Early Oxygen

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Geochemical investigations of the 2.5 billion-year-old Mt. McRae Shale, Western Australia, in the ABDP-9 core of the Astrobiology Drilling Program have yielded multiple lines of evidence of O_2 production before the Great Oxidation Event. These include:

Molybdenum and rhenium enrichments indicating the presence of these redox-sensitive metals in the contemporaneous water column at this location [1];

A shift in sulfur isotope systematics interpreted as revealing the onset of an oxidative sulfur cycle [2];

^{15}N enrichments that record the operation of an aerobic nitrogen cycle, including nitrification and denitrification [3];

Sedimentary iron speciation data documenting euxinic conditions (anoxic and sulfidic conditions), most likely arising from enhanced oxidative weathering of sulfides [4].

This presentation will review these findings, together with results emerging from research into iron, molybdenum and uranium isotopes in the Mt. McRae Shale, and from complementary studies of the Agouron drill cores from S. Africa. Areas of covergence and priorities for future research will be discussed, along with astrobiological implications.

References

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[4] Reinhard et al. (2009). A late Archean sulfidic sea stimulated by early oxidative weathering of the continents. *Science* **326**: 713-716.