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南西インド洋中央海嶺35E-37Eにおける玄武岩組成のセグメント内での変化
The geochemical intra-segment variation at the ultra-slow spreading Southwest Indian Ridge 35-37E

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Mode of spreading style at the mid-ocean ridge might depend on both spreading rate and amount of melt supply. Furthermore, melt supply depend on physical (temperature and pressure) and chemical (composition) of the source mantle. Therefore, the geochemical variations along the ridge with spreading-rate should reflect the deferences physical and chemical variation beneath the ridge.

We attempt to investigate central part of the Southwest Indian Ridge (SWIR) which is one of the ultra-slow spreading systems with spreading date of 14-16 mm/year. The research area is a part of the first order tectonic segment between the Prince Edward and Eric Simpson fracture zones. This segment is considered to be affected by Marion hotspot located south of the SWIR (le Roex et al., 1989). According to T. Sato (2010) and T. Sato et al.(2011), the segment is subdivided into five subsegments: three orthogonal spreading subsegments and two oblique spreading subsegments. In this study, we report geochemical variations of basalts from three subsegments, i.e. western orthogonal spreading subsegment, western oblique spreading subsegment, and central orthogonal spreading subsegment. At eastern end of the western orthogonal spreading subsegment and off-ridge of the western oblique spreading subsegment, topographic height is developed.

We had two cruises (KH-07-4 Leg 2 and KH-09-5 Leg 4) in 2008 and 2010 aboard R/V Hakuho-Maru. During two cruises, we performed 17 dredge operations, and we obtained MORB, mantle peridotite, metamorphic and sedimentary rocks along the central part of the SWIR (Sato et al., 2008, 2010). At the western part of the segment between the Prince Edward and Eric Simpson fracture zones (35.5-37.5E), we performed 7 dredge operations. Geochemical variations are summarized as follows.

1) Most of measured major elements variations can be explained by the crystal fractionation. Estimated compositions of the primary melt, which is back calculated based on equilibrium mineral compositions, for basalt from orthogonal spreading segment and oblique spreading segment have similar compositions. It indicates that the primary melt in this are was finally equilibrated with the mantle under the same conditions (P, T, major composition) even in the different ridge morphology.

2) Basalts from topographic high and oblique spreading segment have enriched compositions in trace elements including rare-earth elements, particularly in highly incompatible elements. Trace element compositions of source mantle calculated by degree of melting (Na8: Na2O content at MgO=8.0 wt%) indicate that basalts from topographic high and oblique spreading segment have enriched compositions in trace elements than those from normal spreading ridge.

3) Helium isotope ratio (3He/4He) of the basaltic glass from oblique spreading segment is approximately 8.0Ra which is similar value to typical MORB.

4) Mantle peridotites are recovered at the northern off-ridge part of the oblique spreading segment, suggesting that avolcanic conditions occurred immediately after formation of the topographic high.

These pieces of information allow us to have the following conclusions.

Geochamical variations along SWIR at 35.5-37.5E are mainly derived from source mantle geochemical heterogeneity particularly for highly incompatible elements. Differences of degree of melting have a small contributions to the geochemical variation. Enrichment in highly incompatible elements is not due to the direct effect of activity of the Marion hotspot although the possibility could not be denied that past hotspot activities metasomatised depleted source mantle.

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