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18. Radio-echo-sounding on Browning Pass, Terra Nova Bay Area, Antarctica

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INTRODUCTION

Browning Pass is a 17.5 km long and about 3 km wide U-shaped NE-SW running valley that forms an easy access route from Campbell Glacier to Priestley Glacier and the Nansen Ice Shelf (Fig. 1). Due to its smooth snow surface, Browning Pass has served in the past as landing site for Hercules- as well as smaller aircraft. An attempt was made to determine the snow and ice thickness along several radio-echo-sounding (RES-) profiles across Browning Pass. Values around 100 m were measured in the NE-part and of 50 m or less in the SW-part. The high moisture content of the snow in the SW-part of the investigated area, however, might have prevented the radar signals to have measured the true depth of bedrock. Arguments are presented, which nevertheless speak for a shallow snow and ice coverage of Browning Pass.

MEASUREMENTS

The positions of selected points along the radio-echo-sounding (RES) profile were determined by GPS and measured with a TRIMBLE SL single frequency receiver. The coordinates of 14 positions along the profiles (see Fig. 2) are given below. RES measurements were made with a back-pack unit developed by Bundesanstalt für Geowissenschaften und Rohstoffe (BGR). Measurements were carried out with radar frequencies between 35-65 MHz. Major internal and subice reflections are plotted in Fig. 2.

Point	Latitude (S)	Longitude (E)
1	74° 35' 47.14"	164° 10' 35.20"
2	74° 35' 26.89"	164° 10' 19.78"
3	74° 35' 11.19"	164° 09' 86.76"
4	74° 34' 86.61"	164° 09' 40.31"
5	74° 34' 73.26"	164° 08' 80.35"
6	74° 34' 59.02"	164° 07' 55.83"
7	74° 34' 52.42"	164° 07' 24.89"
8	74° 34' 45.09"	164° 06' 91.38"
9	74° 33' 99.59"	164° 06' 55.99"
10	74° 34' 17.72"	164° 05' 83.34"
11	74° 34' 95.81"	164° 03' 17.43"
12	74° 34' 76.69"	164° 03' 85.20"
13	74° 34' 56.92"	164° 04' 51.11"
14	74° 34' 37.15"	164° 05' 18.04"

RESULTS AND INTERPRETATION

As shown in Figure 2, the snow/ice cover over the whole length of the valley is rather thin. Only the NE-part of Browning Pass is covered in places by about or slightly over 100 m thick snow/ice. The SW-part is characteri-

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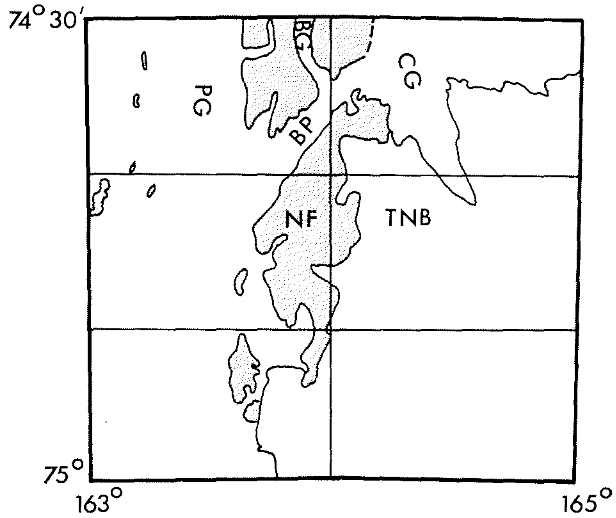

Fig. 1: Location map: PG = Priestley Glacier, BG = Boomerang Glacier, BP = Browning Pass, CG = Campbell Glacier, NF = Northern Foothills, TNB = Terra Nova Bay.

Abb. 1: Lagekarte: BG = Priestley Glacier, BG = Boomerang Glacier, BP = Browning Pass, CG = Campbell Glacier, NF = Northern Foothills, TNB = Terra Nova Bay.

