Iron isotopes in micropyrites from the 2.7 Ga Tumbiana Formation (Western Australia)

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Stromatolites are considered to be the major drivers for the oceanic oxygenation during Archean time. However, respective roles of photosynthetic and chemolithotroph organisms in these Archean rocks is not precisely demonstrated. Primary sub-micrometer pyrites associated with pristine organic matter are widespread in Archean and modern sediments. Iron isotopes are fractionated by redox processes and biological activities and are widely used for tracing paleoredox conditions, diagenetic processes or metabolic signatures as iron respiration (DIR). Sub micrometer $\delta^{56}Fe$ values of micropyrites associated with organic matter-laminae and $CaCO_3$-SiO_2 matrix in stromatolites from the 2.7 Ga Tumbiana Formation have been measured by SIMS using the new Hyperion RF Plasma source. Iron isotope compositions of micropyrites display a wide range of values from -2.20‰ to +4.44‰, comparable to the entire range of known terrestrial iron isotope values (between -2.4‰ and +2‰). Our data show a large and continuous range defined by more positive values compared to the bimodal distribution previously described (Yoshiya et al., 2012). Our results are interpreted as an interplay between abiotic oxidation and biological induced reduction processes during iron cycling at the biofilm scale.

Yoshiya, K. et al. (2012) In situ iron isotope analyses of pyrite and organic carbon isotope ratios in the Fortescue Group: Metabolic variations of a Late Archean ecosystem. *Precambrian Research* 212, 169-193.