

THE ORIGIN OF TRANSPARENT AND NON-TRANSPARENT
WHITE PUMICE: A CASE STUDY OF THE 52 ka
MANINJAU CALDERA-FORMING ERUPTION, INDONESIA

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論 文 名 : THE ORIGIN OF TRANSPARENT AND NON-TRANSPARENT WHITE PUMICE: A CASE STUDY OF THE 52 ka MANINJAU CALDERA-FORMING ERUPTION, INDONESIA

(透明軽石と非透明軽石の成因:インドネシア 5万2千年前 Maninjau カルデラ形成 噴火の例)

区 分 : 甲

論 文 内 容 の 要 旨

The 52 ka eruption of Maninjau caldera in Indonesia produced two distinctive type of white pumices: transparent (TWP) and non-transparent (NTWP). Both pumice types are crystal-poor (avg. 3.3 %), having similar mineralogy, similar glass compositions (avg. 78.5 wt. % SiO₂), and similar plagioclase core compositions (avg. An₂₄). We found that the abundance of TWP decreases towards the upper stratigraphic ignimbrite deposits, together with the increase in NTWP, grey pumice, banded pumice, and lithic (non-juvenile) contents. The TWP are typically dominated by large vesicles, while NTWP characterized by abundant-small vesicles. Large vesicle corresponds to the preexisting vesicle which formed in magma chamber (pheno-vesicle, > 0.1 mm). On the other hand, small vesicle in groundmass (matrix-vesicle, <0.1 mm) is attributed to second nucleation in the conduit during the eruption. We performed quantitative comparison using vesicle data (pheno- and matrix-vesicles) for these two white pumice types. The correlation between pheno- and matrix-vesicles results in negative correlation. We also found that the boundary between TWP and NTWP is clearly defined by the volume fraction and number density ratio of pheno- and matrix-vesicles. Namely TWP originates from phenovesicle-dominated magma, while NTWP dose from phenovesicle-poor magma. In terms of number density, the correlation between pheno-vesicle number density (PVND) and matrix-vesicle number density (MVND) result in two regimes: (1) decompression-controlled regime, showing nearly constant-PVND correlation for TWP, and (2) phenovesicle-controlled regime, showing steeply-decreasing PVND correlation for NTWP. In the first regime, MVNDs value varies dramatically, suggesting the variation of decompression rate by two to three orders of magnitudes. While in the second regime, the slight increase of MVNDs are considered as the effect of the decrease in PVND within the nearly constant decompression rate.

Keywords: Maninjau; transparent white pumice; pheno-vesicle; matrix-vesicle; bimodal vesicle population; vesicle number density