Continental weathering and Earth system response

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Continental weathering is a key component of the processes influencing ocean-atmosphere biogeochemical cycling: it is a natural sink for atmospheric CO_2 and can act as a climate-moderating mechanism. In addition, weathering determines the riverine flux of elemental species into the world's oceans with attendant implications for ocean pH, alkalinity, and nutrient supply. However the evolution of weathering through time and its response to external forcing related to changes in climate remain poorly constrained.

Potential tracers of the nature of ancient continental weathering processes include isotope ratios of lithium, magnesium, calcium and strontium, each operating on and responding to different time scales, weathering intensities and lithology, and thereby defining distinct and discrete isotopic fingerprints by which to document palaeo-weathering processes and products. In combination, these proxies can be used to delineate changes in continental weathering and ocean alkalinity and, consequently, yield improved insights into how Earth's ancient surface environments and conditions evolved and, in turn, contributed to feedbacks that helped drive changing ocean-atmosphere chemistries. We will present a combined isotopic record that gives new understanding of the evolving physical and chemical conditions of Earth's surface and oceans from the Cryogenian (c. 800 Ma) to the Early Cambrian (c. 510 Ma), a time period that experienced extreme environmental perturbations and witnessed profound biological changes ultimately leading to the advent and radiation of complex metazoan life.