小笠原弧土曜海山のアンカラマイト：大陸出現の前駆物質か？
Ankaramite from Doyo seamount in the Izu-Ogasawara arc: A precursor of continents?

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Izu-Ogasawara-Mariana (IOM) system of arcs (also known as the Izu-Bonin-Mariana arc system) is a typical oceanic arc produced by subduction of the Pacific Plate beneath the Philippine Sea Plate. Volcanoes along the southern segment of the Izu-Ogasawara arc are underlain by thin crust (10-20 km). According to the hypothesis presented by Tamura *et al.* (2016), rising mantle diapirs stall near the base of the oceanic crust at depths controlled by the thickness of the overlying crust. Where the crust is thin, melting occurs at relatively low pressures in the mantle wedge producing andesitic magmas. Andesites erupted from Nishinoshima that were produced in the recent history of the volcano have been generated by olivine fractionation of primary andesitic magmas (Tamura *et al.*, 2019).

To further examine this hypothesis, we have dived Doyo Seamount by using manned submersible SHINKAI 6500 to sample primitive magmas from the volcano, which is located about 50 km north of Nishinoshima and is underlain by thinner curst (15 km) compared to Nishinoshima. Doyo Seamount is located approximately 900 km south of Tokyo at 27˚41’ N, 140˚48’ E in the Ogasawara Arc. The seamount attained an elevation of ~400 m below sea level (mbsl) and its submarine flanks extend to the depth of 3,200 mbsl. The basal dimeter of the volcano is about 30 km. The deeper parts of this large submarine edifice have yet to be explored. Primitive lavas tend to erupt in the deeper parts of submarine volcanoes at the depth of ~2,000 m. Deeper satellite vents are expected to erupt more primitive magmas compared to the main summit vents because primitive magmas could bypass the shallow magma chambers where crystal fractionation and magma mixing happen.

There is a small satellite cone about 11 km east of the summit of Doyo Seamount at the depth of ~3,000 m. A ridge extends on the flank of the volcano from the summit in the ENE direction to the depth of ~2,400 m. Thus, we tried to sample this satellite cone and the deeper part of the ridge. Interestingly, 13 samples out of all 21 samples, which we have recovered during this dive 6K#1519, are olivine-clinopyroxene basalts containing 20-40 % of very coarse clinopyroxene phenocrysts, which could be called ankaramite (Figure 1). Ankaramites are strongly vesiculated and their blocks have rough and rugged surface, which are different from smooth surface of basaltic pillow lavas. Some of ankaramite magmas might have had explosive eruptions at the depth of 2,000~3,000 m, which have resulted in volcaniclastic cones or brecciated lava flows.

Similar primitive and phenocryst-rich ankaramitic basalts were recovered from the old submarine knolls near Nishinoshima (Tamura et al., 2019). We suggested that lithospheric mantle was thicker before the development of Nishinoshima volcano (Figure 2). Primary basaltic magmas could have been generated at depth beneath the thicker lithospheric lid, and these magmas might have interacted with the lithospheric uppermost mantle during their ascent and have resulted in the unique ankaramite magmas (Figure 1). The

temperature of the upper part of the mantle wedge increases with frequent passage of magmas through it, and continuous subduction beneath it will drench the whole mantle wedge, thus, the thickness of the lithosphere will decrease and approach the thickness of the curst in mature arcs. Doyo Seamount could represent the early stage of Nishinoshima volcano, and thus, ankaramite magma is deemed to be a precursor of andesitic magmas.

