Ross Sea Iceshelf, would be more likely (DREWRY 1979, STUIVER et al. 1981).

From our field observations we conclude that the glacially eroded plateaus must have been ice free for a longer period than the lower glacial terraces, as they show a stronger degree of weathering. Erratics, striae and crescentic marks found on the glacial terraces show an ice flow direction to the north east. We have found erratics derived from the basement rocks only on the glacial terraces and not on the highest plateaus. This implies that the valleys were cut at times when the summit plateaus already were ice free, but the terraces were still covered with ice. This could be an indication of mountain uplift. Until the results of the ^{10}Be analyses are available, we do not know the age of the overriding phase in this area.

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