Geophysical study of oblique spreading segment at Southwest Indian Ridge 34-40E

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Oblique spreading segments can be seen at ultra-slow spreading ridge. Previous studies about oblique segments indicate that the segment is amagmatic segment and its melt supply might depend on its obliquity. However, why exists oblique spreading segment, which is considered to evolve into orthogonal spreading segment during spreading proceeding, exist at mature seafloor is not explained completely. Such structures are important for characterizing the shape of ultraslow spreading ridge, we identifying recent tectonic/volcanic activities for understating the origin of ridge obliquity.

We conducted surface geophysical survey at Southwest Indian Ridge 34-40E (full spreading rate ˜15mm/yr), where the Marion hotspot interacts ridge process, during R/V Hakuho-Maru KH0704-Leg2 cruise on January, 2008. Seafloor topography is collected by multibeam survey. Magnetic reversal patterns and intensities are deduced from topography and magnetic anomaly collected by proton procession magnetometer. Crustal thickness is deduced from topography and gravity anomaly collected by shipboard gravimeter.

Southwest Indian Ridge 34-40E is located between Prince Edward fracture zone and Eric Simpson fracture zone and is characterized with deep axial valleys. This segment consists of three subsegments perpendicular to the spreading direction and two axial deeps which extend oblique to spreading direction connecting adjacent orthogonal subsegments. Surface surveys were focused on half of western subsegment (35:30-36:20E), part of central subsegment (37:15-37:35E) and the topographic deep (36:35-37:15E) between western and central subsegments. The off-axis areas up to 5 Ma were also covered for these areas. Central and Western subsegment is characterized by melt-focused segment and topographic deep is characterized amagmatic oblique subsegment.

The direction of oblique subsegment is N65E and its spreading direction is N15E, thus the obliquity is 40 in degree. Estimated effective spreading rate (spreading component orthogonal to the ridge trend) is 13 mm/yr in full spreading rate. Sporadic volcanic-like structures could be seen at each subsegment end and center but it is not clear at the latter place. This suggests that oblique spreading subsegment is at least not amagmatic. Off-axis area show highly asymmetric and irregular morphology; the area is blocky and smooth seafloor and South is hillock, those are quite different from adjacent off-axis morphology. Thin crustal thickness at axial deep and blocky area and low magnetization intensity at whole area are also observed. Two types of morphological lineations, perpendicular to spreading direction and parallel to oblique subsegment are observed on-axis area. Former morphological lineations are mainly distributed at near axis valley floor and this suggest that recent activity is dominated by spreading parallel extension, although the relation between two kind of morphological lineation are not constrained. To know the origin of oblique spreading subsegment, we need off-axis exploration about the morphological lineations and crustal thickness temporal variations.