Oceanic lower crust and uppermost mantle of the Shikoku Basin: insights from expeditions to Mado Megamullion

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Oceanic core complexes (OCCs), or megamullions, are domal bathymetric highs with axis-normal corrugations, and with exposure of serpentinized peridotite and gabbroic rocks, interpreted as exhumed footwalls of low-angle detachment faults. OCCs provide a valuable opportunity to directly study the architecture of oceanic lithosphere, together with the tectono-magmatic processes associated with its formation and evolution. A significant fraction of the ocean floor is created in backarc basins where water plays a major role in generating backarc basin basalts, strikingly contrasting to magmatic process at mid-ocean ridges. It is therefore important to study the formation of backarc basin lower crust and upper mantle via backarc basin OCCs for understanding the ocean basins.

The Shikoku Basin is considered as a typical backarc basin that ceased seafloor spreading at ~15 Ma. We noted the presence of OCCs there since early 2000's. Following the first preliminary dredge survey in 2007, we conducted focused research programs as three cruises in 2018 and 2019 (KH-18-2, YK18-07 and YK19-04S) on the Shikoku Basin axial OCCs. These programs successfully confirmed the presence of two OCCs and a non-transform offset (NTO) massif in the southernmost segment of the Shikoku Basin extinct spreading axis. During these cruises, we performed geophysical mapping, dredging, as well as in situ observation and sampling with the DSV Shinkai 6500. One of the OCCs, termed Mado Megamullion, is an ~20 km square domed high with axis-normal corrugations, located at an intersection of a short spreading segment (~30 km) and short transform fault (~45 km). Mado Megamullion and the NTO massif are associated with high mantle Bouguer anomaly. This observation is consistent with the exposure of deep-seated gabbroic rocks and peridotite sampled with dredge as well as the Shinkai. The Mado gabbros show the chemical trend that can be interpreted as assimilation of mantle material at the crust-mantle boundary. The Mado peridotites include the plagioclase-bearing lherzolites that suggest melt stagnation and melt-rock reaction in the dying backarc spreading lithosphere. The scheduled YK20-05S cruise in 2020 April will collect more datasets on this OCC.

In this contribution, we will report the preliminary results of YK20-05S cruise, as well as the compilation of the available datasets, to understand the tectono-magmatic characteristics of Mado Megamullion.