In situ high resolution measurements of Fe isotope composition in micro-pyrite using Hyperion Radio Frequency source on IMS 1280 HR2.

MARIE-NOËLLE DECRAENE[1,2], JOHANNA MARIN-CARBONNE[1], ANNE-SOPHIE BOUVIER[1], NORDINE BOUDEN[2], JOHAN VILLENEUVE[2], ETIENNE DELOULE[2].

[1] ISTE, Université de Lausanne, Suisse.
[2] CRPG-CNRS-Université de Lorraine, Nancy, France.
(marie-noelle.decraene@unil.ch)

Iron isotope composition of sedimentary sulfides is widely used as a proxy for past redox conditions and biogeochemical signatures [1]. In situ analyses by either laser ablation or secondary ion mass spectrometer (SIMS) have evidenced the importance of inter- and intra-grain Fe isotopic variability (*e*.g. [2], [3], [4]) in sedimentary pyrites. The investigation of micrometer scale Fe isotope variation in <20µm pyrites was yet restricted to the primary beam size. The emergence of the new radio-frequency plasma ion source (Hyperion RF) enable high spatial resolution measurements by delivering 10 times the current density compared to the previous $^{16}O^-$ Duoplasmotron source [5]. We present here a new analytical protocol to measure high spatial resolution and high precision Fe isotope compositions applied for now on micro-pyrites in Archean sediments. This method was calibrated on two SIMS-Cameca ims 1280HR2 facilities in CRPG-CNRS (France) and SwissSIMS (Switzerland). The reduction of a gaussian 3nA primary beam in 3µm allow the analyse of micro minerals with an analytical precision between 0.25‰ and 0.30‰ (2σ), similar to the one obtained with the duoplasmatron for a beam size of 10 to 15 µm. Potential analytical effects induced by topography or crystal orientation were carefuly evaluated and none of them were identified. This new method opens a robust analytical way for searching micrometer scale Fe isotopic variations in natural samples.

[1] Johnson, C. et al. (2020). In *Iron Geochemistry: An Isotopic Perspective* (pp. 39-84). Springer, Cham.
[2] Marin-Carbonne, J. et al. (2014). *Earth Planet. Sci. Lett.*, *392*, 67-79.
[3] Whitehouse M. J. et al. (2007). *Geology* **35**, 719-722.
[4] Yoshiya, K. et al. (2015). *Chemical Geology*, *401*, 126-139.
[5] Liu, M. C. et al. (2018). *Int. J. Mass Spectrom*, *424*, 1-9.