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Translithospheric magma pluming system of an intraplate volcano: A case study in NE China

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The research of magma plumbing system on volcanoes mainly focuses on present subduction zone, whereas a few focuses on magma plumbing system on intraplate paleo-volcanos. A late Early Cretaceous volcano in NE China provides an opportunity to construct magma pluming system of an intraplate paleo-volcano. The Ar-Ar dating and zircon U-Pb dating results indicate that the basalts and andesites contemporaneously formed (102Ma and 103Ma, respectively). The olivine basalts and hornblende andesites have SiO_2 of 48-50 wt.% and 61-66wt.%, respectively, and exhibit parallel REE distribution patterns and arc-type geochemical signature. These features imply that the basalts and andesites have independent origin. The plagioclase phenocrysts in hornblende andesites have two types, one has normally zoned structure (An = 62-59-50-49) with abnormally high An rims (60-63), similar to those of plagioclase in the coeval basalt matrix, the other has An=27-34 with abnormally high An (ca. 44) rims. These features suggest that the injection of mafic magma into acidic magma chamber had happened. The olivine phenocrysts in the basalts and orthopyroxene phenocrysts in hornblende andesites have Mg# values of 80-86 and 80-82, respectively, implying that their crystallization happened in mafic magma chamber. Amphibole phenocrysts in hornblende andesites display oscillatory zoning and have Mg# values of 59-72. P-T estimations of orthopyroxene and hornblende pehenocrysts are 6.69-8.47kbar and 1206-1222℃ and 1.37-2.25kbar and 906-982℃, respectively, revealing that mafic and acidic magma chambers are located in 24.1-30.5 km and 5.2-8.5 km, respectively. Thus, we conclude that the geochronology, phenocryst mineralogy, and whole-rock geochemistry from the coeval basalts and andesites reveal a translithospheric magma pluming system of an intraplate paleo-volcano, i.e., a mafic magma (derived from partial melting of lithospheric mantle) chamber located in crust-mantle boundary, and its underplating resulting in partial melting of the lower crust, and then producing an acidic magma chamber located in the upper crust and multiple injections of mafic magma into acidic magma chamber, which is also supported by present geophysical observation.

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