

## Implication of slab window for magma generation from Fukutoku-Oka-no-Ba in 2021 and 1986 based on petrological and geochemical study

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Phreatomagmatic eruption occurred at Fukutoku-Oka-no-Ba (N24°17' 16", E141°28' 55"), Bonin arc, Japan, started from 13 August 2021. This eruption released a large amount of pumice raft and it drifted to southwestern islands of Japan, such as Ryukyu islands, after October 2021. In Fukutoku-Oka-no-Ba (hereafter "FOB"), active volcanic activities have been recorded after 1904, and especially, eruption in 1986 also released pumice raft (Kato, 1988). This study reports petrological and geochemical characteristics about drifted pumice to Ryukyu islands in 2021–2022 with ones preserved in Geoscience section in Faculty of Science, University of the Ryukyus, of 1986 eruption, then we discuss about magma genesis beneath FOB.

FOB pumices in 2021 eruption are divided into 3 types in macroscopically: white–gray colored pumice (hereafter "white pumice"), black–dark brownish colored pumice ("black pumice"), and mixed type between both pumices. The white pumices in 2021 eruption characteristically contain dark colored enclaves (it looks like "chocolate chips" in cookies). On the other hand, both types of white and black pumices contain dark enclaves in 1986 pumices. Apparent density is slightly different between white and black pumices/2021 and 1986 pumices. The black pumices are heavier than white pumices and 1986 pumices are heavier than 2021 pumices.

Phenocryst assemblages of all types are same in both 2021 and 1986 pumices: olivine, clinopyroxene, plagioclase, subordinate apatite and opaque minerals. Most of olivines, clinopyroxenes, and plagioclases show low Fo content, augitic composition, and low An content, respectively. However, a small amount of high Fo olivines (85–92), diopsidic clinopyroxenes, and high An plagioclases (~94) are also found in same sample. Opaque minerals are almost magnetite and pyrrhotite, and chromium spinels are sometimes included in high Fo olivines. It is not recognized the differences of phenocryst assemblages and mineral chemistry between white and black pumices in both 2021 and 1986 eruptions, whereas glasses in groundmass displayed quite different between them. The groundmass glasses in white pumices are colorless and ones in black pumices are dark brown colored due to nano-scale magnetite (Yoshida et al., 2022). For this, black pumices can attach to magnet (Sato et al., 2022), and it colors dark.

These above mineral chemistries suggest that the FOB magma was not differentiated significantly from 1986 to 2021. In evidence, whole-rock chemistries of 2021 and 1986 pumices are also homogeneous. They are all trachyte in TAS diagram regardless of white/black color, except that black pumices have slightly much FeO\* content probably due to iron-rich glasses in groundmass than white pumices. Besides, the FOB magma shows bimodal composition lacking intermediate magma. A small number of mafic enclaves and mafic melt inclusions that the range of basalt, basaltic andesite, and basaltic trachy andesite (Kato, 1988; Yoshida et al., 2022) are found in the 2021 and 1986 pumices. This feature is interpreted that trachyte magma was generated from oceanic crust which was partially melted by primary magma derived from mantle. Helium isotopic compositions with noble gas concentrations preserved in olivines

and clinopyroxenes support such magma generation hypothesis because the results showed the effect of crustal contamination. Spidergrams of incompatible elements normalized by N-MORB show subduction signature, such as high LILE/HFSE ratios. For example, Th/Yb of FOB pumices are higher than volcanic rocks along volcanic front of Izu arc, which suggests the component of slab sediment were affected to the mantle wedge beneath FOB. Pb isotopic compositions support sediment contribution because all samples are plotted near the field of Pacific sediment.

Nd-Hf isotopes are interestingly plotted near the division line of Pacific–Indian type MORB. It is likely that there is slab window on subducted Pacific slab beneath FOB (Zhang et al., 2019). This may affect to peculiar composition near FOB area in Bonin arc. We discuss the effect of slab window for the magma generation in subduction zone.

#### References

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