Japan Geoscience Union Meeting 2010
(May 23-28 2010 at Makuhari, Chiba, Japan)

BPT011-P12 会場:コンベンションホール 時間: 5月24日17:15-18:45

太古代の堆積岩に含まれるパイライトの鉄同位体局所分析

In-situ Fe isotope analyses of pyrite in sedimentary rocks of the Fortescue Group, Western Australia

吉屋 一美[1*], 西澤　学[2], 上野 雄一郎[3], 小宮 剛[4], 丸山 茂徳[1], 吉田 尚弘[5], 平田 岳史[6]

Kazumi Yoshiya[1*], Manabu Nishizawa[2], Yuichiro Ueno[3], Tsuyoshi Komiya[4], Shigenori Maruyama[1], Naohiro Yoshida[5], Takafumi Hirata[6]

[1]東京工業大学理工学研究科地球惑星科学専攻, [2]海洋研究開発機構, [3]グローバルエッジ研究院, [4]東京大学大学院総合文化研究科広域科学専攻, [5]東京工業大学大学院環境理工学創造専攻, [6]京都大学大学院理学研究科地球惑星科学専攻

[1]Department of Earth & Planetary Science,, [2]Japan Agency for Marine-Earth Science an, [3]Global Edge Institute, [4]Department of Earth Science & Astronomy, [5]Department of Environmental Science and, [6]Department of Earth and Planetary Scienc

The timing of the emergence and flourish of oxygenic photosynthetic organisms is still controversial. However, it is one of the key issues of the biological evolution in early Earth. Line of evidence of emergence of stromatolite all over the world (Buick, 1992; Holland, 1994), mass deposition of banded iron formation from 2.8 to 2.5 Ga (Cloud, 1973), and large negative anomaly in carbon isotope ratios ($d^{13}C$) of organic carbon up to -60 permil (Hayes, 1994; Schidlowski et al., 1983; Schoell and Wellmer, 1981) at ca. 2.7 Ga suggests the increase of oxygenic photosynthesis and oxygenation of seawater in the late Archean. However, the detailed redox change of the seawater and its timing are still ambiguous. Reconstruction of redox state of the late Archean seawater is important for understanding the relationship between biological activity and oxygenation.

Ferrous and its compounds were one of the major reduced species in the anoxic Archean seawater. It is widely recognized that the iron isotopic ratio changes largely through redox reactions (Beard and Johnson, 2004; Johnson et al., 2004), and hence, the iron isotopic ratio of marine sedimentary minerals is useful for understanding the ocean's redox state and iron biogeochemistry in the geological past (e.g., Johnson et al., 2008). A previous work has performed in-situ Fe isotope analyses of pyrites within 2.7 Ga shallow marine carbonates from the Fortescue Group (Nishizawa et al., 2010). However, Fe isotopic data of pyrite in other rock types in the Fortescue Group still lack. In order to obtain more detailed information of the redox state of the shallow sea in the Late Archean, we have analyzed $d^{56}Fe$ value of pyrite from various types of sedimentary rocks from the Fortescue Group.

Based on the detailed geological survey of the Fortescue Group in Redmont area, we carefully selected 40 samples, which include calcareous sandstone, homogeneous mudstone, tuffaceous sandstone, tuffaceous mudstone and sandstone/mudstone alternation. We have analyzed $d^{56}Fe$ value of 189 pyrite grains in these samples, and discovered an extremely large variation of d56Fe value from -4.0 permil to 3.5 permil. There are correlations among the lithology, pyrite morphology, and $d^{56}Fe$ value. Euhedral pyrites commonly show positive $d^{56}Fe$ value, whereas anhedral pyrites show negative $d^{56}Fe$ value. The euhedral pyrites are ubiquitous in sandstone part and mudstones whereas the anhedral pyrites are predominant in tuffaceous sandstones and tuffaceous mudstones. Furthermore, several mudstone samples have extremely negative values of

$d^{13}C_{org}$and $d^{56}Fe$. Based on these data, we will discuss the redox state of shallow sea and microbial ecology in the Late Archean.

キーワード:後期太古代,酸素発生型光合成,鉄同位体,局所分析
Keywords: late Archean, oxygenic photosynthesis, iron isotope, in-situ analysis, redox