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Aragats stratovolcano in Armenia - volcano-stratigraphy and petrology

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In this contribution we discuss the geological structure and volcano-stratigraphy of the Quaternary Aragats stratovolcano in Armenia based on recent age determinations as well as petrological and geochemical features of magma generation processes specific for collision zones.
Armenia is situated in the NE part of the Anatolian-Armenian-Iranian plateau, an intensely deformed segment of the Alpine-Himalayan belt. The complex geological structure of the region is represented by a mosaic of tectonic blocks comprising fragments of volcanic arcs, continental crust and exhumed oceanic crust. Collision of the Arabian plate with the Eurasian margin in early Miocene resulted in orogenic uplift associated with intense volcanism. Aragats (4090m) is one the largest volcanoes in the entire region and produced central vent (inc. Plinian VEI>4) and monogenetic type flank eruptions and periphery plateaus within a total area greater than 5000 km2, known as Aragats volcanic province (AVP). The Aragats volcanic province (AVP) comprises the composite cone of Aragats volcano, the peak of which is built on a summit plateau, ∼45 km in diameter shield structure with dozens of flank vents, scattered monogenetic cinder cones on the adjacent volcanic plateaus as well as the neighboring stratovolcano Arailer. New K-Ar and 40Ar/39Ar age determinations of groundmass and separated plagioclase samples indicate that volcanism at AVP began ∼2.5 Ma, while most recent volcanic activity is 0.49 Ma for Plinian eruption of dacites from Irind flank vent and basaltic trachyandesite lava flows from Tirinkatar (0.48-0.61 Ma), Kakavasar, (0.52-0.54 Ma) and Ashtarak (0.58 Ma) monogenetic flank centers, as well as trachyandesites of Jrbazhan volcano on the summit plateau of Aragats (0.52 Ma).
Based on bulk rock geochemical data (major, minor and low abundance trace elements, Sr and Nd isotopes) and mineral chemistry, we conclude that volcanic rocks of AVP are largely recording a complex mixing between deep asthenospheric mantle and remnants of subduction-modified and metasomatically enriched mantle sources, followed by fractionation in large magma chamber(s). Mineral-melt equilibria studies reveal dry (<1%H_2O) and very hot source, fluid inclusions study reveal pronounced enrichment with CO_2 over H_2O in fluid phase. Noteworthy are high eruption temperatures compared to global volcanic arcs, explaining the very long (up to 25 km) and thick (>200m) trachydacitic lava flows.