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Perspectives on magma source variations in Central-Southern Italy from mineral chemistry

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Pliocene-Quaternary magmatism in Central-Southern Italy is characterized by a wide compositional range of silica saturated and undersaturated rock series, virtually all of which are enriched in potassium to variable extents. Despite the dominance of subduction-related geochemical signatures, the precise geodynamic controls of magmagenetic processes remain under debate. A rigorous mineral chemical analysis of primary liquidus assemblages has been carried out on the complete spectrum of magmas, enabling identification of mantle sources in greater detail than has been possible from bulk-rock chemistry till date. Studied samples, covering the provinces between Vulsini and Vulture, virtually all contain primitive (Mg# $>$90) olivine and clinopyroxene, testifying that host magmas were in equilibrium with a mantle source. CaO contents of both phenocrysts generally correlate with the level of potassium enrichment in host lavas, as do incompatible trace element patterns of co-existing clinopyroxenes. Primitive lavas of Potassic (KS) and High Potassic (HKS) series carry olivines with a wide range of CaO contents (0.15 - 0.6 %) at constant Mg#. Olivines in HKS are always richer in CaO than those in KS, but contrasts between the two series vary from one magmatic province to another. Olivine phenocrysts in lamproitic rocks extend this range down to ˜0.1% and those in lavas with kamafugitic affinities up to ˜1% CaO. Correlation between CaO in olivine hosts and Cr# of spinel inclusions from KS-HKS in the Roman Province suggests that MORB type mantle sources (Cr#˜0.4) were progressively modified by metasomatic agents that were also responsible for potassium enrichment and accompanying elevation of Ca activity in melts. "Refractory" Cr# signatures of 0.7-0.8 in most HKS spinels can therefore be attributed to metasomatic enrichment rather than to the nature of the original mantle. In contrast, absence of such systematics and spinel Cr# of 0.7-0.8 are consistent with more refractory sources

for HKS at Vesuvius and Vulture, whereas those of KS-HKS in the Southern Latium Province tend to be transitional between distinct mantle domains to the north and south. Mineral chemistry of early-crystallized phases thus corroborates evidence for the involvement of compositionally different primary melts on a regional scale. Our findings fit into the context of post-collision geodynamics, with laterally distinct "Ionian" and "Adriatic" domains for both the metasomatic agent and the nature of the original mantle. Strong heterogeneity within individual centers also demonstrates the involvement of multiple mantle lithologies on a local scale, whereby mixing may have occurred within sources or between primitive melts.