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Reconstructing the magnesium isotopic composition of Paleogene seawater using larger benthic foraminifera

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The Cenozoic era has seen substantial changes in the atmospheric concentration of CO_2. However, the geological processes driving this variability in atmospheric CO_2 are not sufficiently well understood. Seawater chemistry is sensitive to the same geological processes that drive atmospheric CO_2 and, thus, can be an important link to assess the relative importance of various driving forces and understand the global carbon cycle. Trace element ratios such as the Na/Ca proxy in foraminifera have been developed as a direct proxy for long-term changes in the Ca concentration of seawater[1,2]. Combining the Na/Ca proxy with other El/Ca proxies (e.g., K/Ca and Mg/Ca) can allow us to determine the individual concentration of the major elements in seawater. However, because multiple processes control the temporal evolution of every seawater major element system, a unique solution to the drivers of Cenozoic climate change cannot be determined from elemental data alone. To achieve this aim, additional tools are required, one of which is the reconstructed Mg isotopic composition of seawater.

Here, we combine trace element ratio and Mg isotope proxies to constrain the driving processes of long-term changes in seawater chemistry. We use high-Mg nummulitid foraminifera, which were abundant during the Paleogene and thus have a good potential as an archive for long-term seawater chemistry reconstructions. Specifically, 1) we investigated $\delta^{26}Mg$ in the modern larger benthic foraminifera *Operculina ammonoides*, collected from globally distributed sites, to assess the effect of temperature and salinity on their Mg isotopic compositions, before 2) applying multiple proxy trace element systems and $\delta^{26}Mg$ in Eocene *Nummulites* collected from the Paris basin, Hampshire Basin, and tropical regions. Our results suggest that the $\delta^{26}Mg$ in seawater has not changed significantly over the Cenozoic.

[1] Hauzer, H., et al. (2018), *Earth and Planetary Science Letters* 497, 80–91.

[2] Zhou, X. *et al.* (2021), *Geochimica et Cosmochimica Acta* 305, 306–322.