Sulfur cycling in altered oceanic crust of South China Sea rift margin from IODP expedition 368

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The circulation of seawater within the oceanic crust promotes extensive chemical variations, and sustains the development of biosphere. The study of secondary pyrite in altered oceanic crust is of significance to decipher how microbial activities enfluence the sulfur budget [1]. However, due to limited sample availability, sulfur cycling in altered oceanic crust from the passive continental margin has not been studied.

This study provides a detailed examination of in-situ sulfur isotopes and trace metal distribution in secondary pyrite present in alteration haloes of the oceanic crust from the South China Sea. Framboidal pyrite is characterized by heavy sulfur isotopes ($\delta^{34}S$ up to +50‰) and enrichment in trace metals, such as Co (up to 700 ppm), Ni (up to 600 ppm), Zn (up to 400 ppm) and Cu (up to 800 ppm), and is thought to precipitate from methane-oxidising microbial activities when methane-rich fluids in contact with metal and sulfate-rich hydrothermal fluids [2]. Euhedral pyrite contains $\delta^{34}S$ of ~ 5‰ with Co up to 1 wt%, Ni up to 1000 ppm, Cu up to 800 ppm, and Zn up to 260 ppm, and is interpreted to precipitate directly from metal-rich hydrothermal fluids with sulfur of magmatic source. This study shows a unique pyrite and trace metals association in the passive continental margin setting, further adcancing the understanding of the global biosphere-lithosphere interaction in the subsurface.

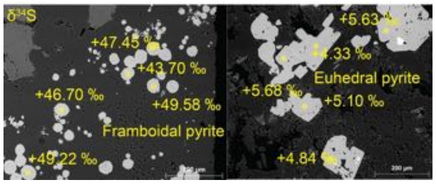

Figure 1: The in-situ sulfur isotope of two groups of pyrite in altered oceanic crust.

[1] Rouxel et al. (2008), EPSL, **268**, 110–123. [2] Lin et al. (2017), GCA, **211**, 153–173.