Petrogenesis of Neogene polymagmatic suites at a monogenetic low-volume volcanic province, Bahariya depression, Western Desert, Egypt

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Monogenetic volcanoes can yield eruptive suites displaying substantial complexity in compositional characteristics. The Bahariya monogenetic volcanoes (BMV) in the Western Desert, Egypt are good example. The architecture of the BMV is the product of two alkali magma batches: pyroclastics and lava flows forming explosive scoria cone (batch 1) and

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subvolcanic sills (batch 2). The two batches have contrast in the concentrations of incompatible trace elements and REE as well as element ratios such as Nb/Yb, Gd/Yb, Nb/U, and Ce/Pb (36, 5.0, 44, 30 vs. 17, 4.0, 39, 24 for batch 1 & 2, respectively). Batches 1 and 2 share common LILE and LREE enrichments and HFSE depletions, analogous to a HIMU-like, mantle-derived OIB source. Trace element modelling proposes a derivation of the Bahariya volcanoes from parental melts generated by 8-12% partial melting of garnet lherzolite and amphibole-bearing garnet lherzolite at 2.18±0.33 and 1.77 ±0.33 GPa for batch 1 and batch 2, respectively across the lithosphere–asthenosphere boundary at c. 70– 90 km-depth (2.14–2.76 GPa). These sources

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had been earlier metasomatized by a volatile-, LILE- and HFSE-rich fluid(s) originating from Neoproterozoic subduction or a Phanerozoic plume. Data results of the geo-barometric computations disclose two magma storage levels involving an intermediate to lower crustal levels at c. 35 km (1.05 GPa) for batch 1 and mid-crustal level at c. 25 km-depth (0.75 GPa) for batch 2. This study delivers proof that magmas emitted at Bahariya depression can undergo complex polymagmatic processes during their storage and passage in the crust, mainly due to the existence of a multilevel plumbing system. The origin of the BMV, as with other within-plate volcanoes in North Egypt, appears to be allied to extension-induced asthenosphere upwelling activated by

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limited exclusion of thickened lithospheric root under a passive rift tectonic regime coupled with the development of lithospheric thinning and continental breakup in North Africa.