Are Li, B and Sr-isotopes tracers for serpentinization?

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As new oceanic lithosphere is built up at mid-ocean ridges, fluid-rock interaction occurs. Bulk rock analyzes on altered spinel harzburgites from ODP leg 209 (Mid-Atlantic Ridge) showed that during serpentinization, light element content changes and influences strongly the light element abundances in the oceanic plate. This effect is supported by *in situ* mineral measurements (e.g. orthopyroxene looses B compare to bastite (polymorphe of serpentine).

Interaction between the mantle and the ocean is not simple. During penetrating into the ocean plate fluid looses and gains elements. Therefore in most cases an evolved fluid is interacting with deeper lying, fresh rocks and leaves an evolved isotopic signature behind. Water-rock ratios, calculated on the base of ^{87}Sr/^{86}Sr -ratios (average 0.708726) in serpentinites from the MAR, indicate high fluid-rock interactions. The unusual high δ^{11}B content (+29.6 to +40.52‰) and normal to very low δ^{7}Li (-28.46 and +7.17‰), however, allowed us to model hydrothermal processes underneath a ridge. Our model suggests, that if equilibrium between fluid and rock occurs, the evolved fluid composition must be as high as + 70 (δ^{11}B) and the δ^{7}Li-compostion of a similar evolved fluid would be as low as O ‰.

Our results show that at ODP leg 209, B, Li and Sr-isotopes can successfully be used to quantify reactions between seawater and very young oceanic mantle rocks. Low water-rock ratios lead to extremely high δ^{11}B and low δ^{7}Li values. This signature could potentially be transported into subduction zones. In general, however, the B, Li and Sr isotopic composition of altered oceanic mantle should be highly variable depending on water-rock ratios and on age.

Our current knowledge of the isotopic composition of Andean ice cores: New observations and modelling studies

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Greenland and Antarctic ice cores have provided a wealth of quantitative paleoclimate information both at orbital and millennial timescales. Motivated by the demonstrated potential of this polar archive, exploration of tropical ice cores started about 30 years ago in the tropical South American Andes, where high altitude glaciers contain well-preserved ice, suitable for paleoclimate investigations. The isotopic composition of Andean ice cores was measured using the same methods as those used for polar ice cores. In Antarctica, a robust relationship exists between surface temperature and the isotopic composition of snow. However, this temperature control breaks down for low latitudes, where cloud systems are dominantly of convective character and the influence of surface or near-surface temperature on the formation of precipitation becomes spurious. Spatially, a weak correlation between the isotopic composition and the amount of precipitation has been found in modern precipitation data. The atmospheric water cycle in the tropics is highly complex and thus our current knowledge about fractionating versus non-fractionating recycling, transpiration, partial evaporation of condensates and equilibrium with surrounding vapour is limited. There is no single controlling factor that dominates the impact of climate on the water isotopes and, consequently, there is a need for a full understanding of local and regional dynamic factors controlling the water isotopes.

Here, we present recent and new studies including both direct observations and modelling developments (mesoscale model, radiative-convective 1D model) that explore the different climate controls on the isotopic composition of Andean precipitation.