Cambrian Phosphorites as an archive of the bio-geochemical evolution during the Cambrian Explosion - A coupled isotope investigation

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The Precambrian-Cambrian (Pc-C) transition is a unique period in Earth's history known for the "Cambrian Explosion", arguably the most extreme evolutionary step for life on Earth. One possible trigger for the Cambrian explosion is enhanced continental weathering, which could have contributed to increased nutrient input into shallow ocean water and enhance perturbations in the marine nutrient cycle. This impact to the marine nutrient cycle induced local anoxia/oxygenation events, which ultimately promoted the development of new niches. Concomitant with the Pc-C transition are widespread deposits of continental margin phosphorite, archives for past seawater chemistry, including the well-preserved section at Koksu in the Karatau Mountain Range, Kazakhstan.

In this study, we present a continuous chemical, radiogenic and stable isotope sequence across the Pc-C transition ($^{87}Sr/^{86}Sr$, $\delta^{13}C$, $\delta^{18}O$, $\delta^{26}Mg$) recorded in phosphatic shallow-water deposits from the Koksu section. Strontium isotope data of these phosphorites are in agreement with seawater $^{87}Sr/^{86}Sr$ evolution during the Cambrian period (0.7086-0.7101) validating the studied phosphate deposit as a seawater archive. Fluctuation of trace and rare earth element concentrations and $\delta^{13}C$ record a time of rapid perturbations, indicative of sealevel changes, the development of bioturbation and development of marine oxidative weathering. Preliminary results of Mg isotope analyses reveal $\delta^{26}Mg_{(DMS3)}$ values ranging from -2.27‰ to +0.48‰, similar to Ediacaran carbonate rocks. Additional Mg isotope data will be presented at the conference and discussed with respect to increased continental weathering as a trigger for the Cambrian revolution.