

変成炭酸塩岩中のストロンチウム、ネオジウム同位体を用いた古海洋の復元 —東西ゴンドワナ間のモザンビーク海— Sr and Nd isotope systematics of metacarbonate rocks as proxies for reconstructing extinct oceans: Mozambique Ocean

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Geochemistry of sedimentary rocks is widely used for understanding the depositional environment and tectonic setting, including source rock composition and paleo-ocean signature. In particular, chemically deposited carbonate rocks are directly precipitated from saturated seawater are supposed to hold key information of extinct paleo-oceans. An important geochemical tool that can lead to the identification of contemporaneous seawater is isotopic composition of strontium and neodymium in carbonate rocks, because these elements have distinct residence and mixing time in seawater and also characterized by surrounding continents.

In the Sør Rondane Mountains (SRMs), East Antarctica, metasedimentary rocks including metacarbonate rocks are widely distributed. These rocks were supposed to have formed in the paleo-ocean called as "Mozambique Ocean". SRMs are divided into two terranes, the SW and NE terranes, by the Main Tectonic Boundary (MTB). In the SW terrane, metaigneous rock that were formed at ca. 1000 Ma and metasedimentary rocks occur as main lithological units, which underwent metamorphic evolution along a anticlockwise *P-T* path, whereas the NE terrane is dominated by metasedimentary rocks, with a characteristic clockwise of *P-T* path. Additionally, metapelitic rocks in the SW terrane have similar detrital age population with the nearby metaigneous rocks, in contrast to those in the NE terrane show older detrital ages (ca. 3300Ma)(Osanaï et al., 2013). If it is possible to reveal the relationship between ocean and continents during depositional timing of carbonate rocks in both terranes, we will be able to put forward a model to explain the difference in depositional setting between SW and NE terranes. To achieve this, analyzed detailed study of Sr and Nd isotopic composition of metacarbonate and metamorphosed silicate rocks, such as pelitic, felsic, mafic and ultramafic rocks, from several important outcrops throughout SRMs were carried out. Based on these data, we discuss about the relationship with continent and depositional basin of carbonate sediments before the final amalgamation of Gondwana.

After geochemical screening for post-depositional alteration, using oxygen isotopes, trace elements and REE + Y patterns, strontium isotope chemostratigraphy was applied to the metacarbonate rocks from SRMs and depositional ages of 880-850 Ma and 820-790 Ma (late-Tonian and early-Cryogenian age) were estimated (Otsuji et al., 2013). Metacarbonate rocks in the Bratnipene and Tangarden regions in the SW terrane are showing typical seawater-rock mixing relationship in a ϵSr vs. ϵNd cross-plot indicating the deposition of metacarbonate rocks nearby meta-tonalitic and orthogneiss dominated continental arc. By contrast, the Perlebandet region exhibits an extremely different depositional setting of a seamount based on Nd model and depositional age and REE and ϵNd compositions. Moreover, the Balchen metacarbonate rocks show a signature of depositional setting surrounding a continent, based on the comparison of metacarbonate rocks with continental and oceanic derived rock units. A comparison of isotopic characteristics of Balchen carbonate rocks with the basement rocks from neighboring Gondwana regions suggested the presence of an ancient continent that is different from Kalahari and Dharwar Craton.

Thus, the Sr and Nd isotopic compositions of carbonate rocks deposited in the Mozambique Ocean have preserved important information about depositional setting of sedimentary rocks and relationship with surrounding basement and continents. In summary, geochemical proxies such as Nd and Sr isotopes of metacarbonate rocks can yield key information not only of paleo-oceans but also about the surrounding rocks during depositional timing, which can lead to a better understanding of oceanic closure during the formation of supercontinents.

Reference cited: Osanaï et al., 2013. PR, 234, 8-29. Otsuji et al., 2013. PR, 234, 257-278.

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