Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

SIT41-06 Room:314 Time:April 28 11:30-11:45

Heterogeneity from mantle to crust at the central Southwest Indian Ridge (2) -Crust-

SATO, Hiroshi[1*] ; SATO, Taichi[2] ; MACHIDA, Shiki[3] ; SENDA, Ryoko[4] ; MATSUNO, Tetsuo[8] ; SEAMA, Nobukazu[5] ; NAKAMURA, Kentaro[6] ; MORISHITA, Tomoaki[7] ; NOGI, Yoshifumi[8] ; OKINO, Kyoko[9]

[1]Senshu Univ., [2]AIST, [3]Waseda Univ., [4]JAMSTEC, [5]Kobe Univ., [6]Dept. System Innovation, Univ. of Tokyo, [7]Kanazawa Univ., [8]NIPR, [9]AORI, Univ. of Tokyo

Mantle is heterogeneous in terms of geophysical (e.g., bathymetry, geomagnetics, and gravity) and geological (e.g., petrology and geochemistry) aspects. Because heterogeneity is enhanced at slow spreading ridge, the ultra-slow spreading Southwest Indian ridge is suitable for understanding the heterogeneity. We conducted geophysical and geological investigations since 2007 at the segment along the central Southwest Indian Ridge (SWIR) between 35E and 40E, where the ridge segment is close to the Marion hotspot.

Recent investigations of topography and geophysics along the central Southwest Indian ridge between 35E and 40E (Sato, T. et al., 2013) classify the segment between the Prince Edward and Eric Simpson fracture zones as four subsegments: PE-1, PE-2, PE-3, and PE-4 from west to east. A long oblique axial valley (NTD-1) is recognized between PE-1 and PE-2. Geochemical and isotopic compositions of MORB samples from these subsegments consist with previously reported MORB and/or SWIR basalts. However, small scale geochemical and isotopic heterogeneity are recognized in these samples. Sato, T. et al. (2013) considered that strong melt-focusing could be principle process to produce volcanic and low volcanic subsegment rather than the effect of proximity to the Marion hotspot. Continuous seafloor morphology and isochrons over off-axis areas of segment PE-1 and NTD-1 suggest that PE-1 shortened after the C2An chron, indicating the magmatic process has changed for several million years.

Among MORB from the subsegments, PE-1 and NTD-1, geochemically enriched sample (e.g. those with La/Sm>1) are enriched in isotope (higher Sr and lower Nd), suggesting that enrichment is due to source enrichment rather than smaller degree of melting of the homogeneous source mantle. Although geochemical and isotopic compositions could be explained by the mixture of depleted MORB source and the Marion components, contribution of the Marion component is limited only in the eastern part of PE-1 and NTD-1 subsegments. Therefore, it is reasonable to consider that source mantle beneath eastern part of PE-1 segment contains the enriched Marion components rather than direct contribution from Marion hotspot. Degree of enrichment (i.e. amount of enriched component) is higher beneath the present eastern part of PE-1 subsegment.

Sato, T. et al. (2013) pointed out that the melt supply center (tip of V-shaped bathymetric structure) between segment PE-1 and NTD-1 has migrated westward. It means that the enriched portion in the source mantle beneath PE-1 and NTD-1 subsegments has migrated westward. Melting of enriched, probably preferentially melting, components induced the strong melt-focusing process to form the V-shape bathymetric structure between PE-1 and NTD-1. This constraints the spatial scale and type of enriched component in depleted mantle.

References

Sato, T., K. Okino, H. Sato, M. Mizuno, T. Hanyu, and N. Seama (2013), Magmatic activities on the Southwest Indian Ridge between 35E and 40E, the closest segment to the Marion hotspot, Geochem. Geophys. Geosyst., 14, 5286?5307, doi:10.1002/2013GC004814.

Keywords: heterogeneity, mantle, crust, MORB, Southwest Indian Ridge