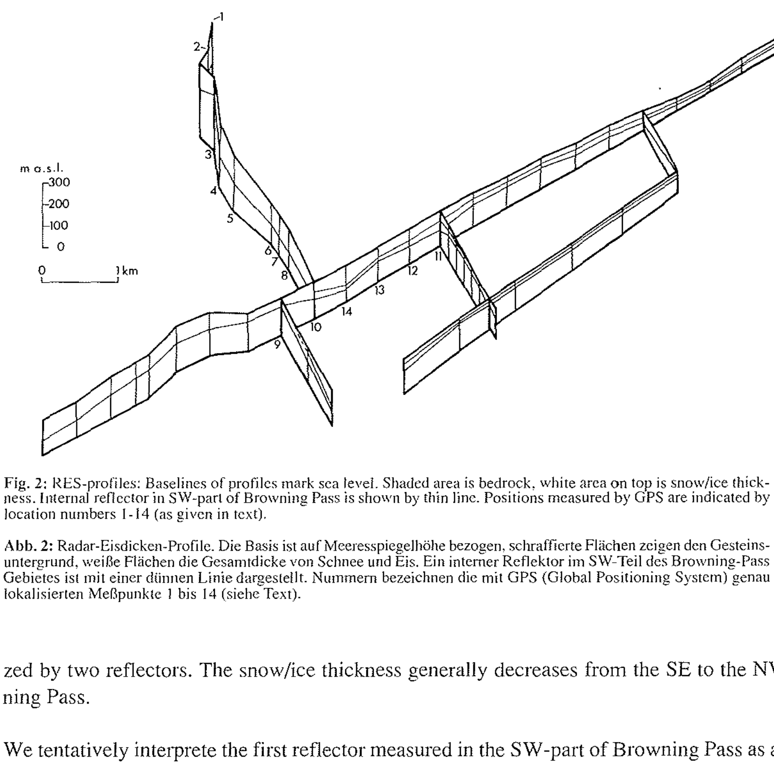

Fig. 2: RES-profiles: Baselines of profiles mark sea level. Shaded area is bedrock, white area on top is snow/ice thickness. Internal reflector in SW-part of Browning Pass is shown by thin line. Positions measured by GPS are indicated by location numbers 1-14 (as given in text).

Abb. 2: Radar-Eisdicken-Profile. Die Basis ist auf Meeresspiegelhöhe bezogen, schraffierte Flächen zeigen den Gesteinsuntergrund, weiße Flächen die Gesamtdicke von Schnee und Eis. Ein interner Reflektor im SW-Teil des Browning-Pass Gebietes ist mit einer dünnen Linie dargestellt. Nummern bezeichnen die mit GPS (Global Positioning System) genau lokalisierten Meßpunkte 1 bis 14 (siehe Text).

zed by two reflectors. The snow/ice thickness generally decreases from the SE to the NW boundary of Browning Pass.

We tentatively interprete the first reflector measured in the SW-part of Browning Pass as an internal one (snow-firn transition?) and the second reflector as the top of the bedrock. The measurements in the SW-part are ambiguous. The snow cover there is rather wet. Numerous melt water lakes are aligned along the NW boundary of Browning Pass and rivers nourished by the glacier tongue of Boomerang Glacier seem to penetrate under the snow cover. The radar signals of our instrument were possibly unable to penetrate to the bottom of the ice, being reflected by something akin to a water layer, indicating therefore only a minimum ice thickness. However, we consider this possibility not as very likely, since it would be hard to explain why two different water tables on Browning Pass - one on the surface (lakes) and one at about 50 m below surface - should have developed.

Boomerang Glacier, which today terminates before entering Browning Pass, once moved along the NW-boundary of the pass toward SW and deposited lateral moraines. Our favoured interpretation - shallow snow-/ice thickness - does explain, why these lateral moraines of the Boomerang Glacier have not been displaced subsequently. The snow/ice cover on Browning Pass is too thin to be able to move under its own weight.