Geophysical Research Abstracts,
Vol. 11, EGU2009-10851-1, 2009
EGU General Assembly 2009

Does sediment geochemistry (based on selective extractions of Al and Fe and REE) provide a record of soil evolution?

B. Mourier (1,2), J. Poulenard (1), O. Blarquez (2,3), D. Williamson (4), F. Arnaud (5), C. Carcaillet (2,3)

(1) CARRTEL (UMR 42 INRA), University of Savoie, Le Bourget du lac, France (brice.mourier@univ-savoie.fr), (2) Centre for Bio-Archaeology and Ecology (UMR 5059 CNRS), Montpellier, France, (3) Paleoenvironments and chronoecology (PALECO EPHE), Montpellier, France, (4) CEREGE (UMR 6635 CNRS), Aix-en Provence, France, (5) EDYTEM (UMR 5204 CNRS), University of Savoie, Le Bourget-du-Lac, France

Soil is a natural body occurring at the interface between the lithosphere, atmosphere and biosphere. As a result, the physical and chemical properties of soils evolve with time, and the reconstruction of their history represents a key to understand past environmental changes. Palaeolimnological techniques such as sediment geochemistry can be used to investigate changes in catchment history by providing information about soil development. However, due to the lack of conservative pedosignatures (soil proxies), only few paleoecological studies have attempted to reconstruct the history of soil genesis using geochemical analyses of lacustrine sediments. Here we present a multidisciplinary study which aims to use pedosignatures, defined by a previous soil study, in order to characterize the history of soil genesis, podzolization and chemical weathering processes in two sediment sequences. Moreover, we aim to compare the timing of soil evolution with other paleoenvironmental markers (macroremains, charcoals. . .) in order to infer the role of climate, vegetation and possible human activities as forcing factors.

In a first step, the geochemical investigation of eight subalpine soil profiles from the inner Alps allowed to define relevant proxies of two major soil processes. Parent material normalized REE patterns provide a precise tracer of chemical weathering whereas the proportions of secondary Al- and Fe-bearing phases provide a tracer of the podzolisation process.

Then, the same tracers were assessed on two lacustrine and peat sediment sequences (Loup and Thyl lakes) from the subalpine domain. The proxy records, spanning ca. 4.500 yr at the Thyl lake and ca. 13.500 yr at the Loup lake, indicate that both progressive and regressive pedogenesis occurred after the deglaciation.

The Thyl record is highly contrasted: the progressive setting of the mixed cembra pine ecosystem is associated to the podzolisation process (secondary Al- and Fe-bearing phases are maximal) and the increase of chemical weathering (enrichments of specific REE's fractions) that lasted totally ca. 1500 to 2000 years. Then, these progressive pathways are followed by abrupt and rapid secondary processes that could result from drastic transformation of the plant cover. The flat normalized REE patterns associated with low secondary Al and Fe values suggest a decrease of chemical weathering and podzolization. Moreover, the higher variability in cembra pine and the enrichment in sedge and other herbs remains in the lake suggest the setting of semi-open vegetation associated to the evidence of regressive soil processes.

On the other hand, Loup environment and soil history are characterized by a progressive and stable evolution leading to present day old growing forests and Podzol soil type. Whereas the major sedimentological changes are sensitive to climate, the soil proxy records may be more triggered by the natural dynamic of the plant cover. At this site, human disturbances seem to have lower importance than at the Thyl site.