Nature of magma storage system beneath the Damavand volcano (Iran)

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One of the main parameters controlling magma properties and eruption style of volcanoes is the depth of magma chamber. Therefore its estimation is critical to the evaluation of hazards associated with the future eruption in both active and quiescent volcanoes. This study focuses on petrological studies and combining to literature geophysical models to infer levels of magma storage in Damavand quiescent stratovolcano that is situated near the most populous regions of Northern Iran. This alkaline intraplate volcano is located in Central Alborz Mountains, one of the most active tectonic regions of Iran. Last magmatism dated back to 7300 year; however, fumarolic activity, warm springs and surface thermal anomalies revealed from our remote sensing study indicate existence of hot body beneath the volcano. Main lithology of building cone lavas include trachyandesite-trachyte with minor alkali olivine basalt erupted as cinder cones in southern flanks. Compositional data were acquired from ternary feldspar, two pyroxene and olivine crystals using EPMA analysis as well as from whole-rock samples using XRF and several geobarometers were employed. Results for alkali olivine basalts suggest the final pressure equilibration range of 8-10 kb (28-35km) that is correspondent with crystallization in lower crust (the thickness of crust in Central Alborz geophysically estimated 58±2 km and locally in the region beneath the volcano is 67 km). Phenocrysts in trachyandesite-trachyte lavas of old cone remnants record dominant pressure range of 4-6 kb (15-22 km) that is nearly consistent with elderly crystallized magma chamber geophysically imaged at 20 km depth. Results from young lavas of new cone indicate two level of storage, 4-6 kb and 0.6-3kb (2-11 km). Integration of Geophysical studies (siesmic, local earthquake tomography, magnetotelluric) have revealed two hot magma chamber beneath the young cone, the shallowest of which lies at 3-4.5 km depth and another at 6-8 km. However, petrological results proposed more wide range of levels of magma storage. Comparison of barometric results based on age of lavas show that preferential magma ponding levels changed and migrated upward through time. Also multi depth magma reservoirs may account local thickening of crust below the volcano region.