The oldest oceanic plate and Minami Tori Shima: Minato Project

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Minato Project started in 2017 to study submarine volcanoes of Minami Tori Shima and its adjacent areas, which are part of the Marcus-Wake Seamount Chain. The main scientific target of the Minato Project is to unravel the origin of these submarine volcanoes erupted on the Jurassic Pacific plate, which is the oldest part of the Pacific plate produced at the Jurassic midocean ridge between the Pacific and Izanagi plates. The old midocean ridge and the Izanagi plate had subducted beneath Japan and have not remained now on the Earth’ s surface.
The formation ages of Marcus-Wake seamounts are another enigma. As shown by Koppers et al. (2003), volcanoes in the western area are older than those of the eastern area, but their age variations are not systematic, and are different from age variation expected if they were hot spot tracks. Moreover, each volcano itself seems to have a wide age variation. For example, the small seamount Seth shows the eruption ages of lavas ranging from 114 to 139 Ma. Did the hot spot stayed beneath this small volcano for 25 million years? This is impossible, but actually, Minami Tori Shima has the similar problem. Preliminary Ar-Ar age determinations by Osamu Ishizuka (unpublished) showed that lava blocks collected from Minami Tori Shima during KM17-E01 have two different ages. One sample from KM-ROV#47, which dived southern ridge of Minami Tori Shima and another sample from KM-ROV#49 collected from southeastern ridge of the volcano have Ar-Ar ages of 108.5 Ma and 35.8 Ma, respectively.
The chemistry of lava blocks also shows two different patterns, which could correspond to the two different ages. Lava blocks from the southern ridge (KM-ROV#47 R02) shows light REEs and incompatible elements enriched patterns, which are typical to oceanic island basalts. On the other hand, samples from southeastern ridge (KM-ROV#49 R06) are depleted in Nb and Ta, and Zr and Hf, in comparison to neighboring elements, which patterns are typical of subduction related arc magmas (Figure7right diagram). Apparently, the lavas having arc signatures are younger than those having ocean island basalt signatures, in spite of the fact that both lava types are definitely plume-related magmas.

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