

Compound specific stable isotopes and specific biomarkers to trace sediment origin and connectivity of sediment source areas to freshwater systems: case of the Baldeggersee catchment (Switzerland)

Marlène Lavrieux, Katrin Meusburger, Axel Birkholz, Christine Alewell

affiliation:

University of Basel, Environmental Sciences Department, Bernoullistrasse 30, 4056 Basel, Switzerland

abstract:

Slope destabilization and associated sediment transfer are one of the major causes of aquatic ecosystems and surface waters quality impairment. Through land uses and agricultural practices, human activities modify the soils erosive risk and the catchments sedimentary connectivity, becoming a key factor of sediment dynamics. Hence, restoration and management plans of water bodies can only be efficient if the sediment sources and their respective contributions, and thus the proportion attributable to different land uses and agricultural practices are identified. Several sediment fingerprinting methods, based on the geochemical (elemental composition), color, magnetic or isotopic (^{137}Cs) sediment properties, are currently in use. However, these tools are not suitable for a land-use based fingerprinting. New organic geochemical approaches are now developed to discriminate source-soil contributions under different land-uses:

- i The compound-specific stable isotopes (CSSI) technique, based on the biomarkers isotopic signature (here, fatty acids $\delta^{13}\text{C}$) variability within the vegetal species,
- ii The analysis of highly specific (i.e. source-family- or even source-species-specific) biomarkers assemblages, which use is until now mainly restricted to palaeoenvironmental reconstructions, and which offer also promising prospects for tracing current sediment origin.

This project aims at reconstructing the spatio-temporal variability of the main sediment sources of Baldeggersee (Lucerne Canton, Switzerland), which suffers from a substantial eutrophication, despite several restoration attempts during the last 40 years. The sediment supplying areas and the exported volumes will be identified using CSSI technique and highly specific biomarkers, coupled to a sediment connectivity model. The sediment origin variability will be defined through the analysis of plants, soils, suspended river sediments sampled at base and high flow conditions (short term), and by the analysis of a lake sediment core (long term).