STRATIGRAPHY RENEWAL, MAGMA CHAMBER STRATIFICATION, AND CONDUIT PROCESS OF THE 1815 TAMBORA CALDERA FORMING ERUPTION

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The 1815 eruption of Tambora volcano was initiated by two precursory Plinian falls and terminated by pyroclastic density current (PDC) deposits. Although the occurrence of fall deposits and pumice rich PDC has been well-described by previous researchers, we discover scoria rich PDC deposits. However, the presence and relationship of scoria rich PDC with another well-described 1815 eruption deposit has never been discussed in detail. Moreover, several aspects of the magma chamber and conduit dynamics are still poorly understood. In order to that, we conducted petrography by optical microscope, chemical anlyses by XRF, SEM-EDS, and FE-EPMA, and textural analyses of BND and MND. Systematic change in the phenocryst, vesicle, microlite, and chemical compositions also observed through the stratigraphic position. Plinian fall units are characterized by relatively low crystal abundance and small average phenocryst size (0.44 - 0.52 mm) with higher silica content (56.8-58.05 wt.% SiO_2). In contrast, PDC deposits are characterized by relatively higher crystal abundance and greater average phenocryst size (0.53 - 0.59 mm) with lower silica content (56.5-57.5 wt.% SiO_2). There is no evidence of magma mixing because no bimodal distribution in anorthite content and no reverse zoning pattern in plagioclase phenocryst. Large phenocrysts (>1 mm) have less variation than small phenocrysts (<1 mm) in chemistry. Core compositions of large phenocrysts are An_{70}-$_{90,}$ while those of small phenocrysts are An_{40}-$_{95}$. The correlation between crystal size, chemical composition, and stratigraphic position suggests that stratification of crystals and chemical compositions in the magma chamber was established prior to 1815 eruption. Juveniles from Plinian eruption are composed of higher BND and lower MND value, compared to juveniles from PDC. As a result, we explained negative correlation of BND and MND by the control of decompression rate (dP/dt). Namely, high decompression rate will induce high nucleation rate of bubble thus facilitate magma to ascent rapidly and limiting the growth of microlite. The increase of lithic population from precursory Plinian towards PDC can be regarded as vent-widening process. Therefore, the decrease of decompression rate accompanied by conduit widening during the early to later phase has shifted the eruption style, from buoyant Plinian column to PDC. Finally, rapid and voluminous magma withdrawal from the chamber has led to the formation of caldera.

Keywords: Tambora, caldera forming eruption, textural analyses, detailed stratigraphy, bubble number density, microlite number density

