K. Tani

Abstract 1 (Talk).

Unraveling the crustal structure of the proto-Philippine Sea Plate: Possible continental basement beneath the Northern Izu-Bonin Arc

The Izu-Bonin Arc is widely regarded as a typical intra-oceanic arc, where the oceanic Pacific Plate is subducting beneath the Philippine Sea Plate, an evolving complex of active and inactive arcs and back-arc basins. It is dominated by oceanic crust 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 (Ishizuka et al. 2011, EPSL). 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 investigate the crustal structures of the proto-Philippine Sea Plate, we conducted manned-submersible SHINKAI6500 and Deep-Tow camera surveys during the April 2010 cruise of the R/V YOKOSUKA cruise (YK10-04) at the Amami Plateau, Daito Ridge, and Okidaito Ridge (ADO) region. The ADO region comprises the northwestern Philippine Sea Plate along with what are regarded as remnants of the proto-Philippine Sea Plate. Submersible observations and rock sampling revealed that ADO region exposes deep crustal sections of gabbroic, granitic, and metamorphic rocks, indicating that part of the proto-Philippine Sea Plate is composed of older, possibly continental, crust. Jurassic to Cretaceous magmatic zircon U-Pb ages have been obtained from the ADO plutonic rocks.

These findings and tectonic reconstruction of the proto-Philippine Sea Plate (Deschamps and Lallemand 2002, JGR) suggests that subduction of the Izu-Bonin Arc initiated at the continental margin of the Southeast Asia, possibly correlating to the Mesozoic island-arc and ophiolite complexes exposed in the Philippine Islands and Borneo, and later acquired "intra-oceanic"-like setting through formation of the backarc basins.

Furthermore, detrital zircon ages from volcaniclastic sandstones collected from northern Izu-Bonin forearc, counterpart of the ADO region, yield Mesozoic to Paleozoic ages, indicating that such continental basement may even exist beneath the present Izu-Bonin Arc. To confirm this hypothesis, we have conducted a SHINKAI6500 survey on the landward slope of the northern Izu-Bonin Trench during the R/V YOKOSUKA cruise (YK11-07) in September, 2011. The collected samples were dominantly andesite

with two diorite samples, and preliminary zircon U-Pb dating of the diorite sample yielded Cretaceous (~100 Ma) magmatic age as well as abundant Paleozoic to Proterozoic detrital zircons.

Abstract 2 (Poster).

Temporal and compositional variations of the Izu-Bonin-Mariana middle crust layer

The Izu-Bonin-Mariana (IBM) arc system is a typical intra-oceanic arc, where silicic middle (i.e. granitic) crust is being generated through subduction zone magmatism. This environment thus provides an important natural laboratory to study the juvenile arc crust formation, and ultimately to understand the genesis of continental crust. Furthermore, the IBM arc has been colliding end-on with the Honshu arc at the Izu collision zone (ICZ) for the past 15 million years. As a result of this collision, voluminous granitic rocks are exposed in the ICZ, previously interpreted to represent a deep crustal section of the IBM arc, exposed as a result of this collision. Despite their importance, the granitic rocks in the IBM arc and ICZ have not been well characterized geochronologically and geochemically to understand their petrogenesis.

In this study, ranitic rocks from the IBM arc and ICZ were comprehensively acquired for zircon geochronology and whole-rock geochemistry. The new results show that silicic crust formation in IBM arc was initiated at the earliest stage of arc magmatism and continues to present. The IBM middle crust layer displays geochemical and petrological across-arc variations and is not the previously believed monolithologic layer of tonalitic rocks. Furthermore, the middle crust with continental affinities occurs in the rear-arc region, not in the volcanic front where arc magmatism predominates. Zircon dating of abundant granitic plutons exposed in the ICZ reveals that all of these plutons were syncollisional, formed after the onset of IBM arc collision with the Honshu arc. This implies voluminous and rapid granitic magma formation during the arc-arc collision, providing an important present-day analogue for continental crust growth though arc-arc accretion.