A new tectonic window into the backarc basin lower oceanic crust and upper mantle: Mado Megamullion in the Shikoku Basin

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Oceanic core complexes are well known from mid-ocean ridges. There, they represent large scale low-angle detachment faults exposing lower crust and upper mantle rocks. As such, they are among the primary tectonic windows into the understanding of fundamental processes in the ocean lithosphere. On the other hand, 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. In addition, much of our understanding of all ocean crust comes from ophiolites, most of which are largely attributed to the suprasubduction zone environment. The opportunity to explore the formation of backarc basin lower crust and upper mantle is, therefore, an important contribution to the overall geology of oceanic crust.

Here we introduce a previously unreported backarc oceanic core complex, Mado Megamullion in the Shikoku Basin in the Philippine Sea. First detected during the Japan's continental shelf survey for Law of the Sea in the early 2000's, it was sampled and mapped in 2007 on the cruise KH07-4 of R/V Hakuho, and in 2018 by YK18-07 of R/V Yokosuka with DSV Shinkai 6500 and KH18-2 of R/V Hakuho.

Bathymetry survey reveals robust spreading parallel corrugations extending ~25 km from breakaway to termination. The total area of the corrugated surface is ~550 km^2, tiny compared to Godzilla Megamullion further south in the Parece Vela Basin (total area of Godzilla is ~7200 km^2), but about the same size as Kane Megamullion in the Atlantic Ocean. Rock types sampled thus far within the megamullion surface include peridotite, troctolite, gabbro, and minor basalt. The gabbros include undeformed and deformed varieties, and include varitextured and microgabbro lithologies that have been associated with the dike-gabbro transition at other oceanic core complexes. Though the sampling thus far has been limited, it agrees completely with the model of a lower crustal detachment rooted in the dike-gabbro transition, and lubricated by the entrainment of serpentinized mantle rocks in the detachment zone.

Mado Megamullion represents an important tectonic window for the understanding of the 3D architecture of oceanic lower crust and upper mantle for two important reasons. First, the size of Mado Megamullion can be the typical for world's oceanic core complex, easy to make comparison with other well-studied oceanic core complex, such as Kane. Second, Mado Megamullion is only ~1300 km (~2 days transit) from Tokyo, making it the most physically

accessible tectonic window in the world's oceans, thus being expected to become a focused study site for an oceanic core complex.