Understanding Circum-Antarctic Ridges: Do abyssal hills of the Southeast Indian Ridge record climate influences?

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Seafloor is formed along volcanic mid-ocean ridges with spreading rate of several centimeters per year. Both tectonic and volcanic processes characterize the seafloor topography and ultimately the oceanic lithosphere. One of characteristic lineaments of the seafloor is known as abyssal hills, which can be originated by extensional faults associated with rifting processes. Recent studies of the Australian-Antarctic ridge and East Pacific Rise found that these hilly topography are also linked to ice age periodicity, suggesting sea level change influences seafloor topography [Crowley et al., 2015; Tolstoy, 2015]. Although further identification in other ridges with different spreading rate is essentially needed for understanding nature of global pattern of abyssal hills, they remain largely unexplored because their remoteness and difficulty of broad surveys with swath acoustic sonar installed on the ship. Furthermore, topographic feature considering certain seafloor age is poorly discussed because time constrain from magnetic anomalies is extremely limited.

Here, we report dated bathymetric features of the Southern Ocean. We conducted multibeam echo-sounding surveys along 110°E areas from 40°S to 60°S during Japanese Antarctic Research Expeditions (JARE) 51–55 in 2009–2013. The Japanese icebreaker "*Shirase*" successfully covered more than 2,000 km across the Southeast Indian Ridge. The measurements of shipboard three components magnetometer [Isezaki, 1986] were also performed. Marine vector magnetic anomalies along survey tracks were calculated to detect seafloor age.

Geomagnetic polarity chrons from marine magnetic anomalies were certainly identified up to C3n.4n (~5.230 Ma) in north sides and C4An.4n (~9.025 Ma) in south sides and of the spreading axis of the Southeast Indian Ridge. Magnetic anomalies in the seafloor older than these ages did not show simple correlation with known geomagnetic polarity chrons. It is likely because of that fracture zones, which can be seen from satellite gravity anomalies [Sandwell et al., 2014], disturb crustal magnetization patterns. Seafloor topography within 5 Ma in north and 9 Ma in south shows clear abyssal hill patterns with a few hundreds meters high. In this presentation, we will discuss the relationship between topographic change and climate proxies to verify tectonic faulting or volcanic origin of abyssal hills and whether seafloor topography in this region records climate influences.

References

Crowley, J.W., Katz, R.F., Huybers, P., Langmuir, C.H., Park, S.-H., 2015. Glacial cycles drive variations in the production of oceanic crust. Science, 347, 1237–1240.

Tolstoy, M., 2015. Mid-ocean ridge eruptions as a climate valve. Geophys. Res. Lett., 42, 1346–1351.

Isezaki, N., 1986. A new shipboard three-component magnetometer. Geophysics, 51, 1992–1998.

Sandwell, D.T., Müller, R.D., Smith, W.H.F., Garcia, E., Francis, R., 2014. New global marine gravity model from CryoSat-2 and Jason-1 reveals buried tectonic structure. Science, 80, 346, 65–67.