Nutrients, ocean redox and a explosion of life: A brief description of the Middle Ordovician

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Earth's biosphere experienced one of its most dramatic changes during the early Paleozoic. The Middle Ordovician witnessed the emergence of the earliest land plants (bryophytes) and the Great Ordovician Biodiversification Event (GOBE)—the most rapid and sustained increase in marine Phanerozoic biodiversity. These changes not only meant the beginning of Earth's surface transformation to the green world we see today; they also drastically transformed biogeochemical cycles. With the introduction of vegetation cover to the continents, weathering fluxes could have been affected by the selective means of plants to reach nutrients, increasing rock dissolution and phosphorus release. An increase in phosphorus delivery to the oceans would in turn have increased primary productivity and organic carbon burial, resulting in a slow long-term rise in atmospheric oxygen levels and in a positive shift in the carbonate carbon isotope record. In addition, contemporaneous changes in ocean circulation patterns would have favored the upwelling of nutrients, overall contributing to the important changes happening to the nutrient cycling at the time. As a result, variations in the global ocean oxygenation state are to be expected.

Here, we test the hypothesis that variations in nutrient cycling triggered important changes in the ocean redox landscape by measuring the uranium (U) isotope composition of marine carbonates across the Middle Ordovician. The U isotope proxy allows us to constrain the oxygenation of the oceans at a globally integrated scale. Results from a high-resolution carbonate section from Baltica are presented and interpreted in the context of changing nutrient levels and ocean oxygenation, which ultimately could have been key in the inception of the GOBE.