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Past Levels and Present State of Northern Victoria Land Glaciers

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continuous variation of resistivity with depth. The most satisfactory model at the 1973-1974 base camp (82°32.5'S. 166°01'W.) corresponds to a bottom melt/freeze rate close to zero and an activation energy for electrical conduction of 0.25 electron volt, in agreement with laboratory measurements on antarctic ice samples. The actual resistivity in the solid ice at a depth of about 100 meters lies within 10 percent of 70,000 ohm-meters, thus again confirming the very low resistivities typical of polar glacier ice. At the 1974-1975 base camp (80°11.8'S. 161°34'W.) the resistivities through most of the ice shelf are similar, but there is a highly resistive layer (resistivity on the order of 1 million ohm-meters) about 75 meters thick at the base of the ice. Since the latter station lies on ice that has emerged onto the shelf through a major west antarctic ice stream, whereas the former lies on sheet-flow ice from the Siple Coast, the basal layer may result from annealing and/or plastic deformation in the low part of the ice stream.

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Past levels and present state of northern Victoria Land glaciers

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Late Cenozoic glacial events and recent ice and snowpatch adjustments were investigated during the 1974-1975 austral summer in the region of the upper Rennick Glacier, northern Victoria Land (Mayewski, 1975). Three study areas were visited: Morozumi Range and Helliwell Hills (figure 1) and Evans Névé (figure 2). A forthcoming final report (Mayewski and Attig, in preparation) will contain a detailed glacial stratigraphy and former ice surface reconstructions for the Rennick Glacier as well as a discussion of the recent ice and snowpatch dynamics in the area. Following, however, is an introduction to the types of information available from the three sites.

The Morozumi Range (figure 1), particularly along its southeastern flank, contains deposits that record several former ice surface levels of the Rennick Glacier. The highest and oldest of these ice surfaces completely covered the southern end of the Morozumi Range with a minimum recorded level of 410 meters above present ice surface. The steeply sloping walls of the Morozumi provide too active a mass-wasting environment for the preservation of intermediate ice surface levels, although further downslope gently tilting ice-free embayments contain one to two sets of recessional moraines developed from these intermediate stands. Lacustrine deposits and strandline dating from a warmer and/or moister period stratigraphically separate these recessional moraines from a series of ice-cored moraines that stand close to the present margin of the Rennick. We examined the relationship between these ice-cored moraines and the present ice margin. Along lateral portions of the Rennick, the margin has been modified into lobes by general lowering of the Rennick ice surface and attendant increase in topographic control by the Morozumi. The resultant lobate margins are sensitive regions for recording the present activity of the Rennick. At such sites cliffed margins of the lateral lobes of the Rennick are overriding ice-cored moraines due to some fairly recent physical readjustment and/or mass balance change. Similarly, local alpine glaciers of the Morozumi appear to be extending, while areal coverage of snowpatches here has decreased since 1964. Possible causes and effects of these snow and ice conditions are being studied.

