The Magnesium Isotopic Composition of Cenozoic Planktonic Foraminifera

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Magnesium is a major cation in the carbon cycle, and thus in global climate variations throughout the Cenozoic, due to its prominence in silicate weathering. The Mg concentration and isotopic composition ($\delta^{26}Mg_{SW}$ = -0.82‰) of seawater is conservative, reflecting a balance between continental weathering driven input via rivers ($\delta^{26}Mg_{River}$ ~ -1.09‰) and removal by high-temperature hydrothermal reactions ($\Delta\delta^{26}Mg_{SW-HT}$ ~ 0.0‰), dolomite formation, and low-temperature alteration of the oceanic crust. Since the oceanic residence time of Mg is significantly longer than the mixing time, temporal variations in $\delta^{26}Mg_{SW}$ recorded by marine calcites, such as foraminifera, can reflect a global imbalance of the sources and sink throughout the Cenozoic[1].

Previous work by Pogge von Strandmann et al. (2014)[1] examined $\delta^{26}Mg$ of Cenozoic seawater by analyzing planktonic foraminifera and found a ~1‰ decrease in $\delta^{26}Mg$ from 40 Ma to today. In contrast, Higgins & Schrag (2015)[2] analyzed pelagic carbonate sediments and determined that there was very little $\delta^{26}Mg$ variability over the past 80 Myr. We present a new and preliminary record of planktonic foraminifera spanning the Cenozoic (Fig. 1). The significance of the observed ~1‰ decrease in $\delta^{26}Mg$ toward present day values is challenged by the high variability in our core-top foraminifera calibration ($\delta^{26}Mg$ = -4.63±0.57‰ (n=48, 2σ))[3]. However, preliminary box model scenarios demonstrate that such a decrease in $\delta^{26}Mg$ could be driven by a decrease in the dolomite formation flux from ~3.0 Tmol/yr to present-day values of ~0.8 Tmol/yr. The present study also contributes toward understanding the Mg isotopic biomineralization and seawater signature in Cenozoic planktonic foraminifera.

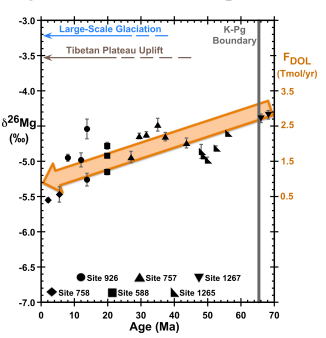

Figure 1: $\delta^{26}Mg$ (‰) of 22 Cenozoic planktonic foraminifera from six core sites. Preliminary model results suggest that a decrease in the dolomite precipitation flux (F_{DOL}, Tmol/yr) could cause a decrease in $\delta^{26}Mg$ throughout the Cenozoic.

[1] Pogge von Strandmann et al. (2014) *Biogeosciences*. **11**, 5155-5168. [2] Higgins & Schrag (2015) *Earth and Planet. Sci. Letters* **416**, 73-81. [3] Dial et al. (2015) *Goldschmidt Abstracts* **727**.