Surface characteristics of rock glaciers in the Jutulsessen, Dronning Maud Land, Antarctica

A thesis submitted in fulfilment of the requirements for the degree of MASTER OF SCIENCE in GEOGRAPHY

by ELIZABETH MAGDALENA RUDOLPH to RHODES UNIVERSITY

DECEMBER 2015

SUPERVISOR: PROF. K.I. MEIKLEJOHN (RHODES UNIVERSITY) CO-SUPERVISOR: PROF. A. BUMBY (UNIVERSITY OF PRETORIA)

ABSTRACT

Rock glaciers are landforms that present downslope movement of debris under the influence of ice and gravity. These landforms can be used as paleo-climate indicators as well as proxies for climate change. Rock glaciers have been investigated in a variety of climates and landscapes, however continental Antarctica, Dronning Maud Land specifically, remains understudied. This thesis aimed to investigate and classify five rock glaciers observed in the Jutulsessen, Dronning Maud Land. The surface characteristics and geomorphology were assessed and used as generic classifiers. Size, shape and landscape association was established by field surveying and GIS, whilst sediment and clast characteristics were determined from sampling. A surface temperature profile was created from short-term high frequency temperature measurements. All of the rock glaciers exhibit either undulating surfaces or patterned ground, or both, which suggests active-layer related processes. Sediment particle size analysis is inconclusive. The 137Cs-content and fabric analysis suggest movement regimes similar to other rock glaciers with higher activity at the head, and variable movement directions at the toe. Relative “activeness” is inferred from morphology: Grjotlia, Grjotøyra and Vassdalen were classified as lobate, spatulate and tongue-shaped respectively with Grjotlia the most stable. A new morphological classification of ‘crownshaped’ is suggested for Brugdedalen and Jutulldalen, and they also appear most active. The control of local climate on rock glacier mechanics is emphasised by the findings, and thus climatic interpolation from a single weather stations is not useful. Increased spatial and temporal coverage of sediment profiles, surface topography and active-layer characteristics could be used to elucidate the processes and controls of these landforms in the Antarctic.

Keywords: rock glaciers, active-layer, Antarctica, Jutulsessen, Dronning Maud Land