

## Soil organic geochemistry and carbon dynamics of an alpine chronosequence

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Newly formed or exposed landscapes provide a natural experiment to investigate the build-up of the soil organic matter and its composition through time, and the roles various mechanisms of OM stabilization may play. We present insights in the early development of high Alpine soils that were gradually exposed after glacier retreat in Central Switzerland. An exponential increase in TOC content along the 150 year long chronosequence clearly shows initial SOC accumulation. Chemical and physical separation techniques combined with chemical fingerprinting techniques of size and density fractions along the chronosequence gives a first insight in the build-up and relative importance of such-defined SOC pools through time. Analysis of a suite of specific biomarkers that can be detected using various analytical techniques gives further insight in the sources of SOC, e.g. plant input and fungal or bacterial (re)cycling, and their relative importance in younger and older soils.

More specifically, the use of radiocarbon analysis as natural tracer for the age of various organic carbon pools and compounds is explored. Comparison of the radiocarbon content of physically and chemically separated fractions already gives insight in the mean residence time (MRT) of these fractions. Radiocarbon analysis of specific compounds or compound classes with a varying degree of hydrophobicity, followed over the chronosequence, provides further insight in the mechanisms that play a role in carbon dynamics. In order to do this, various separation schemes, mainly involving fraction collection on an HPLC system, are developed. The radiocarbon measurements are performed on the 'MICADAS' AMS system that is equipped with a gas source, allowing the <sup>14</sup>C measurement of very small samples.

## Hydrogen in the Earth's interior

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Hydrogen is perhaps the least well constrained compositional variable in the Earth's interior. Although Earth's oceans dominate most of the surface geological processes, they constitute only 0.023 percent of the planet's mass. H, as hydroxyl, is soluble in all of the silicate and oxide phases of the interior so that relatively small amounts incorporated into major minerals of the mantle may constitute a reservoir many times larger than Earth's hydrosphere. A reservoir of this magnitude would control many of the dynamic processes of the interior. Recently, new elastic parameter and equation of state data have become available for hydrous forsterite (up to 8900 ppmw H<sub>2</sub>O) [1,2], hydrous wadsleyite (up to 21,000 ppmw H<sub>2</sub>O) [1,3,4], and hydrous ringwoodite (up to 28,000 ppmw H<sub>2</sub>O) [1,5].

We have used these new data to extend a model of calculated P and S velocities in the upper mantle and transition zone as a function of hydrogen content. We find that anhydrous pyrolite compositions are inconsistent with PREM and other velocity structure models, whereas a hydrous pyrolite with 5000 to 10,000 ppmw H<sub>2</sub>O is consistent with these velocity models. Compositions with more than 5000 ppmw H<sub>2</sub>O may generate small amounts of partial melt at depths of 100 to 400 km.

[1]Ye *et al.* (2009) *Am.Min* **93** (in press). [2] Jacobsen *et al.* (2008) *GRL* **35**, L14303. [3] Mao *et al.* (2008) *GRL* **35**, L35618, [4] Mao *et al.* (2008) *EPSL* **268**, 540-549, [5] Inoue *et al.* (1998) *EPSL* **160**, 107-113.