Tracking soil organic matter export across the continent-ocean interface: A case study of the NW Mediterranean using the BIT index

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The BIT (Branched and Isoprenoid Tetraether) index has recently been introduced as a proxy for soil organic matter input and is based on the relative abundance of non-isoprenoidal glycerol dialkyl glycerol tetraethers (GDGTs) derived from organisms living in terrestrial environments versus a structurally related isoprenoid GDGT "crenarchaeol" produced by marine Crenarchaeota [1]. In this study, detailed spatial distribution patterns of BIT index were investigated in combination with other organic parameters in the continental margin of the western Mediterranean. Based on a transect sampling strategy from source (land) to sink (sea) via river, we analysed a variety of soils from the Têt Basin, suspended particulate matter in waters of the various rivers flowing into the Gulf of Lions, and marine surface sediments from the Gulf of Lions. The BIT index in soils and suspended particulate matter in river waters showed high values (>0.6), while it varies between 0.02 and 0.83 in marine sediments. Higher BIT values (>0.1) in the Gulf of Lions were distributed along the coastal zone decreasing seawards. Our results suggest that the BIT index is an appropriate proxy for tracking soil organic matter in the continental margins and especially valuable in multi-proxy studies. Furthermore, the BIT index can be used to trace past soil organic matter input where sediment deposition has been continuous.

[1] Hopmans, E.C., Weijers, J.W.H., Schefuß, E., Herfort, L., Sinninghe Damsté, J.S. & Schouten, S. (2004) *Earth and Planetary Science Letters* **224**, 107-116.

Groundwater recharge and redox zoning in an alluvial aquifer, Cheonan, Korea

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A hydrogeochemical study of a semi-confined alluvial aquifer underneath an agricultural area in the Cheonan area, Korea, was conducted to examine the lateral redox zoning in groundwater. The aquifer consists mainly of sand-gravel alluvia locally underlying an organic-rich silt layer which is used for rice paddy fields. The redox zoning changes gradually from a 'suboxic' zone up-gradient to an 'oxic zone' near a stream along the groundwater flow path. This is caused by progressive freshening of groundwater due to changes in the infiltration mechanisms, as indicated by the isotopic composition of the groundwater. Irrigation water in paddy fields during agricultural season experiences significant evaporation during and before recharge via diffusive infiltration through an organic-rich silt layer. This results in substantial increases of solute concentrations under strong reducing conditions and a characteristic isotopic signature of the infiltration water. During the flow of suboxic groundwater toward the stream, oxic and dilute surface water infiltrates directly and mixes with the groundwater in locations where an impermeable silt layer is absent. Through this mixing, the groundwater is progressively freshened and is also contaminated by agricultural nitrate.

Reaction path modeling was performed using PHREEQC to simulate the hydrogeochemical changes across the various redox zones. The model results agree well with the observed changes of water chemistry and show that lateral redox zoning in the suboxic zone consists of denitrificaiton, Fe/Mn reduction, and possibly sulfate reduction. In contrast, the chemistry of oxic groundwater toward the stream is characterized by precipitation of Fe/Mn hydroxides and the inputs of oxidants such as nitrate. The modeling results also suggest that the amount of reactive organic carbon originating form silty paddy soils controls the lateral extent of the interface between the suboxic and oxic zones.