Cenozoic δ^7Li variations of marine authigenic smectite

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The Li isotope composition of the ocean is controlled by inputs from rivers and hydrothermal vents and by formation of marine clays. Continental weathering, especially of silicates which have high Li contents, thus influences oceanic Li concentration and isotope ratio. The ocean δ^7Li record may provide information about past variations in silicate weathering, which removes CO_2 from the atmosphere, thereby playing a critical role in global climate regulation. The first complete Cenozoic marine δ^7Li reconstruction was made from foraminifera tests [1]. However, some studies indicate that vital effects occur during foraminifera calcite formation [2], which could have an effect on the ocean Li isotope composition reconstructed from such samples.

In this study we extracted lithium from clays of sediment cores and mesured their major/trace element composition by ICP-AES and their lithium isotope ratio by MC-ICP-MS. Samples come from the equatorial Pacific Ocean and range in age from 50 Myr to <1Myr. Samples from the Atlantic Ocean will also be analysed for comparison.

Extracted clays are dominated by authigenic smectite with little exchangeable lithium. The lithium isotope signature of the 0-10Myr old clays is constant and fractionated by 25‰ compared to present-day seawater composition, in agreement with low-T clay experimental syntheses. Thus, Cenozoic clay data provide an alternative means of reconstructing the marine Li isotope record, avoiding the potential complexities related to variable vital effects when using biogenic carbonates.

[1] Misra & Froelich (2012) Science 335, 818-823.
[2] Vigier et al. (2015) C. R. Geoscience 347, 43-51.