Contrasting petrogenetic evolution of contemporaneous Quaternary rhyolites of the eastern Snake River Plain and Blackfoot volcanic fields, SE Idaho

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The ~1500 km² Blackfoot volcanic field (BVF) is a region of Quaternary bimodal basalt-rhyolite volcanism that has infilled parts of two northwest-trending late Cenozoic grabens, adjacent to the southern margin of the eastern Snake River Plain (ESRP). Diachronous clusters of compositionally and mineralogical similar high-silica, pl+sa+bt+hb-bearing (76.8% SiO₂) rhyolite domes occur in the northern and central parts of the field (1.5 Ma and 0.05 Ma, respectively). The BVF volcanic domes overlap broadly in age and in most compositional characteristics with Quaternary ESRP rhyolite domes. However the BVF domes are distinguished in some major- and trace-element concentrations (higher quantities of Cs, Rb, Th, U and lower quantities of FeO*, La, Zr, Ta and Hf), by more evolved initial Sr- and Nd-isotopic ratios (~0.7098 and eNd = -12 to -11, respectively), and by hydrous-mineral-bearing assemblages (sa > pl > bt, hb). Mineral thermobarometry and melt inclusion data indicates that BVF rhyolites equilibrated at P = ~350 MPa, T = 760°C, and XH₂O ~ 4%. EC-RAF and MELTS modeling indicates that the rhyolites evolved primarily by fractional crystallization from a mafic parent, accompanied by ~20% assimilation of upper crust. Basaltic magmatic enclaves within the rhyolites suggest that the eruptions occurred in response to basalt magma injection. We propose that, like ESRP, genesis of BVF Quaternary rhyolites occurred primarily by polybaric fractionation of basaltic parental magmas - albeit with a higher fraction of assimilant owing to less refractory crustal country rocks. Magma mixing and assimilation appear to play recurring, but variable and subsidiary roles.