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# Eruption sequence and the magma chamber system of the 12 ka eruption episode of Nantai volcano, NE Japan

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Major and trace element data on 69 juvenile pyroclasts, lavas, and magmatic enclaves of the 12 ka eruption episode of Nantai Volcano, NE Japan, and their petrography have been used to obtain more detailed information about processes taking place in crustal magma chambers associated with explosive arc volcanism. The 12 ka eruption episode was initiated with scoria fallout (unit B) and scoria flow (unit C) followed by pumice fallout (unit D) and pumice flow (unit E), and terminated by the extrusion of a heterogeneous dacite-andesite mingled lava flow (unit F). Four distinct dacite-andesite linear compositional variations are identified on several Harker diagrams, which correlate with the products of the scoria-fall eruption (unit B), scoria-flow eruption (unit C), pumice eruption (units D and E), and lava eruption (unit F). These linear variations are interpreted on petrographic grounds to be mixing lines between two dacite end-members and at least four mafic end-members.

The early scoriae are phenocryst-poor (~3-15 vol.%) tholeiitic dacite and andesite (58.7-65.8 wt.% $SiO_2$) with an anhydrous phenocryst assemblage (pl + opx + cpx + oxides +/- ol). Chemical trends of the whole-rock of the unit-B and unit-C samples on the several Harker diagrams converge around ~66% $SiO_2$, suggesting that the dacite rocks are identical to each other. On the other hand, mafic rocks from the unit B plot separately from those of the unit C, suggesting the mafic end-members of the units B and C are different to each other. .

Unit D-F eruptives are porphyritic calc-alkaline dacite and andesite (54.2-66.4 wt% $SiO_2$) with a hydrous phenocryst assemblage (pl + amp + qtz + opx + cpx + oxides +/- ol). The products erupted between unit D and F show evidence of mingling and mixing. The felsic end-member has invariably a dacitic composition (~67 wt.% $SiO_2$) whereas a large variability occurs in the mafic end-member; the mafic end-member of units D and E is more MgO- and Ni-poor than the unit-F mafic end-member. Although major and trace elements are similar in all dacites erupted between unit D and F, there are considerably differences in phenocryst contents: unit-D and unit-E dacites have lower phenocryst contents (~20 vol.%) whereas unit-F lava has higher phenocryst contents (~40-50 vol.%). The unit D-E dacite (pumice) and the unit-F dacite (lava) may have been derived from different parts of a magma chamber, perhaps from inner melt-rich and marginal mushy parts, respectively.

In summary, the geochemistry and mixing/mingling relationships indicate two dacitic magma chambers (tholeiitic dacite chamber and calc-alkaline dacite chamber) fed the 12 ka eruption products. Probably 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. Whole-rock chemical composition of the latest dacite of the Bentenkawara pyroclastic flow deposit (Miyake et al., 2006) are similar to those erupted between unit D and F of the 12 ka eruption episode. The dacitic magma existing prior to the latest magmatic eruption would be the residuum of the calc-alkaline dacite magma chamber of the 12 ka eruption episode.