References

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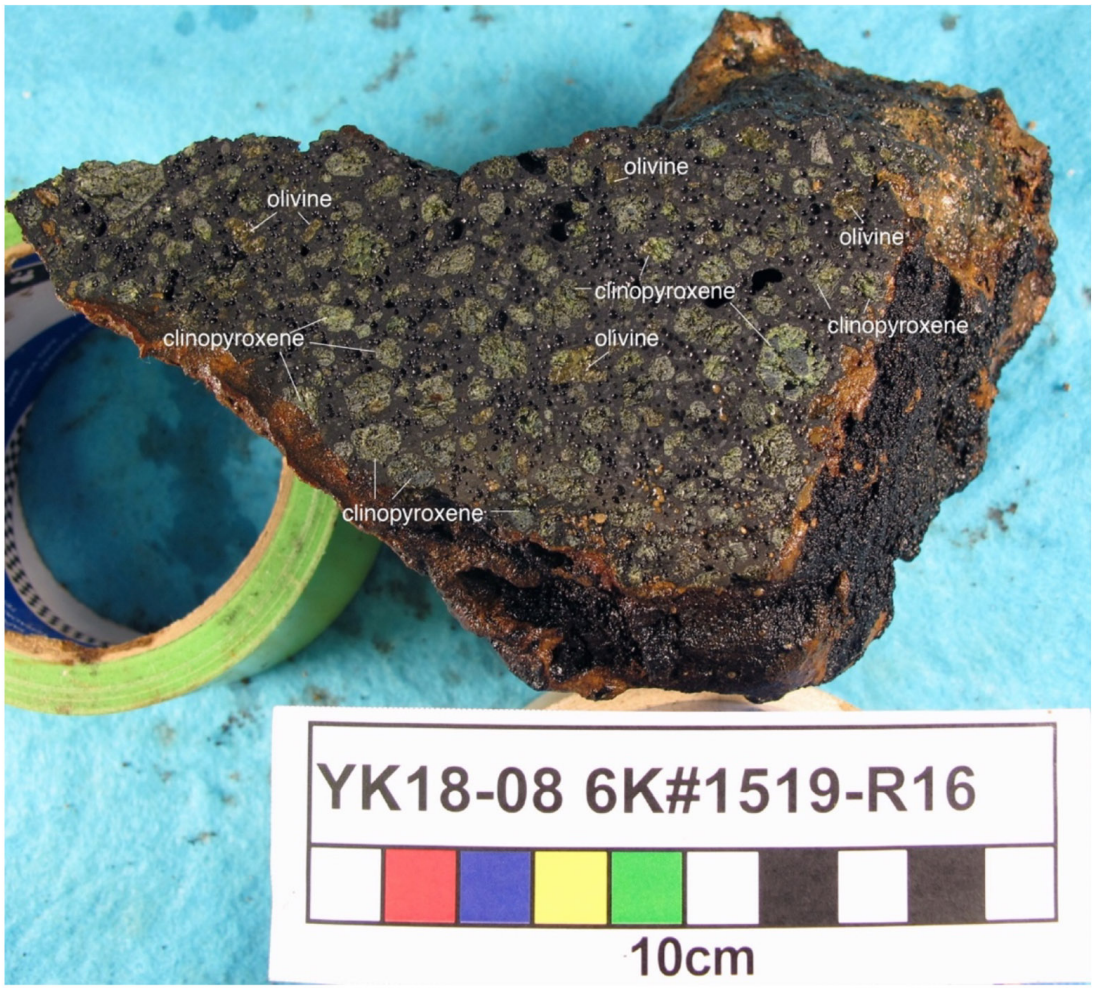

Figure 1. Ankaramite recovered from Doyo Seamount.

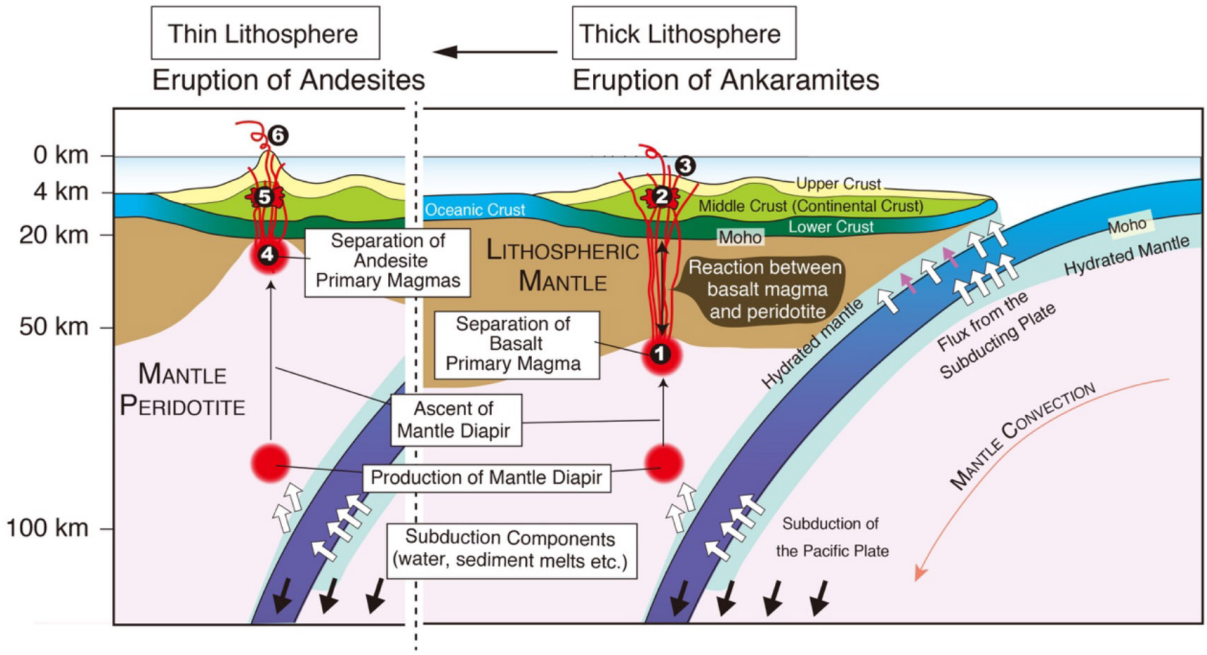

Figure 2. Schematic diagrams showing the genesis of andesite and ankaramite magmas in the Ogasawara arc.

