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Ice Mass Fluctuations in NorthernVictoria Land

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Rennick Glacier is one of the major ice drainages for the northern Victoria Land sector of East Antarctica. Unlike glaciers farther south along the Transantarctic Mountains, Rennick Glacier does not drain into the Ross Ice Shelf but flows directly into a seasonally ice-covered ocean. Therefore, current fluctuations of this glacier are unhampered by the dampening effects of the Ross Ice Shelf. The primary controls on the activity of this glacier and others in this region are mass balance and sea level.

Two major glacial events are recorded in the upper Rennick Glacier region (Mayewski, Attig, and Drewry 1979). The location of erratics and glacially scoured features suggests that during the oldest, or Evans, glaciation ice covered all but the highest peaks in the region. Following this glaciation a re-advance produced the Rennick glaciation. Drift produced during Rennick glaciation has a surface cover of unweathered clasts and is commonly found in the form of recessional moraines with associated ice-marginal lakes. Rennick Glacier is currently in a recessional phase of the Rennick glaciation, characterized by physical re-adjustments of local ice masses (Cameron and Goldthwait 1961; Mayewski and Attig 1978) including progressive inland migration of the Rennick Glacier grounding line. To date the grounding line has migrated up to the midpoint of the glacier.

During the 1980–1981 and 1981–1982 austral summer field seasons investigations were conducted to document and understand the physically and/or climatically induced changes characteristic of the retreat phase of the Rennick glaciation. Studies used to document the retreat phase included: (1) glacial geologic mapping; (2) monitoring of velocity, strain, and ablation on Rennick Glacier and two alpine glaciers close to the grounding line of Rennick Glacier; (3) radio-echo sounding at selected sites throughout the region; and (4) recovery of several shallow ice cores for glaciochemical analyses (sulfate, nitrate plus nitrite, reactive iron, reactive silicate, sodium, chloride, and tritium). A brief summary of the results to date follows.

Mapping of glacio-depositional and glacio-erosional features reveals that relatively extensive areas of wet-based ice characterize the Rennick Glacier region and that they have in the recent past. The fact that this ice is relatively temperate by comparison with most ice in East Antarctica is also indicated by ablation values of about 20 grams per square centimeter per year for both the lower Rennick Glacier and nearby alpine glaciers. Velocities of about 160 meters per year and about 30 meters per year characterize Rennick Glacier close to its grounding line and at nearby alpine glaciers, respectively. Strain rates measured at velocity monitoring sites are approximately 0.001 per year. A radio-echo sounding profile along the lower Rennick Glacier (Mayewski, Attig, and Drewry 1979) has been extended up one of the tributary glaciers feeding Rennick Glacier and up into the Evans Névé, one of the major sources of ice for Rennick Glacier. Ice thicknesses computed from the radio-echo sounding studies portray relatively thin ice, less than 100 meters, for the sites measured in Evans Névé. Therefore, ice flow out of this accumulation basin is minimal and Rennick Glacier may experience continued inland retreat of its grounding line due to reductions in ice flow to this site. In the future, as bedrock topography exerts its control on the flow of ice in Evans Névé, this situation will worsen. Finally, glaciochemical studies which are still being analyzed point to a 2- to 3-times greater net mass balance in the lower Rennick Glacier area versus that in the Evans Névé. Source determination for the chemical species examined in the cores are being used to plot pathways taken by the precipitate entering the core sites.

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