Zn isotopic variation in human hair and finger nails

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Zn is an essential microelement for plants and is also a component of many proteins. The isotopic composition of Zn in human blood and red blood cells displays very little variation (the total range reported is limited to 0.2‰). In contrast to Fe, no difference in Zn isotopic composition between male and female blood was yet reported. However, exploratory work did reveal that the isotopic composition of Zn in hair is lighter than that of blood. A first goal is now to ascertain that this observation is not due to the use of Zn-containing beauty products, such as shampoo or dye, although first literature results excluded these as the source of isotopic variations. The second aim was to determine if other parts of human body have fractionated Zn and finally to investigate any seasonality of the measured Zn isotopic variations.

In this study, hair, finger nails and shampoo samples from and used by the same subject have been investigated for their Zn isotopic composition. 4 hair samples and 3 finger nail samples have been analysed to date, covering a one year period. The hair reference material CRM 397 was also measured in order to control the reproducibility of the entire procedure. Two aliquots digested twice give the same results within uncertainties with values of –0.01‰ and –0.09‰ in terms of δ^{66}Zn relative to JMC Lyon. Hair samples from the subject revealed overall variation of 0.20‰ in δ^{66}Zn ranging from –0.06 to +0.14‰. This value is significantly different from the 0.24‰ obtained for the shampoo, suggesting that the shampoo is not governing the Zn isotopic composition in the hair. Moreover, finger nails present a variation similar to the hair from –0.04 to 0.24‰. Both hair and finger nails sampled between July and October are enriched in ^{66}Zn by 0.2‰ relatively to the rest of the year.

These results together with the hypothesis that the blood value ranges between 0.3 and 0.5‰ point out a real biological fractionation in the human body of up to 0.6‰ along with a seasonal Zn isotopic variation. The origin of the seasonal variation could be linked to the diet but this is still to be confirmed.

^{13}C-enriched bacterial lipids in the modern ocean: An analogue to the Proterozoic record

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We have isolated organic matter from bacterioplankton in the modern oligotrophic surface and mesopelagic water column of the North Pacific gyre, and have observed an enriched ^{13}C content of *n*-alkyl lipids in relation to total organic carbon. We postulate that this signature may be the natural outcome of carbon dynamics in a mixed, but bacterially-dominated marine community. This phenomenon has been rarely recorded in the Phanerozoic due to the bias of the sediment and sedimentary rock record toward preserving highly productive, eukaryote-dominated shelf environments instead of bacterially-dominated open ocean environments. A similar enrichment in ^{13}C of *n*-alkyl lipids as compared to total organic carbon has been a persistent challenge in interpreting the Proterozoic record. We thus suggest that modern oligotrophic, bacterially-dominated water columns may serve as our best observable analogue to the Proterozoic ocean, and that the reversal of the *n*-alkyl—TOC isotopic relationship with the onset of the Phanerozoic might derive from a fundamental change in marine communities to a higher proportion of eukaryotes. It also suggests that Proterozoic surface oceans were organic carbon-limited as a result of nutrient deficiency, perhaps in association with severe trace-metal limitation and/or episodic periods of bottom water euxinia. Here we begin to explore the environmental dependencies of the ^{13}C-enriched bacterioplankton signature by comparing results from the oligotrophic North Pacific gyre and the productive Eastern Tropical Pacific. The 0.2-0.5 µm size class was filtered from surface and mesopelagic depths at both sites. We couple compound-specific carbon isotopic analysis of fatty acids by GC-C-IRMS with genetic profiling by Phylochip in order to elucidate the relationship between the dominant living communities and the dominant contributors to lipid biomarkers, and to reveal details of organic matter transfer from the surface ocean to mesopelagic depths. We have derived a preliminary model of carbon export in a bacterially-dominated water column in order to test whether the Proterozoic-Phanerozoic switch in the organic carbon record could be the result of increased eukaryotic dominance, and what environmental constraints would be necessary for this interpretation.