Analyses of seawater-bearing evaporite fluid inclusions suggest that the Mg/Ca ratio of global oceans has increased from ~1.5 to ~5.2 over the past 150 Ma. Ocean chemistry, including the Mg/Ca ratio, is controlled by a variety of processes, including surface runoff from the continents into the oceans, mid-ocean ridge (MOR) hydrothermal processes, and biogenic calcite fixation. The amount of water transported into and/or out of the oceans by each of these processes has varied over the past 150 Ma, suggesting that the relative contribution of each of these processes to ocean chemistry has also changed with time. Previous workers have investigated variations in MOR hydrothermal processes relative to oceanic crust production and water-rock interaction over the past 150 Ma, and its effect on ocean chemistry [1].

We have developed a quantitative geochemical model using previously published estimates to assess the potential influence of variations in seafloor spreading rates, surface runoff and marine biogenic activity on the observed changes in ocean Mg/Ca ratios over the past 150 Ma. Input data for the model includes the amount of water in various reservoirs within the geohydrologic cycle [2] including the oceans, oceanic lithosphere, and surface water reservoirs, together with the fluxes of H_2O, Ca, and Mg between these reservoirs. The amount of Ca and Mg transported to the oceans via surface runoff assumes that the size of the surface water reservoir changes in proportion to subaerial continental surface area not covered by ice. The amount of Ca and Mg sequestered in biogenic calcite assumes that the rate of biomineralization changes in proportion to changes in total marine biomass. Our results suggest that ocean Mg/Ca is more sensitive to variations in both MOR hydrothermal processes and surface runoff, and that ocean Mg/Ca is less sensitive to variations in marine biomass over the past 150 Ma.

[1] Ligi *et al* (2013), *Sci. Rep.* **3** p. [2] Bodnar *et al* (2013), *Geol. Soc. Am. Sp.* Paper 500