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変成炭酸塩岩における Sm-Nd 同位体組成から見るゴンドワナ衝突以前の海洋の記録
Sr and Nd isotope systematics of metacarbonate rocks as proxies for extinct oceans in continental collision zones

大辻 奈穂 [1*], Madhusoodhan Satish-Kumar[1], 亀井 淳志 [2]
Naho Otsuji[1*], Satish-Kumar Madhusoodhan[1], Atsushi Kamei[2]

[1] 新潟大学, [2] 島根大学
[1]Niigata University, [2]Shimane University

Geochemistry of chemically deposited sedimentary rocks, especially neodymium isotopes, is often used as an indicator to understand paleo-oceans, its relationship with continents and so on. Because of the infinitely low concentration of neodymium in sea water than that of continental material and a very short residence time in the seawater, the Nd budget of the ocean is dominated by continental source and sedimentary rocks record its local differences. In particular carbonate rocks are good indicator for understanding the relationship between continents and surrounding oceans, because it is commonly deposited in a platform environment surrounding a continent.

The Sor Rondane Mountains, located in the Neoproterozoic to Early Cambrian East African-Antarctic collisional orogen, are the best location for understanding the Gondwana amalgamation, and recently lots of new information on these mountains have been generated in terms of its geology, lithological variations, tectonic evolution, geophysics and so on. These mountains are composed of medium- to high-grade metasedimentary, metaigneous and intrusive rocks of diverse composition (Osanai et al., 2013 and references therein). Within the metasedimentary rocks, the metacarbonate rocks are considered to have deposited chemically in the so-called the ”Mozambique Ocean” that separated the continental blocks East Antarctica and southern Africa that amalgamated to form Gondwana. It is possible that the metacarbonate rocks record geochemical signatures of contemporaneous seawater. Metasedimentary rocks distribute in Northeastern area of the Sor Rondane Mountains, and the southwestern area is dominated by metaigneous rocks that were derived from the subduction of young hot oceanic crust. Recently, Otsuji et al. (2013) reported 880-850 Ma and 820-790 Ma (late-Tonian and early-Cryogenian age) depositional ages of the metacarbonate rocks by using strontium and carbon isotopic stratigraphy. However, there exist regional variations in the Sr isotopic composition and it is necessary to understand the relation with surrounding continental blocks. To achieve this, we analyzed Nd isotopic composition in pure and impure metacarbonate rocks from the Sor Rondane Mountains, East Antarctica and discuss about the relationship with continent and depositional basin of carbonate sediments before the Gondwana amalgamation. Combining the reported Nd isotopic ratio from various rock units from the Sor Rondane Mountains (e.g. Kamei et al., 2013; Nakano et al., 2013; Shiraishi et al., 2008 and reference therein), we evaluate the possible source characteristics of Nd in the platforms that potentially surrounded the Sor Rondane Basin of the Mozambique ocean.

The epsilon values of Sr and Nd from pure carbonate rocks are lower than metaigneous rocks from the southeastern area in the Sor Rondane Mountains. A clear trend is also visible in the order from metaigneous rocks (rocks in the southeastern area), through impure carbonate to pure carbonate rocks in the Sor Rondane Mountains, suggesting a potential mixing of continental and oceanic source. Additionally, impure carbonate rocks show a narrow range, while pure ones have wide and various distributions in each region. There is also a marked variation in Nd model ages (T_{2DM}) for pure carbonate rocks in the Sor Rondane Mountains. These imply that the age of continents that acted as sources to the surrounding sea water during timing of carbonate deposition, were possibly different. In our presentation we attempt to discuss the pros and cons of using metacarbonate rocks which can lead to review the process during continental collision, and before and after that.

References

Kamei et al., 2013. Precambrian Research (in press); Nakano et al., 2013. Precambrian Research (in press); Otsuji et al., 2013. Precambrian Research (in press); Shiraishi et al., 2008. Geological Society, London, vol. 308, pp. 21-67.

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