Active Layer Landforms and Environments in Western Dronning Maud Land, Antarctica

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Permafrost and active-layer thermal and moisture regimes, together with an inventory of landforms commenced in the Ahlmannryggen and the Jutulsessen areas of Western Dronning Maud Land, Antarctica commenced in the 2006/2007 Austral Summer. Initial investigations comprised exploratory observations on 14 nunataks. Initially three nunataks, which was later expanded to eight in the 2012/2013 summer, were identified for measuring ground temperature and moisture using ANTPAS protocols. The selection criteria used for these eight sites were: location relative to the SANAE IV and Troll Bases, accessibility, soil characteristics, the presence of periglacial landforms, and logistical constraints. Ground temperature, and ground moisture, have been, and are being measured in shallow boreholes, using automated logging devices at ten locations (two nunataks have two logging stations each). Periglacial landforms, where present, were noted and measured on all 14 nunataks investigated.

Thermal and moisture regimes show seasonal variability common to all locations with strong signals that were synchronous with Southern Ocean seasonal controls. Additional controls on seasonal and annual regimes were the distance of a site from the continental margins, the length of daylight, and altitude. Data indicate that shorter-term intra-seasonal variability was influenced by synoptic-scale weather, boundary layer climate and topographic influences. The Ahlmannryggen clearly operates under different synoptic systems to the Jutulsessen areas. It was possible, solely through visual observations, to separate out diurnal, synoptic-scale and seasonal regimes in the data recorded.

The locations, orientations, and dimensions of thermal contraction polygons, frost cracks, sorted patterns, blockfields, rock glaciers, solifluction terraces, and frost mounds were mapped and recorded as part of an inventory that could be utilised for future periglacial research. The distribution, type and size of landforms were found to be dependent on the underlying geology, local topography, and moisture availability. The research undertaken provides a baseline for long term active-layer and permafrost monitoring as well as the impact of geomorphology on providing a habitat for the colonisation of biodiversity.