



Late Pleistocene glacial chronologies in the Balkans: new ^{36}Cl exposure-age dating from Montenegro and Greece

James Allard¹, Philip Hughes¹, Jamie Woodward¹, David Fink², Krista Simon², Klaus Wilcken², and Matt Tomkins¹

¹Department of Geography, The University of Manchester, Manchester, UK (james.allard@manchester.ac.uk)

²Australian Nuclear Science and Technology Organisation, PMB1, Menai, NSW, 2234, Australia

The timing and extent of mountain glaciation during the Late Pleistocene shows considerable variability around the world. Identifying the nature and timing of glaciation is important for understanding landscape evolution and changing climatic conditions (precipitation and temperature). In the Balkans, glaciers were actually larger during the Middle Pleistocene when large ice caps formed in several mountain ranges including the Dinaric Alps, Montenegro, and the Pindus Mountains, Greece. Glaciations younger than Marine Isotope Stage 6 were characterised by smaller ice masses with glaciers mainly restricted to the highest mountains. The behaviour of Late Pleistocene glaciers in this region influenced the timing of sediment and meltwater delivery to river systems; the migration of modern humans across Europe; and the dynamics of biological refugia. However, dating control is limited for Late Pleistocene glaciers in the Balkans.

Here we report new in-situ ^{36}Cl terrestrial cosmogenic nuclide exposure ages from moraine boulders sampled in the Velika Kalica valley, in the Durmitor massif, Montenegro. This valley was targeted because it contains the Debeli Namet glacier - the last remaining glacier in Montenegro. We have sampled 25 limestone boulders from 5 moraines situated down-valley of the current glacier at altitudes between 1650–2000 m. AgCl targets for ^{36}Cl assay were prepared at The University of Manchester and ^{36}Cl concentrations were measured on the SIRIUS 6MV accelerator at the Centre for Accelerator Science at the Australian Nuclear Science and Technology Organisation. At the last local glacial maximum, the Debeli Namet glacier extended almost 3 km beyond its current position. These ^{36}Cl analyses are part of a wider regional Mediterranean study, totalling >50 new exposure ages, which also includes Mount Tymphi in the Pindus Mountains, NW Greece. The project will address both a significant spatial and temporal gap in Mediterranean glacial chronologies by targeting the hitherto undated Late Pleistocene glacial record. The work in Montenegro will also shed light on the nature of Holocene glaciation in the Balkans.