

19. Site Survey for Future Heat Flow Measurements, Prince Albert Mountains, Antarctica

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Summary: Aim of the survey was the identification of ice fields with an internal temperature field characterized by predominantly conductive heat transport. Blue ice fields of limited thickness and minor surface topography are most favourable in this respect. Suitable drill sites on blue ice fields at which terrestrial heat flow will be measured in the future will be selected after evaluation of the available data.

INTRODUCTION

Antarctica is the only continent, from which almost no terrestrial heat flow values are available. The continent is covered by a thick ice sheet, which continuously deforms under its own weight. Ad- and convective heat transport prevails in the ice body and, therefore, does not allow the measurement of heat flow using conventional methods, which rely on the prevalence of conductive heat flow in the measured section.

Inspection of satellite photographs of the western boundary of the Transantarctic Mountains in Victoria Land reveals the existence of numerous blue ice fields. The ice thickness of such fields is frequently on the order of a few hundred meters or less. Thin ice sheets hardly deform under their own weight and show little lateral displacement unless they are exposed to considerable surface relief. Under such conditions it might be possible to determine terrestrial heat flow in bore holes that penetrate ice.

The purpose of the site survey in the Prince Albert Mountains during GANOVEX VI was to determine ice thickness variations by radar in selected areas in order to identify suitable locations for future heat flow measurements on ice.

INVESTIGATIONS

The radar measurements were carried out in three areas (see also Figure 1):

- Blue ice fields to the E and N of Brimstone Peak
- Blue ice fields to the NE of Griffin Nunatak
- Ice fields to the W, N and E of Mt. Joyce.

The total area covered within the available 5 weeks amounts to roughly 900 km².

Brimstone Peak: Adjacent blue ice fields are typically less than 300 m thick but show remarkably strong surface relief. Two glacial valleys (about 600 m deep) run in NW - SE direction presumably along a fault between Brimstone Peak and Tent Rock to the N.

Griffin Nunatak: The blue ice field to the NE of Griffin Nunatak is almost uniformly 900 m thick and shows very little surface relief. Lateral moraines having been formed on the blue ice by an overriding ice stream during a former period with a higher ice stand have hardly been displaced by later ice flow. It is therefore believed that this ice field is currently almost stagnant.

Mt. Joyce: Local blue ice fields characteristically slope slightly towards David Glacier to the N. Most fields are 500 to 600 m thick and show minor subice topography caused by glacial erosion. Ice thickness is decreasing to the E of Mt. Howard towards Mt. Stephen. The valley between Mt. Billing and Mt. Bowen is covered by a thin

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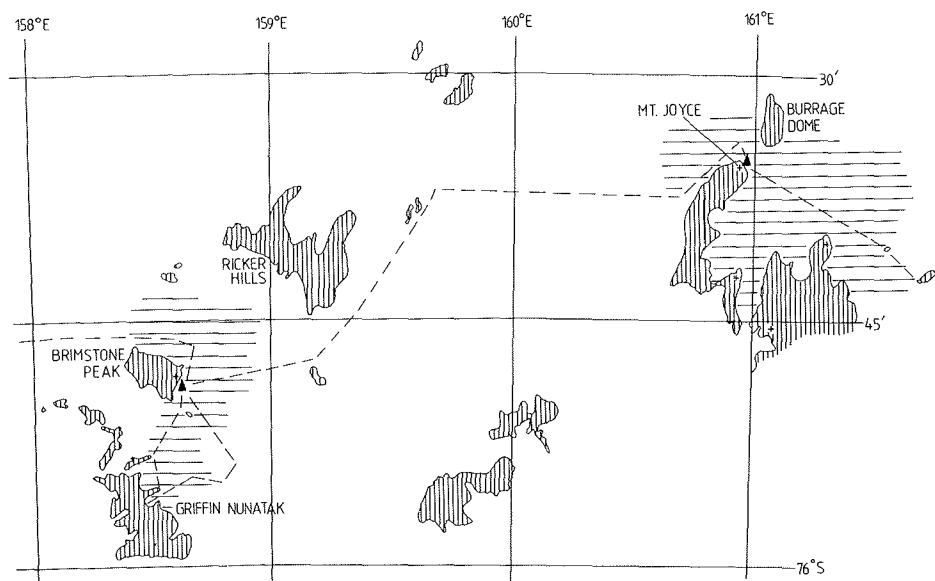


Fig. 1: Locality map of the investigated area. Horizontally striped areas have been investigated by radar. Routes negotiable by skidoo between the areas of interest are shown as well.

Abb. 1: Übersichtskarte des Untersuchungsgebietes. Horizontal schraffierte Gebiete wurden mit Radar vermessen. Mit Skidoos befahrbare Routen zwischen den Arbeitsgebieten sind strich-liniert dargestellt.

ice layer (150 to 200 m) and slopes to the S toward the previous ice source area defined by a former ice fall. This area is probably the most promising locality for a future drilling operation.

A numerical model which predicts the rate of ice deformation and movement will be applied for all areas. Future drill sites for measuring heat flow will be selected depending on the results of these calculations.