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INVESTIGATING PETROLOGIC INDICATORS OF MAGMATIC PROCESSES IN VOLCANIC ROCKS

Intrinsic conditions of magma genesis at the Lunar Crater Volcanic Field (Nevada), and implications for internal plumbing and magma ascent†

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Abstract

The northern part of the Lunar Crater Volcanic Field (central Nevada, U.S.A.) contains more than 100 Quaternary basaltic cones and maars and related eruptive products. We focused on four informal units of different ages and locations in the field to test the compositional variability and magma ascent processes within the time span of an individual eruption and the variability between very closely spaced volcanoes with different ages. Based in whole-rock chemistry, mineral chemistry and the calculation of intrinsic properties (pressure, temperature, and oxygen fugacity) we found that individual magma batches were generated in the asthenospheric mantle from a heterogeneous garnet lherzolite/olivine websterite source by ~3–5% partial melting. Each magma batch and temporary deep reservoir was a separate entity rather than part of a continuous long-lived reservoir. Magmas ascended relatively fast, stalled and crystallized in the uppermost several kilometers of the mantle near the base of the crust and some also stalled at mid-crustal levels with minor or no geochemical interaction with surrounding rocks. Our data also suggest that volcanoes erupting within certain time windows had similar source characteristics and ascent processes whether they were located within a few hundred meters of each other or were separated by many kilometers.

Keywords: Lunar Crater Volcanic Field, monogenetic volcanism, whole-rock chemistry, mineral chemistry, geothermobarometry