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Postglacial sediment budget and relief development in Hrafndalur, Eastern Iceland

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There have been only few integrated-quantitative studies of Holocene and present-day sediment budgets and Postglacial relief development in cold environments. The Hrafndalur catchment (7 km^2, 6-731 m a.s.l.; 65º28‘N, 13º42‘W) is situated in the northern part of the subarctic oceanic Easter Fjords region (Austfirðir) in Iceland. Austfirðir is characterised by fjords and U-shaped valleys formed during Pleistocene glaciations. Lithology in Hrafndalur is dominated by Rhyolites. Aims of this study are to: (1) analyse the rates and the spatio-temporal variability of denudative processes and sediment transfers within the Hrafndalur catchment; (2) analyse the absolute and the relative importance of the different denudative processes; (3) quantify the sediment budget for this catchment; (4) analyse Postglacial relief development in this cold environment.

Rates of present-day denudative processes and mass transfers have been calculated after a six-years investigation and monitoring programme (2001 – 2007). Geophysical investigations for quantification of storage elements, regolith thickness and Holocene process rates were performed in the summer of 2005.

Under the present-day morphoclimate and vegetation cover fluvial transport in the main channels, with respect to mass transfers, dominates over slope processes. Fluvial solute transport is more important than suspended sediment transport. Due to high bedload transport rates fluvial transport of solids dominates over fluvial solute transport. At the slope systems, rock and boulder falls are, with respect to mass transfers, clearly

the most important denudative process followed by chemical denudation, slope wash, creep processes, avalanches, debris flows, translational slides and deflation. The transport of debris from the slope systems into the main channels is significant. Slope processes cause a valley widening and the formation of larger talus cones. Both Holocene and present-day process rates are altogether higher than in the extended Basalt areas of Austfirðir.

Postglacial modification of the Pleistocene landscape is significant in this Rhyolit area and clearly more advanced than in the Basalt areas of Austfirðir. The importance of lithology for Postglacial relief development, with the lower weathering resistance of the Rhyolites found in Hrafndalur as compared to the more resistant Basalts given in most areas of Austfirðir, is stressed. Space-for-time substitution is applied to model Postglacial relief development in Austfirðir.

The collected data can be used for direct quantitative comparisons with other cold environment catchments. This type of catchment-based quantitative study, carried out in different cold environments, will contribute to gain better understanding of the internal differentiation of cold environments and of the Postglacial relief and landform development in these environments.