

Unraveling the Mesozoic continental basement of the proto-Philippine Sea Plate

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The Izu-Bonin arc has been regarded as a typical intra-oceanic arc, where the oceanic Pacific plate is subducting beneath the Philippine Sea plate. The current Philippine Sea plate is a complex of active and inactive arcs and back-arc basins. It is dominated by oceanic crust domains forming three large back-arc basins; Shikoku, Parece Vela, and West Philippine Basins, making the present Philippine Sea plate look like an 'oceanic' plate. However, all of these back-arc basins were formed after the inception of subduction at Izu-Bonin arc, which began at ~52 Ma. Little is known about the proto-Philippine Sea plate, which existed as a counterpart to the Pacific plate during subduction initiation and before the formation of back-arc basins.

To understand the detailed geology of the proto-Philippine Sea plate, we have conducted manned-submersible SHINKAI6500 and Deep-Tow camera surveys during the R/V Yokosuka cruise (YK10-04) at the Amami Plateau, Daito Ridge, and Okidaito Ridge (ADO) region in April, 2010. The ADO region comprises the current northwestern Philippine Sea plate and considered to represent the remnants of the proto-Philippine Sea plate. The submersible observations and rock sampling conducted during the YK10-04 cruise revealed that ADO region, especially the Amami Plateau and the Daito Ridge, dominantly expose deep crustal section of gabbroic, granitic, and metamorphic rocks, indicating that a part of the proto-Philippine Sea plate is composed of older, non-oceanic, possibly continental, crust. Jurassic to Cretaceous zircon U/Pb ages have been obtained from the ADO plutonic rocks. This suggests that subduction of the Izu-Bonin arc initiated at the Mesozoic continental margin, and later acquired "intra-oceanic"-like setting through formation of the backarc basins.

Furthermore, the detrital zircon studies conducted at the northern Izu-Bonin forearc, counterpart of the ADO region, show that part of the zircons yield Mesozoic to Paleozoic ages, indicating that such continental basement may even exist beneath the present Izu-Bonin arc.