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Sediment transfers, sediment budgets and relief development in three catchments in different cold environments in sub-Arctic East Iceland and Arctic Swedish Lapland

A.A. Beylich (1,2)

(1) Geological Survey of Norway, Landscape & Climate Team, Norway, (2) Norwegian University of Science and Technology, Norway

(achim.beylich@ngu.no / Phone: +47-73-90 4117)

This study analyzes present-day sediment transfers, sediment budgets and relief development in three selected catchments ($<$30 km^2) in different cold environments in East Iceland and Swedish Lapland. Main focus is on the role of the controlling factors morphoclimate, vegetation cover, sediment availability, lithology, relief and human impact on solute and sediment fluxes and sediment budgets. By a combined quantitative investigation/monitoring of the relevant denudative slope processes as well as of fluvial solute and sediment transport in Austdalur, located in the Basalt area of sub-Arctic East Iceland, in Hrafndalur, situated in a Rhyolite area in sub-Arctic East Iceland, and in Latnjavagge, located in a Mica Schist area in Arctic-oceanic Swedish Lapland, quantitative information on the intensity of present-day geomorphologic processes, the relative importance of the different denudative processes for slope and valley formation, and trends of relief development is presented. Monitoring programmes have been in operation since ten years in Austdalur, since five years in Hrafndalur and since seven years in Latnjavagge. In annual mass transfer, fluvial sediment transport in the main channels dominates over slope processes in all three catchments. In the Icelandic catchments (Austdalur and Hrafndalur) fluvial sediment transport is more important than fluvial solute transport whereas in the Swedish catchment (Latnjavagge) fluvial solute transport dominates over fluvial sediment transport. The dominance of mechanical over chemical denudation in East Iceland is mainly due to the partly destroyed vegetation cover – as caused by direct human impact – in these areas

whereas in Latnjavagge a stable and closed vegetation cover is leading to low mechanical denudation rates and a dominance of chemical over mechanical denudation. The different slope processes active in the three study areas cause in all three catchments a valley widening. In Hrafndalur Postglacial modification of the glacial relief is significantly further developed than in Austdalur, which is due to the lower resistance of the Rhyolite present in Hrafndalur as compared to the resistant Basalt, which is given in Austdalur. Both in Austdalur (Basalt) and in Latnjavagge (Mica Schist) Postglacial modification of the glacial relief is rather little. The application of the Ergodic principle of space-for-time substitution is applied to model (i) relief development and (ii) effects of projected climate change in the selected cold environment target areas. Due to the short time since the deglaciation (8000 – 12000 years in the different study areas) and the altogether rather low intensity of the denudative surface processes in the three areas there has been no adjustment of the larger Pleistocene glacial landforms to the geomorphologic processes which have been active after the deglaciation.