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南西インド洋中央海嶺 35E-40E における地球物理観測から見る火成活動および断層活動のセグメント内での変化
The geophysical intra-segmentation variation at the ultra-slow spreading Southwest Indian ridge 35-40E

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It has been widely accepted for many years that the gross morphology of the mid-ocean ridge spreading centers varies with the spreading rate. Over the last decade, several exceptions to the spreading rate dependency have been reported. Recently, the ridge morphology is thought to be governed by the balance of the melt supply and the spreading rate. In this time, we attempt to understand how the variation of melt supply affects ridge architecture using geophysical observations (bathymetry, geomagnetism and gravimetric).

The Southwest Indian Ridge (SWIR) is an ultraslow spreading system, where the spreading rate is almost constant over the whole system, 14-16 mm/yr. The ridge shows a wide variability of seafloor structure, indicating that the spatial and temporal variation of melt supply may play a critical role in the structural process of mid-ocean ridge. The survey area is between Prince Edward fracture zone and Eric Simpson fracture zone (35-40E), which is one of the first order segments of the SWIR and the length is about 300 km. This segment is fully covered by prominent geoid high anomaly, and the Marion Island, the nearest the hotspot (37 51E 46 52S) from the ridge, is now located on 28 Ma crust about 250 km south from the SWIR. Low Na8.0 (Na_2O contents at MgO=8wt%, indicator of the degree of melting) along the axis within the geoid high area has also been reported.

New swath bathymetry, magnetic data and gravimetric data were acquired in 2008 and 2010 by scientists aboard R/V Hakuho-Maru (KH07-04, Leg2 and KH09-05, Leg4). Basement dredge, seismic survey and electromagnetic survey were also conducted during these cruises. Brief geophysical results were already presented by Sato et al., 2010, so now we focus on the development of oblique spreading subsegment based on the analysis of geophysical and geochemical data. We draw the following conclusions;

1) The continuity of seafloor morphology and magnetic isochrones adjacent orthogonal (35 30E to 36 20E) and oblique spreading subsegment (36 20E to 37 10E) at the western half of the survey area suggest that oblique spreading geometry is not a stable structure at least in the survey area. The current oblique subsegment could be orthogonal spreading segment around 3-4 Ma. Major element variation of the obtained MORBs suggest that the primary melt condition (P, T and major composition) is same at orthogonal and oblique subsegment (Sato et al., 2011). On the other hand, trace elements of the MORBs are slightly higher than the typical MORB (Sato et al., 2011). These results suggest that the slightly difference of the source mantle and the degree of melting may result in the forming of the orthogonal and oblique subsegment.
2) Some volcanic structures and moderate present normal magnetization are observed within the axial valley of the oblique subsegment. These may imply that the oblique spreading segment is not amagmatic segment and the melt supplied to the oblique subsegment is more divided into small scale, resulting in the formation of the third-order segment (Mizuno et al., 2010) through the melt focus process.
3) The asymmetric seafloor morphology and crustal thickness at oblique subsegment may be caused the same process at the inside and outside corner of the ridge-transform intersection. The recovery of mantle peridotites at the northern off-ridge part of the oblique spreading segment can support this idea.

Assuming that the on-axis geochemical variation can extend to that of the off-axis, the ~3 Myr temporal crustal thickness variation calculated using shipborne gravity (Sato et al., 2010) may be closely related to the difference of the source mantle. However; it should be remembered that the ridge obliquity may encourage the along axis melt migration from oblique subsegment to the adjacent orthogonal subsegment, resulting in the melt focusing.

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