

マリアナ弧NW Rota-1火山の二つの初生玄武岩マグマ

Two primary basalt magmatypes from Northwest Rota-1 volcano, Mariana arc

田村 芳彦^{1*}, 石塚 治², 宿野 浩司¹, 川畑 博¹, ロバート スターン³, ロバート エンブレイ⁴, 巽 好幸¹, 布川 章子¹

Yoshihiko Tamura^{1*}, Osamu Ishizuka², Hiroshi Shukuno¹, Hiroshi Kawabata¹, R. J. Stern³, R. W. Embley⁴, Yoshiyuki Tatsumi¹, Akiko Nunokawa¹

¹海洋研究開発機構, ²産業技術総合研究所・地質情報研究部門, ³テキサス大学ダラス校, ⁴NOAA/PMEL

¹IFREE, JAMSTEC, ²GSJ/AIST, ³University of Texas at Dallas, ⁴NOAA/PMEL

Primitive NW Rota-1 basalts provide a unique example of near-primitive basaltic magmas in the Mariana arc. Northwest Rota-1 is a submarine volcano that is located about 100 km north of Guam in the Southern Seamount Province (SSP) of the Mariana arc. A single continuous submarine eruption was witnessed during ROV visits in 2004, 2005, 2006, 2008 and 2009 near the summit at 520 m depth. We visited NW Rota-1 in 2005 (NT05-17) and 2009 (NT09-02), using remotely operated vehicle (ROV) Hyper-Dolphin and RV Natsushima. Rocks were collected from the summit areas at 520-1000 m depth (dives HPD480, HPD481 and HPD952), from the eastern slope of the volcano (HPD 488; 1500-2300 mbsl), and from an andesite knoll about 13 km east of the NW Rota-1 summit (HPD951; 2000-2300 mbsl). Volcanic samples from these dives range from basalt to andesite (51-58 wt % SiO₂). Samples from HPD480 (summit) and HPD488 (eastern slope) include 17 magnesian basalts (51-52 wt % SiO₂) having 7.5-9.5 wt % MgO and Mg# of 61-67, indicating little fractionation. These magnesian basalts are classified on a basis of petrography into three groups: 1) olivine-clinopyroxene (Ol-Cpx) basalts; 2) olivine-plagioclase (Ol-Pl) basalts; and 3) porphyritic basalts. Ol-Cpx basalts (8 samples from deeper part of HPD488) contain phenocrysts of olivine (1.1-4.6%) and clinopyroxene (0-2.4%) sometimes with rare (<0.2 %) plagioclase. Ol-Pl basalts (6 samples from shallower part of HPD488) have olivine (0.8-3.8 %) and plagioclase (rare-1.9 %) phenocrysts with 0-0.3 % clinopyroxene. Porphyritic basalts (3 samples from HPD480) contain up to 9 % olivine, 20 % plagioclase, and 2 % clinopyroxene; these basalts are not discussed here because of high phenocryst contents. Ol-Pl basalts have higher Mg# (63-67) than Ol-Cpx basalts (61-65 Mg#) at the same silica contents, but these two groups differ in incompatible trace element ratios at the same silica contents. Zr/Y and Nb/Yb are higher in Ol-Pl basalts (3.1-3.2 and 1.2-1.5, respectively) than in Ol-Cpx basalts (Zr/Y = 2.8-3.0 and Nb/Yb = 0.7-0.9), suggesting that Ol-Pl basalts formed from lower degree of melting of its mantle source, or that the Ol-Cpx mantle source was more depleted. On the other hand, Ol-Cpx basalts have Ba/Nb = 70-80, Ba/Ta = 700-1300, Th/Nb = 0.4-0.5; and Th/Ta = 4-8, which are higher than trace element ratios for Ol-Pl basalts (30-35, 300-500, 0.1-0.2 and 1-3, respectively), suggesting that Ol-Cpx basalts have a greater subduction component than Ol-Pl basalts. Some olivine phenocrysts in Ol-Cpx basalts are Fo₉₃ and 0.4 wt % NiO, which indicates equilibrium with mantle olivines. Most olivines of both basalt groups are more iron-rich (Fo₈₀₋₉₀), thus differentiated, but Ol-Cpx basalts have more magnesian olivine at the same NiO contents, which further suggests a more magnesian, thus more depleted mantle source of the Ol-Cpx basalts and confirming higher degrees of melting. Olivine chemistry is consistent with the previous trace element ratios. We (Tamura et al., 2005

and 2007) also found two basalt magmas in Sumisu and Torishima volcanoes in the Izu-Bonin arc, originating from either wet or dry parental basaltic magmas. The two NW Rota-1 basalt series have an interesting contrast, which can be derived not only from the different water contents, but also from the different subduction melt components coupled with the water contents.

References

Tamura, Y., Tani, K., Chang, Q., Shukuno, H., Kawabata, H., Ishizuka, O. & Fiske, R. S. (2007). Wet and dry basalt magma evolution at Torishima volcano, Izu-Bonin arc, Japan: the possible role of phengite in the downgoing slab. *Journal of Petrology* 48, 1999-2031.

Tamura, Y., Tani, K., Ishizuka, O., Chang, Q., Shukuno, H. & Fiske, R. S. (2005). Are arc basalts dry, wet, or both? Evidence from the Sumisu caldera volcano, Izu-Bonin arc, Japan. *Journal of Petrology* 46, 1769-1803.

キーワード:沈み込み帯,マグマ,初生マグマ,伊豆小笠原マリアナ弧,島弧

Keywords: primary magma, IBM arc, subduction zone, basalt