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Long-term monitoring of sediment transfer processes at an alpine catchment (Lake Anterne, French Alps): concept and first results

D. Enters (1), F. Arnaud (1), J. Poulenard (2), C. Giguet-Covex (1), Malet, E. (1)

(1) UMR CNRS 5204, EDYTEM, Université de Savoie - Technolac, F-73376 Le Bourget du Lac, France, (2) CARRTEL - INRA, Université de Savoie - Technolac, F-73376 Le Bourget du Lac, France

(dirk.enters@univ-savoie.fr)

Laminated sediments from alpine lakes provide natural archives to reconstruct palaeoenvironmental and palaeoclimatic conditions in regions scarce of long-term instrumental measurements and historical information. An essential prerequisite, however, is that factors controlling the deposition of sediment are well understood. These processes are often complex and even if a direct and linear response of a climatic forcing factor to a sedimentary proxy parameter (such as lamina thickness or grain size) exists, quantitative reconstructions will only be possible by knowing the linkage between forcing and response variable. Monitoring studies which investigate the climatic control over sediment transfer and deposition are therefore ideally suited to improve the interpretation of palaeolimnological results.

Lake Anterne is a relatively small, sub-alpine lake (0.11 km^2, max. depth 13.2 m) situated at 2061 m asl in the north-western French Alps. Several perennial and intermittent tributaries enter the lake and form conspicuous fan and delta areas. The highly minerogenic sediments of Lake Anterne point to a significant input of eroded terrigenic material. The total catchment area has a size of 2.55 km^2 with a maximum elevation of 2470 m asl. Different soils types are found in the catchment according to the underlying bedrock (limestones, calcareous schists) including histosols, cambisols and regosols. The catchment is located above the present (anthropogenically

depressed) treeline and vegetation varies from alpine meadows with occasional dwarf shrubs to barely vegetated scree slopes.

During spring and summer 2007, a weather station (precipitation, air temperature and humidity, soil temperature) was progressively set up in the catchment and intregrating sediment traps together with a thermistor chain were moored in the lake. In addition, an automatic time-lapse camera takes daily pictures since November 2007.

The first results show that the annual snow melt is not the only dominating erosional process at Lake Anterne. Several summer rainstorm-generated floods led to underflows in the lake and caused the deposition of graded event-layers. Further monitoring applications include a sediment sensor at the lake bottom, discharge and turbidity measurements at one of the tributaries as well as infiltration/rainfall simulation experiments to further pinpoint the exact timing and amount of sediment transfer into the lake and the role of extreme events. In addition, terrestrial laser-scan measurements will directly record topographical changes of erosion-prone slopes.

This project supplements ongoing paleolimnological studies at Lake Anterne and contributes to the modeling of future effects of climate change in alpine landscapes.