Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.37077

Mingled Basanite - Carbonatite in Maale Ramon Vent, Negev Desert, Israel: Melt Immiscibility or Carbothermal Alteration?

ITAMAR ISRAEL KEREN, HARAN HENNIG, BAR ELISHA AND **YARON KATZIR**

Ben Gurion University of the Negev



Fig. 1

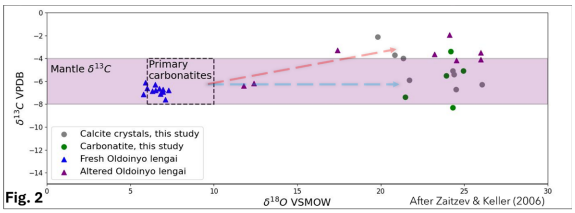


Fig. 2

Most carbonatites occur in cratons and are associated with alkaline igneous rocks. Located in a passive continental margin lying on top of lithosphere of average thickness, the Levant area hardly contains any carbonatite occurrences. However, our study of the Early Cretaceous intraplate magmatism in the Negev Desert, Israel, revealed closely associated basanitic and carbonatitic rocks in Maale Ramon Vent (MRV). A sub-vertical wall of quartzite and horizontal basaltic columns at the contact against sedimentary country rocks rimming the igneous exposure define a vent-like structure and indicate the hypabyssal nature of the rocks exposed within it. The sub-volcanic exposure includes purple to grey carbonate rich rock in complex irregular contact with greenish altered basanite, and the two mingled rock types are crossed by coarse-crystalline calcite veins (Fig. 1).

'Carbonatite' thin sections show vermicular or globular intergrowth of fine-grained carbonate and silicate domains, comprising calcite and K-feldspar-magnetite-apatite, respectively. Altered basanite hosts concentrically zoned ocelli: calcite – baryte core is surrounded by spherulite-bearing silicate glass, whereas ocelli rims are dominated by K-feldspar. The co-occurrence of K-feldspar rich (phonolite) domains and carbonate-rich domains within basanite-hosted ocelli and in 'carbonatite' groundmass may provide unique evidence for immiscibility of evolved alkaline melt, potentially leading to REE enrichment [1]. Alternatively, the petrographic evidence may be interpreted in terms of carbothermal calcite, precipitated from CO_2-rich magmatic fluids, filling vesicles and cementing basanite.

Carbon isotope ratios of calcite from carbonatite groundmass and coarse-grained veins of MRV, $\delta^{13}C$=-2 to -8‰ (PDB), are mostly within the mantle $\delta^{13}C$ range (Fig. 2). Nonetheless, $\delta^{18}O_{Cc}$ values range from 20 to 26‰ (SMOW), indicating exchange with aqueous solutions, which have interacted with marine carbonates. U-Pb calcite age of 115 ± 8 Ma (n=94) overlaps the age of volcanism, suggesting that if calcite had been either altered or recrystallized, water rock interaction should have occurred during or shortly after magma emplacement. Recent melt-inclusion study of the Ramon volcanics revealed abundant CO_2-rich (≤ 3wt%) alkaline magmas, favouring carbothermal origin for the MRV mingled 'carbonatite' – basanite association, shortly followed by interaction with heated groundwater.

[1] Anenburg, M., Broom-Fendley, S., & Chen, W. (2021), *Elements*, 17, 327-332.