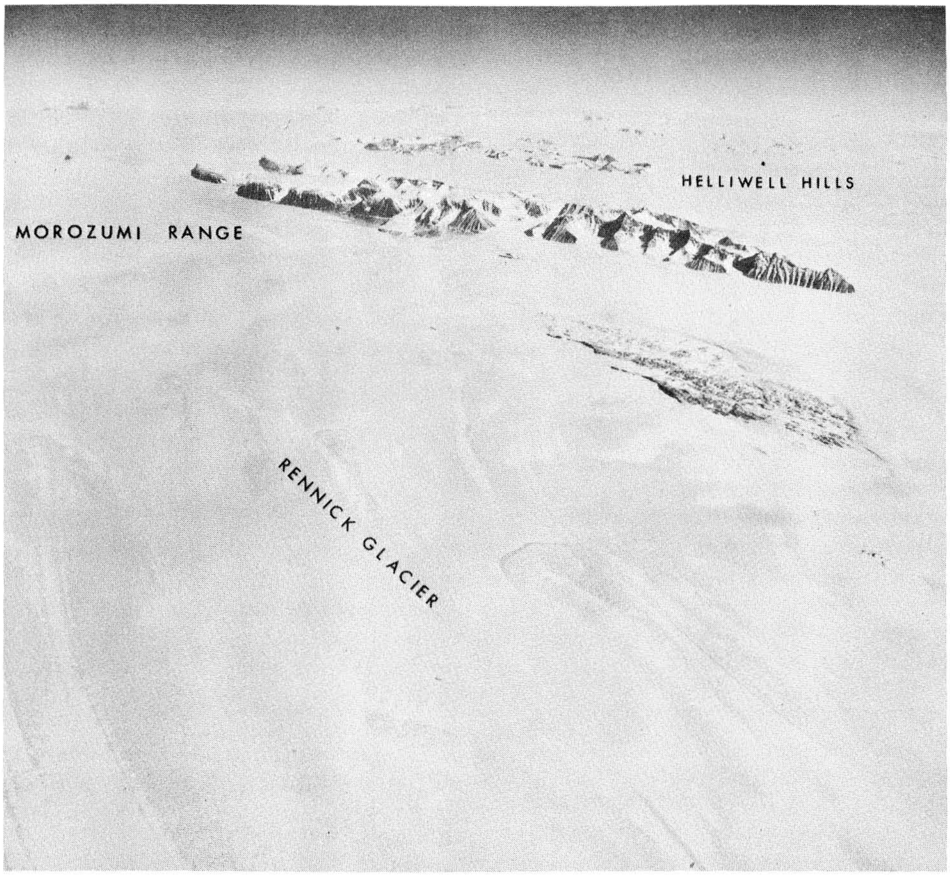

Figure 1. View looking south-southeast up the Rennick Glacier. U.S. Navy photograph 190 F-33 TMA 867.

In the Helliwell Hills (figure 1) a glacial record was determined comparable to that in the Morozumi. Additionally, striations, gouges, and grooves mapped within an embayment along the southeastern flank of the Helliwell Hills chart the pattern of ice inundation by the highest ice surface recorded in the area. These erosion features and the tills in the area are being employed as basal ice environment indicators.

The Evans Névé area (figure 2) contains steeper slopes and less ice-free exposure than either the Morozumi or the Helliwell Hills. Therefore, former ice surface levels are recorded only by the presence of erratics strewn on these steep slopes. This situation masks the detailed stratigraphy of the area. Crevasse distributions of ice masses covering nunataks but tied to the névé attest to a recent drop of the ice surface level in this area (Mayewski, 1975).

Since our field season in northern Victoria Land, glacial-geomorphologic studies of the Transantarctic Mountains undertaken at the University of New Hampshire have comprised three parts in addition to data simulation from the upper Rennick Glacier study. First, photographic and field observations of recent activity and changes in snowpatch distribution along the Rennick Glacier are being used in a time-sequence photographic analysis. These changes are potential indicators of regional or local climate change or physical responses to movements of related larger ice masses. Second, we are making megascopic, microscopic, and electron microprobe analyses of weathering rinds on lithologically separated clasts comprising the surface of glacial deposits. These analyses are being used to help define the weathering environment and to differentiate glacial deposits (Talkington *et al.*, 1976). Third, a rock glacier survey begun in 1968 with P. Calkin (State University of New York at Buffalo) is in its second to last year of measurements. The remaining years' observations should give knowledge of large-scale mass-wasting phenomena in southern Victoria Land.

