Ni signatures from the Dales Gorge Member of the Hamersley Group, Australia: Constraints on the origin of Banded Iron Formations

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The deposition of Precambrian banded iron-formations (BIFs) has been linked to significant compositional changes in the Earth's atmosphere hydrosphere, and biosphere. Previous geochemical studies have measured the isotopic composition and the concentration of major, trace and rare earth elements in BIFs. Those studies have focused on the source of the metals (Fe, Mn, and Si) but others also have considered the role of the microbial activity and the nature of the primary precipitates. In this study we present the results of microscale geochemical analyses, coupled with high-resolution petrography, with the aim of establishing the controlling factors in the source and distribution of trace elements in BIFs.

As primary precipitates, hydrous amorphous silica would have crystallized as pure chert and cationic silica gels as siderite and greenalite, the latter entirely transformed into ferroan-talc. In addition, ferroan-talc is arguably a reaction product of siderite and chert. The presence of platy hematite is accompanied by an increase of ferroan-talc and a diminished siderite content. There is no evidence of magnetite as a primary precipitate, rather, it tends to occur as overgrowths on hematite and may have also formed at the expense of disperse platy hematite. Early diagenetic apatite and late diagenetic ankerite-ferroan dolomite crystals constitute the remaining mineral phases.

We conclude that the distribution and concentration of trace elements in different mineral phases were influenced by hydrothermal activity. Considering the high concentration and strong correlation with Fe, it is suggested that Ni represents a reliable indicator of element contribution from hydrothermal vent systems, which is consistent with previous models based on REE and Nd isotopic signatures. Furthermore, by comparing the Ni:Fe ratios of the Dales Gorge Member with other major BIF types (Algoma-, Superior-, and Rapitan-type), it appears that hydrothermal input was a major source of some trace metals to the BIF depositional setting, particularly Ni.

Comparison of δ^{13}C and δD values of *n*-alkanes from angiosperms and gymnosperms in Western Europe

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Successful applications of stable isotopes of terrestrial plant leaf waxes in paleoclimate research depend on a thorough understanding of isotopic composition of different plant types contributing to sedimentary organic matter. The primary objective of this project is to investigate the effect of environmental conditions on δ^{13}C and δD values of leaf wax *n*-alkanes from modern gymnosperm and angiosperm species throughout a north-south climatic gradient in Western Europe.

The initial $n\text{C}_{27}$-alkane data from Newcastle, UK, Bremen, Germany, and Porano, Italy (3 to 5 species per location) indicate that, overall, there is a strong negative correlation between δ^{13}C and δD values. While there is a definite ^{13}C-enrichment of gymnosperms in comparison with deciduous angiosperms (at least 1‰, but mostly from 2 to 6‰ in δ^{13}C), a significant relative D-depletion of gymnosperm species (between *c.* 14 to 42‰ in δD) was observed only in Porano. Gymnosperms in Newcastle and Bremen were characterized by much more similar δD values in comparison with deciduous angiosperms, the D-depletion being only between 0 and 21‰ and 0 and 14‰, respectively.

The observed isotopic variations between angiosperm and gymnosperm species in relatively warmer and drier Porano most likely resulted from physiological differences among the species. Relative ^{13}C-enrichment and D-depletion of gymnosperms may have resulted from their lower stomatal conductance and greater water use efficiency. The δD data from Newcastle and Bremen, however, suggest that differences in plant physiology were not sufficient to cause appreciable variations between angiosperm and gymnosperm species in these colder and wetter locations.

The results of this study have important implications for interpreting stable isotope data of sedimentary *n*-alkanes. Large shifts in δ^{13}C and δD values may result not only from changes in paleoenvironmental parameters but also from shift in plant communities. The magnitude of isotopic differences between plant types may also depend on climatic conditions, so that δ^{13}C and δD differences between angiosperms and angiosperms are greater in warmer and drier locations.