

## Lu/Hf ratio and initial $^{176}\text{Hf}/^{177}\text{Hf}$ in the Solar System and the Earth

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The  $^{176}\text{Lu}$ - $^{176}\text{Hf}$  system is an invaluable tool for studying early differentiation in the Earth and other planets. An accurate knowledge of the initial condition of this isotopic system in the Earth remains elusive, despite the growing amount of Lu-Hf data on early Solar System materials. Determinations of  $^{176}\text{Lu}$  decay constant by age comparison on terrestrial minerals and meteoritic phosphates yield consistent results, but two conflicts are still unresolved: 1) Slopes of Lu-Hf isochrons for bulk chondrites and achondrites, and some recently reported internal isochrons for eucrites and angrites are inconsistent with the “terrestrial”  $^{176}\text{Lu}$  decay constant value, whereas other eucrite internal isochrons are consistent with it (e.g. Bouvier *et al.*, MetSoc-2006, abstract #5348, Thrane *et al.*, MetSoc-2006, abstract #5125); 2) Lu-Hf and Sm-Nd systems give different images of early mantle differentiation and proto-crust formation in the Earth, if we use the currently accepted  $^{176}\text{Lu}$  decay constant value (e.g., Jacobsen (2003), Nature 421, 901-903).

There are several potential complications in determination of Lu/Hf ratio (and ratios of other refractory lithophile elements) from analysis of chondrites. First, Lu/Hf in chondrites can be heterogeneous, as a result of metamorphic phosphate growth, or uneven distribution of chondrules and CAIs. Second, Lu/Hf may vary between the classes of chondrites, and may not be representative of the Solar System value. Third, the bulk Solar System Lu/Hf value is not necessarily identical to the bulk Earth value.

There are several ways to address the first two complications, and to improve our knowledge of the bulk Solar System Lu/Hf. For example, one can study the Lu-Hf system in the least metamorphosed chondrites and chondritic matrices, and explore the correlation between Lu/Hf and the ratios of other refractory lithophile elements in various classes of chondrites and Solar photosphere. In addition, it may be possible to determine the initial  $^{176}\text{Hf}/^{177}\text{Hf}$  of the Solar System directly from analyses of minerals with low Lu/Hf from old, well preserved meteorites. An approach to the third problem – precise matching of the Lu/Hf ratio (and other geochemically significant elemental ratios) between the bulk Earth and the bulk Solar System, needs to be developed.

## Biogeochemical interactions in soil – Ccontrols through aggregation?

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The microbial turnover of natural organic matter (OM) and anthropogenic contaminants in soils depends on both quality and accessibility of the substrates. Agglomeration of soil minerals with plant and microbial remains to soil aggregates of different sizes strongly affects this bio-accessibility. Applied pesticides, for instance, are first caught in-between or at the surface of aggregates. Sequestration occurs after movement into interior parts. Also natural OM turnover is restricted in inner-aggregate pore space, however, when aggregates are broken down by e.g. ploughing, (old) organic C and N sources are made available to microbial growth and can rapidly be degraded.

This keynote aims at elucidating the role of aggregate cycling for compound turnover and sequestration in soil. Case studies presented relate to the tracing of xenobiotics using mass spectrometry after sequential extraction, to the cycling and preservation of natural OM using compound-specific stable isotope techniques of biomarkers and amino acid racemisation assessment.

The results suggested that selective preservation of organic molecules in soil may become insignificant when bio-accessibility is not restricted at the surface of aggregates or after their break-down. In undisturbed and very small pore spaces the pollutants and natural organic nutrient sources are withdrawn from actual biogeochemical cycles for unknown periods of time. Racemization of amino acids indicates that the conserved molecules may even age for centuries, despite N deficiency frequently occurring in living terrestrial environments.