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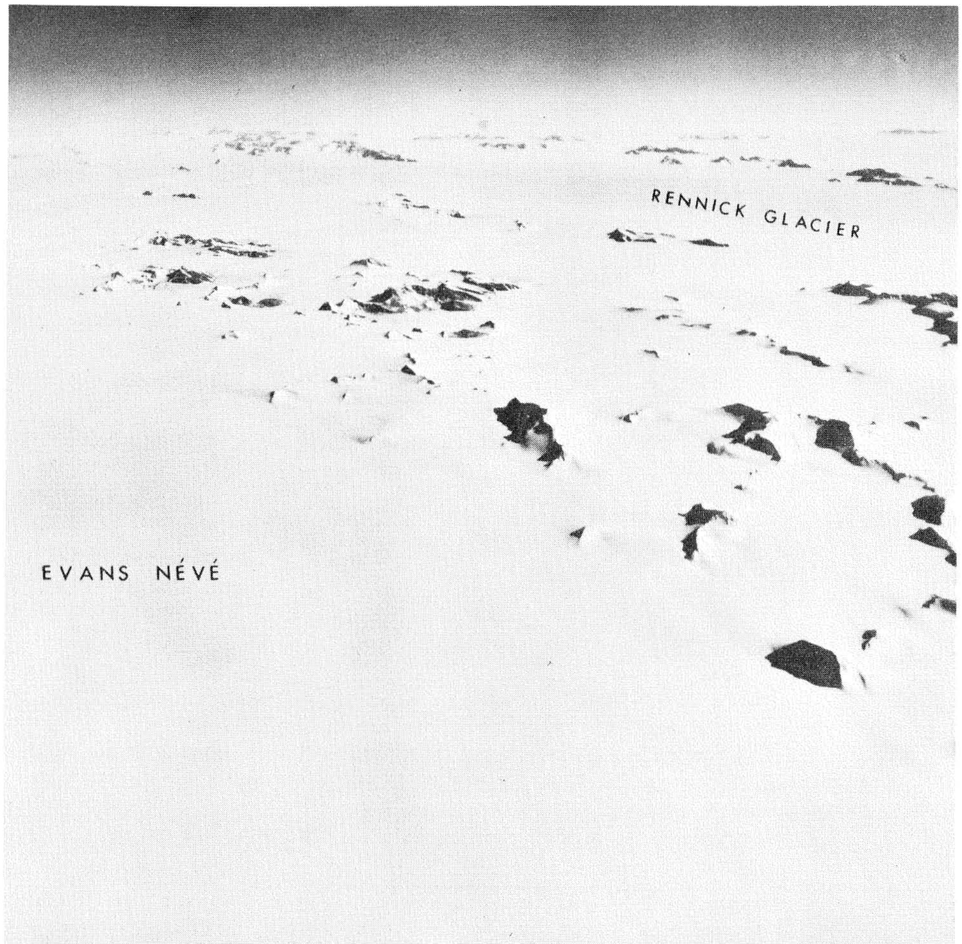

Figure 2. View looking south-southeast over the Evans Névé to the south-east of figure 1. U.S. Navy photograph 068 F-31 TMA 1035.

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Ice velocities on the Ross Ice Shelf

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Before 1973, movement of the Ross Ice Shelf had been measured near the Transantarctic Mountains (Swithinbank, 1963), near Ross Island (Stuart and Heine, 1961) and near the ice front and to the south of Roosevelt Island (Dorrer *et al.*, 1969). Robin (1975), assuming steady state, extrapolated these data across the ice shelf by applying volume conservation principles to measured ice thickness profiles of the ice shelf.

As part of the Ross Ice Shelf Project (Zumberge, 1971), the U.S. Geological Survey made accurate position fixes with a satellite-tracking geoceiver at stations in the southeast quadrant of the ice shelf in 1973-1974 and again in 1974-1975. Comparison of the fixes gives ice velocities with an estimated accuracy of 5 to 20 meters per year depending on the number and the geometry of satellite passes recorded by the geoceiver.

Velocities have been interpolated between the geoceiver stations using ice strain rates measured at 41 stations in the same region (figure 1). These stations were about 50 kilometers apart. Principal strain rates were calculated for each station by