Large ε_{Nd} change in South Indian seawater driven by Australian weathering at 15 Ma

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We present Nd upper seawater data analysed on Indian Ocean carbonated oozes sediment from Site ODP 756 (located on the Ninety East Ridge, at 1518 m of water depth) and from Site ODP 762 (located on northwest Australian margin, at 1360 m of water depth). Our data cover the past 40 Ma at a resolution of two samples/Ma.

Amazingly, the records strongly mimic previous data from northern ODP Sites (ODP 757 and 707) (Gourlan *et al.* 2008; Martin and Scher, 2006).

We show that from 40 Ma to 10 Ma, the ε_{Nd} geographical distribution was homogenous over most of the Indian intermediate seawater, from a paleolatitute of 40°S up to the equator and over the entire Indian Ocean width. From 40 to 15 Ma, the ε_{Nd} value of Indian Ocean intermediate seawater recorded at all four ODP sites was almost constant, around -7 to -8 and increased by 3 ε_{Nd} units from 15 to 10 Ma. This sharp increase of ε_{Nd} is related to the enrichment by radiogenic Nd of the water mass originating from the Pacific as it flows through the Indonesian Passage. The numerous volcanic islands of this region corroborate the hypothesis of erosion and weathering of radiogenic Nd. By extending the studied area to the south, we demonstrated that this oceanic event is so strong that it can drive the ε_{Nd} of South Indian Ocean down to 40°S. With a two end-members model, we calculated that this event is characterized by an increase of ~1.7 time of the Nd transported through the Indonesian Pathway.

At 10 Ma, a large ε_{Nd} decrease (down to 6 ε_{Nd} units at Site ODP 762) is recorded. Such a large decrease was never observed in other northern Indian sites. Additional ε_{Nd} analyses on the detrital component of our two cores allow us to show that the seawater ε_{Nd} is then driven by detrital inputs linked to the weathering of Australia Continent. We estimate at about 20% the Nd contribution of this continental source to the oceanic Nd budget between 10 to 5 Ma. This could result of the beginning of the Australian drying (Bowler, 1976; Jonhson, 2009; Martin, 2006).

Long-term dynamics of differently stable soil organic matter fractions as function of soil management

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Rationale and experimental

Soil carbon is an integral part of soil organic matter (SOM), and modelling of its dynamics requires detailed information on the long-term fate of differently stable pools. Pyrolysis-field ionisation mass spectrometry (Py-FIMS) is the only method currently available that enables a rapid quantitation of ten different SOM compound classes and their thermal (biological) stability. We applied Py-FIMS to sample series from different treatments in one of the World´s oldest agricultural field experiments. First we determined temperature thresholds for 'labile' and 'stable' fractions of compound classes in laboratory incubation experiments. Next we applied these temperatures to quantitate differently stabile portions of compound classes, and test to what extent they have altered in various cropping systems from the early 1960ies until today.

Results and discussion

A kinetic model with coupled exponential functions was fitted to time series for relative abundances of compound classes. Cropping change from rye to maize led to (i) initial depletions in phenols & lignin monomers carbohydrates and N-compounds, the latter two being relatively enriched after 20 yrs, and (ii) initial enrichments in alkylaromatics, lipids and lignin dimers (for 15 yrs) followed by their net-decomposition over the next 30 yrs. This, however, was valid the labile proportions of compounds only (Fig. 1).

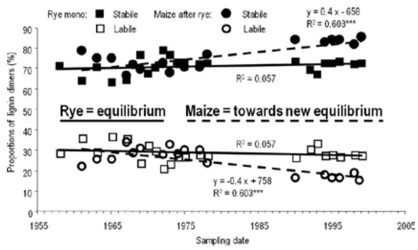

Figure 1: Proportions of labile and stabile lignin dimers in the "Eternal Rye Cultivation" as revealed by Py-FIMS.

Overall, we will demonstrate which SOM fractions were most susceptible to alterations according to cropping (rye, potato, maize) and fertilization (mineral vs. organic) practices.