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男体火山 17 cal. ka BP 噴火で見られるマグマ溜りからの対照的なマグマ噴出過程
Contrasting tapping processes from the magma chambers of the 17 cal. ka BP eruption of Nantai volcano, NE Japan

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Nantai volcano, located on the volcanic front of NE Japan, has been characterized by intermittent plinian and subplinian eruptions since its birth (Yamasaki, 1957; Akutsu, 1979; Muramoto, 1992; Suzuki et al., 1994), and the latest and largest one occurred at 17 cal. ka BP (Nakamura et al., 2011). The eruption sequence of the 17 cal. ka BP eruption is complex, being initiated with scoria fallout (Nantai-Imaichi tephra) and subsequent scoria flow (Sizu and Takanosu pyroclastic flow deposits) followed by pumice fallout (Nantai-Shichihonsakura tephra) and terminated by the generation of pumice flows (Arasawa-Ryuzutaki pyroclastic flow deposits) (Ishizaki and Morita, 2011). Our previous studies on the geochemistry and mixing/mingling relationships of the juvenile materials have revealed that two dacitic magma chambers (tholeiitic one and calc-alkaline one) fed the 17 cal. ka BP eruption products (Ishizaki and Kureyama, 2004). In addition, petrologic evidence have shown that the initial scoria eruption was triggered when mafic magma intruded the tholeiitic dacite chamber; then, emptying of the tholeiitic chamber and the new mafic replenishment led to successive eruption of the adjacent calc-alkaline chamber. Our new componentry data show that the tapping processes differ between the early scoria eruption and the later pumice eruption. During the scoria eruption, homogeneous phenocryst-poor chamber dacite (64.6-67.4 wt.% SiO2) was first tapped by the plinian phase from the main portion of the preexisting magma chamber. As eruption proceeded, less-evolved, replenished andesitic magma (53.6-54.5 wt.% SiO2) was tapped from the deeper part of the chamber, forming the uppermost part of the scoria-fall deposit and the overlying scoria-flow deposits. A similar eruption sequence from the chamber dacite to the replenished andesite has been reported for many other plinian-related eruptions (e.g., the 1912 eruption of Katmai; Hildreth, 1983). In contrast, during the later pumice eruption, relatively less-evolved hybrid magma (59.1-60.8 wt.% SiO2) was first tapped by the plinian phase. As the eruption proceeded, more-evolved, phenocryst-rich chamber dacite magma (64.4-65.7 wt.% SiO2) was tapped, forming the main part of the pumice-fall deposit and the overlying pumice-flow deposits. A similar eruption sequence has been reported for some other plinian-related eruptions (e.g., the 1929 eruption of Hokkaido-Komagatake; Takeuchi and Nakamura, 2001), suggesting that eruption of a mixed magma is a precursor of phenocryst-rich chamber dacitic magmas. The complex magma tapping processes and the resultant eruption sequence (i.e., dacitic precursor to andesitic successor vs. andesitic precursor to dacitic successor) may be controlled by the density contrast between the chamber dacite magma and the replenished mafic magma.

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