>3700 Ma oxidized ocean water, Pb isotopic evidence from Isua, West Greenland.

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The >3700 Ma Isua supracrustal belt, West Greenland, comprises water lain sediments which preserve information about early Archaean ocean chemistry. The REE chemistry of Isua banded iron formation show marked negative Ce anomalies consistent with scavenging of tetravalent Ce from the ocean water in local oxidized environment [1]. We have analyzed the Pb isotopic compositions of metamorphosed pelagic sediments rich in ^{13}C depleted reduced carbon in an effort to establish the U/Th of the original sediment. These sediments are interpreted as originally deposited with high contents of biogenic organic debris [2]. The metasediments have extremely radiogenic Pb compositions, which plot above the Stacey & Kramer growth curve for uranogenic Pb and to the right of the growth curve in the thorogenic-uranogenic system. This indicates that the sediments evolved with high U/Pb ratios (μ = 22) while there was only insignificant production of thorogenic Pb due to extremely low Th/Pb values during the early Archaean. The strong fractionation of U from Th observed in the Isua metasediments is similar to the situation in modern black shales, and can best be explained by solute transport of U by oxidized water followed by precipitation by organic debris at the site of sedimentation. The strong U/Th fractionation indicates the existence of relatively oxidized compartments in the >3700 Ma oceans, probably maintained by biologic activity.

References

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Isotopic crustal and slab fingerprints in arc volcanic rocks from the Central Volcanic Zone of the Andes

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The continent-ocean collision system of the Central Andes is characterised by a thick continental lithosphere and is therefore suited to study the interaction of mantle wedge-derived magmas with different source reservoirs, especially the subducted slab and the continental crust. We present Sr, Nd, Pb and B isotope data from Pliocene to Quaternary volcanic rocks of the Central Volcanic Zone (CVZ) between 22° and 27° S and discuss them in light of new Andean basement data from Lucassen et al., (2001).
Radiogenic isotope ratios fall in the same range as those reported from Trumbull et al., (1999) and Kay et al., (1994) for other volcanic centers in the study region. The $^{87}Sr/^{86}Sr$ and $^{143}Nd/^{144}Nd$ isotope ratios vary between 0.70603 and 0.70811 and between 0.512249 and 0.512481, respectively. The Pb isotope compositions are very homogeneous, with $^{206}Pb/^{204}Pb$ ratios of 18.722 to 18.887. The Pb isotope ratios plot near the Andean Pb-line (post Archean μ=10), which has been defined from basement lead data (e.g. Lucassen et al., 2001). The $\delta^{11}B$ values of samples from the volcanic front are positive and range from +4 to +2‰.
The radiogenic isotope ratios indicate a crustal component in all investigated rocks. Because the continental crust is highly enriched in Pb relative to the mantle and the oceanic crust, only a small degree of crustal contamination is sufficant to overprint a mantle derived Pb signal. In contrast, Sr and Nd isotope ratios are not fully overprinted by crustal contamination. Compared with the Sr and Nd isotope ratios from island-arc basalts, Andean $^{87}Sr/^{86}Sr$ ratios are much more radiogenic and $^{143}Nd/^{144}Nd$ are less radiogenic. εNd and $^{87}Sr/^{86}Sr$ data form a negative correlation, consistent with mixing between a mantle endmember and continental crust. Using the average Andean basement values for Sr and Nd from Lucassen et al., (2001), mixing models indicate an addition of 20 to 45% crust to the arc-magmas. However, the positive $\delta^{11}B$ values rule out a pure crust-mantle mixing origin for the arc magmas and indicate involvement of ^{11}B-rich fluids from the subducted slab.

References

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