Terrigenous organic matter in suspended marine particulates: The link between aerosols and sediments?

P. J. HERNES[1] AND R. BENNER[2]

[1]Department of Land, Air and Water Resources, University of California, One Shields Avenue, Davis, CA 95616 (pjhernes@ucdavis.edu)

[2]Department of Biological Sciences and Marine Science Program, University of South Carolina, Columbia, SC 29208 (benner@biol.sc.edu)

Suspended particulate organic matter (POM) measured at Station Aloha in the North Pacific and at the Bermuda Atlantic Time Series station in the western North Atlantic constitutes <2% of the total organic matter in the water column. However, suspended POM contains as much as 37% of the total lignin phenols in the water column, indicating that these materials are rich in terrigenous organic matter. At depth, carbon-normalized yields of lignin phenols are as high as 470 μg 100 mg OC^{-1}, while $\delta\ ^{13}C$ values range from -25 to -27 ‰, consistent with a terrigenous content of >50%. Riverine input alone does not satisfactorily explain this high terrigenous loading. Therefore we hypothesize that the primary source for this material must be aerosols. Long range transport of aerosols are generally considered as the source of black carbon and other terrigenous organic matter in open ocean sediments, but corresponding evidence for aerosol-derived organic matter in the water column has been lacking. These new lignin measurements could effectively close the mechanistic loop for delivery of terrigenous organic matter to open ocean sediments.

References

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Geochemistry of Proterozoic shales from the Vindhyan basin, Rajasthan: Source area and weathering

A.M. DAYAL

National Geophysical Research Institute, Hyderabad 500 007, India (dayalisotope@yahoo.com)

The Vindhyan basin occurs on Bundelkhand massif, bounded by Aravalli, Delhi belt and great boundary fault in the west. In south-eastern Rajasthan the Vindhyan basin is characterized by the presence of lower Vindhyan succession overlying on Banded Gneissic Complex (Heron, 1953). The Lower Vindhyan succession to the south of Chittorgarh is well developed. It contains thick succession of shales and sandstone with limestone at different stratigraphic levels. Trace, REE and strontium isotopic compositions of five shale units, occurring in chronological order have been analysed. The Th/Sc, Th/Co, Th/Cr, La/Sc, La/Co, La/Cr ratios are higher than then PAAS, NASC and UC (upper crust) and suggest that these shales contain terrigenous debris that has been derived from nearby crust similar to those supplied debris to the PAAS and NASC.

LILE (Rb, Sr, Ba) of the shales normalized with NASC show variable concentrations, probably due to their mobility during alteration processes. Transition trace elements (Sc, V, Cr, Co, Ni) normalized with NASC vary and show high concentration of Sc and V. High field strength elements (HFSE) normalized with NASC also show enrichment (Y, Zr, Nb and Th). Probably transition and HFS elements remained immobile throughout the sedimentary processes and represent the source rock composition. REE data normalized with Chondrite show enrichment for LREE, negative anomaly for Eu and flat pattern for HREE. REE data normalized with PAAS show little enrichment for LREE, flat pattern of HREE and positive/negative anomaly for Ce and Tm. Negative anomaly for Eu and support that the source rocks are silicic one. Negative anomaly for Ce for some of the samples indicate oxygenated bottom seawater in the Archean (Ohmoto et al, 2001). High contents of Th and La and low contents of Co, Sc and Cr also suggest silicic igneous rocks as source for these shales.High strontium isotopic ratios suggest that the source rocks were granite and mafic enclaves of Banded Gneissic complex occurring west of the Vindhyan basin. These sedimentary deposits suggest a tectonically stable environment. The large variation in strontium isotopic ratio also suggests that the source area underwent severe weathering in warm and humid tropical climate that prevailed throughout the sedimentation of Lower Vindhyan succession.

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