Lignin phenols and cutin- and suberin-derived aliphatic monomers as biomarkers for stand history, SOM source, and turnover

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Lignin phenols as well as cutin- and suberin-derived aliphatic monomers were analysed for nine sites which were formerly stocked with Norway spruce but differ in their recent vegetation (spruce, fir, beech, oak, grass). The aim was to investigate whether the species specific chemical composition of the biomacromolecules can be traced back after transformation into soil organic matter (SOM) to study SOM source and stand history.

We yielded a series of monomers corresponding to previously reported hydrolysates [1, 2]. Statistical analysis identified eight variables which discriminated significantly between cutin and suberin (table 1), and 19 variables which discriminated significantly between the different plant species. The structural pattern of cutin and suberin changed with increasing ^{14}C age, but alteration resulted in less degradable structures which are still indicative for the respective plant source in SOM with mean residence times up to 500 years.

Variable	Discrimination coefficient
Σ hydrolysable phenols	0.63
Σ n-alkan-1-ols	0.64
Σ n-alkanoic acids	0.57
Σ Long-chain ω-hydroxyalkanoic acids	0.77
Σ Long-chain α,ω-diacids	0.63
9,10-epoxy-C_{18} α,ω dioic acid	0.56
Σ Mid-chain hydroxy $C_{14,\ 15,\ 17}$ acids	0.77
Σ C_{16} Mono- and dihydroxy (di)acids	0.53

Table 1: Variables for discrimination between cutin and suberin (above ground and below ground plant input).

[1] Kögel-Knabner *et al.* (1989) Zeitschr. Pflanzenern. Bodenkunde **152**, 409–413. [2] Otto & Simpson (2007) J. Separat. Sci. **30**, 272–282.

Hf-W chronology of the eucrite parent body

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The ^{182}Hf-^{182}W system has successfully been applied to unravel the timescales of core formation in a variety of planetary bodies but its application to eucrites has so far been unsuccessful [1-3]. To better constrain the Hf-W chronology of the eucrite parent body we present new Hf-W data for whole-rocks of seven basaltic eucrites. These have variable ^{180}Hf/^{184}W ranging from ~6 to ~42 and ε^{182}W values between ~14 and ~33. A linear regression of the Hf-W data reveals substantial scatter and yields a slope that corresponds to an 'age' of ~11 Myr after CAI formation. The initial ε^{182}W obtained from the regression is radiogenic and similar to values directly measured for eucrite metals [2]. The elevated initial ε^{182}W indicates a late re-distribution of radiogenic ^{182}W, which most likely was caused by a global crustal metamorphism. The timing of this event, however, is not well defined, probably because the metamorphism occurred over a period of time rather than as a well defined event. This is consistent with the observed range in ε^{182}W of eucrite metals [2] that correspond to model ages for the redistribtion of radiogenic ^{182}W from ~6 Myr (for Bereba) to ~15 Myr (for Juvinas) after solar system formation. Metal in the Camel Donga eucrite acquired its radiogenic ^{182}W even later at ~22 Myr [2], indicating that the crustal metamorphism might have occurred over a period of at least ~15 Myr. The late redistribution of radiogenic ^{182}W in eucrites renders determining an age of core formation difficult. For instance, Bereba has a negative two-stage model age of core formation, indicating that the Hf-W systematics of this sample reflect more than one Hf/W fractionation event. The other eucrites have two-stage model ages ranging from 0 to 4 Myr after solar system formation and most ages cluster between 0 and 2 Myr. This may be interpreted to reflect the timing of core formation in the eucrite parent body, consistent with the timescale of parent body accretion and differentiation deduced from Al-Mg data [4].

[1] Kleine *et al.* (2004) *GCA* **68**, 2935–2946. [2] Kleine *et al.* (2005) *EPSL* **231**, 41–52. [3] Kleine *et al.* (2009) *GCA* **73**, 5150–5188. [4] Bizzarro *et al.* (2005) *ApJ* **632**, L41-L44.