



## **Structural evolution of aprons at the margins of cold glaciers: implications for the apron entrainment model of basal ice formation**

**Sean Fitzsimons, Nicola Webb, Sarah Mager and Shelley MacDonell**

Department of Geography, University of Otago, P.O. Box 56, Dunedin, New Zealand(sjf@geography.otago.ac.nz / Fax +64 3 4799037 / Phone +64 3 4798786)

Previous studies of stratified basal ice in polar glaciers have attributed this facies to overriding and entrainment of ice and debris aprons that accumulate at the foot of ice cliffs. The process of apron entrainment results in gradual attenuation of ice and sediment accumulations that produce complexly deformed basal ice consisting of layers and lenses of sediment interstratified with ice-rich layers. A study of the morphology, structure, and deformation of the apron and basal ice at the terminus of Upper Victoria Glacier in the McMurdo dry valleys was undertaken to test whether the basal ice is derived from entrainment of the glacier apron. Our results show that the apron has a two structural elements: an inner element that is strongly foliated and has a steep up-glacier dip and an outer element that has a down-glacier, slope parallel dip and lacks a consistent foliation. Although the whole apron is deforming internally the inner part is differentiated by high compressive shear whereas deformation in the outer part of the apron is characterised by weak shear and low creep velocities. Co-isotopic analyses of the ice facies together with analysis of solute chemistry and sedimentary characteristics show that the apron is compositionally different from the basal ice. Our results show that although the apron may be the origin of part of the basal ice sequence the apron entrainment process does not provide a full explanation of the origin of the basal ice sequence which appears to have a subglacial rather than proglacial provenance.