MOWALL –Moho Observation along long transform fault WALLs

*Kyoko Okino[1], Tomoaki Morishita[2], Shiki Machida[3], Kentaro Nakamura[1], Yasuhiko Ohara[4], Kenichiro Tani[5], Osamu Ishizuka[6]

1. The University of Tokyo, 2. Kanazawa University, 3. Chiba Instutue of Technology, 4. Japan Coast Guard, 5. National Museum of Nature and Science, 6. National Institute of Advanced Industrial Science and Technology

Long oceanic transform faults (TFs) are the places where whole crustal section is exposed in chronological order. This is the best place to obtain a comprehensive understanding in diversity of crustal structure and mid-ocean ridge process, and its spatio-temporal variation. Pioneering works along the Vema Transform (e.g., Bonatti et al., 2003) shows a 3-4 Myr. fluctuation of melt supply of the ridge segment based on dense sampling and gravity analysis along the TF. However, the cause of this fluctuation is still unknown, and we do not know if this fluctuation is universal phenomenon of global MORs. Moreover, the Vema TF area is characterized by well-ordered abyssal hills and does not include structures such as oceanic core complexes (OCCs) and smooth seafloor indicating lower melt supply. Our working hypothesis is that the crustal structure and its formation process are controlled by spatial heterogeneity of chemical composition of upper mantle. To confirm the hypothesis, we started the project **MOWALL (Moho Observation along transform fault WALLs)** since 2018. The project aims to investigate the temporal variation of mid-ocean ridge process by systematic rock sampling along long oceanic transforms in the world. We select three focused study areas; Marie Celeste TF in the Indian Ocean, Shikoku-Parece Vela backarc rift in the Philippine Sea, and Vulcan TF in Southern Ocean.

Marie Celeste TF: The Central Indian Ridge spreads at rate of 37-40mm/yr. and a 215km long transform exposes the oceanic crust from 0 to 12 Ma. Pre-existed bathymetry data just south of transform indicate large temporal variation of melt supply. On-axis sheet lava flow and recent off-axis volcanoes suggest vigorous melt supply since ca. 3Ma, whereas a couple of OCCs were developed just before then. We plan to do 25km interval dredge hauls along the fault wall in coming R/V Hakuho-maru cruise in October 2020. Along axis gravity/magnetic mapping is also planned to estimate the crustal thickness variation and precise age dating.
Shikoku-Parece Vela TFs: In the Shikoku -Parece Vela backarc basins in the Philippine Sea, remnant backarc rift is closely segmented by many transforms. Several OCCs including the world-largest Godzilla Mullion and smooth seafloors are discovered along the rift, indicating large fluctuation of melt supply. The transforms are generally short and not suitable for long-term variation analysis; however, existing peridotite samples show clear fluctuation of degree of melting from different parts of the OCC. Our recent cruises in 2018 and 2019 and many previous cruises reveal the detailed history of melt supply in the final stage of backarc basin formation.
Vulcan TF: The Vulcan transform is located unexplored Southern Ocean, 59°S, 17°W. The South American-Antarctic Ridge spreads at rate of 14 mm/yr. and the ridge axis is offset about 55km by this transform exposing 8 Myr age transect. During R/V Hakuho-maru cruise KH-19-4, we conducted five dredge hauls along the transform at 15-20km interval.

We present the preliminary results of survey in the Shikoku-Parece Vela and the Vulcan TFs and introduce the pre-cruise studies on Marie Celeste TF.

Keywords: transform fault, oceanic crust, mantle heterogeneity, mid-ocean ridge process

