Geophysical Research Abstracts
Vol. 15, EGU2013-1320-1, 2013
EGU General Assembly 2013

Glacial isostatic adjustment and Holocene to contemporary source-to-sink fluxes in valley-fjord systems in western Norway

Achim A. Beylich, Katja Laute, and Susan Liermann
Geological Survey of Norway (NGU), Geo-Environment Division, Trondheim, Norway (achim.beylich@ngu.no)

The focus of this Norwegian Research Council (NFR) funded Norwegian Individual Project (http://www.ngu.no/sedymont) within the European Science Foundation (ESF) SedyMONT (as part of EUROCORES TOPO-EUROPE) Programme (http://www.esf.org/topoeurope) is on Holocene, subrecent and contemporary sedimentary fluxes and budgets in selected valley-fjord systems (Erdalen and Bødalen) in Nordfjord, western Norway.

The following main aims can be pointed out:

- Analyse in which way glacial isostatic adjustment and surface denudational processes have been interacting over the Holocene
- Analyse how the inheritance of the landscape due to the influence of the Last Glacial Maximum (LGM) has affected surface process rates over time
- Document changes in surface process rates over different timescales by combining knowledge on Holocene surface process rates with data on subrecent and contemporary surface process rates

High-resolution monitoring of denudational surface processes in the Erdalen and Bødalen drainage basin systems, in combination with repeated analyses of surface water chemistry, atmospheric solute inputs and granulometric as well as shape analyses of suspended sediments provide high-resolution data to analyse and quantify present-day sedimentary and solute fluxes as well as sediment sources, denudation rates, and meteorological and topographical / landscape morphometric controls of denudational surface processes. In addition to standard methods for monitoring bedload transport, innovative techniques like impact sensors and biofilm analysis are applied in combination with advanced flume experiments (for calibration of field data) to analyse channel stability / mobility and to estimate bedload transport rates in both drainage basin systems.
Lakes are functioning as significant sediment traps within both drainage basins and the volume and composition of lake sediments are studied using echo-sounder, georadar and different coring techniques. Investigations on volumes and architecture of major storage elements (talus cones, valley infills, deltas at the outlets of both drainage basins) using different geophysical methods like georadar and seismic refraction surveys are carried out to improve the quantitative knowledge on Holocene process rates and sedimentary budgets. Detailed geomorphological mapping is conducted and interpreted in combination with digital elevation models and data.

The U-shaped valley morphometry is the main control of Holocene denudational surface processes in both Erdalen and Bødalen. Stepped longitudinal valley profiles within the drainage basin systems have caused that glacial isostatic adjustment has not had significant effects on surface denudational processes in the middle and upper parts of both Erdalen and Bødalen. In Erdalen the more clearly defined stepped longitudinal valley profile has resulted in larger storage (especially in larger volumes of Holocene valley infill and talus cones) and in a lower level of slope-channel coupling as compared to Bødalen.

As a result, the glacial inheritance of topography is the most important factor controlling valley development since the LGM and sediment storage capacity is primarily conditioned by valley morphometry. Different periods within the Holocene with varying intensity of denudational surface processes can be identified and the glacially sculpted topography has not yet adapted to denudational surface processes acting under Holocene environmental conditions. Under the present-day environmental conditions mechanical denudation dominates over chemical denudation. Surface process rates are moderate to low, and the valley systems are altogether supply-limited.

The process and denudation rates from the Erdalen and Bødalen drainage basins are compared with rates from other SedyMONT test sites (transport-limited drainage basin systems located in the Alps), and with denudational process rates in other cold environment drainage basin systems worldwide through the SEDIBUD (Sediment Budgets in Cold Environments) Programme (http://www.geomorph.org/wg/wgsb.html).