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Distribution and partitioning of trace elements during crustal anatexis: a LA-ICP-MS study of metapelitic enclaves within El Hoyazo dacite, SE Spain

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The El Hoyazo volcano is located in the Neogene Volcanic Province (NVP) of south-eastern Spain, consists of a pipe and surrounding block lava, and is composed of peraluminous (ASI≈1.5) dacites. Dacites contain frequent enclaves (≈ 1-2 volume %) of mainly anatectic metapelites and gabbros/basalts (Zeck 1992). One of the main types of metapelitic enclaves, the Grt-Bt-Sil type (Zeck 1970), represents fragments of middle-to-lower continental crust, partially melted at ∼800-850^{o}C and 5-7 kbar, depleted in a granitic component after melt extraction, and brought to surface from a partially molten state within the host dacites ≈ 6 Ma ago (Cesare et al. 2003). Grt-Bt-Sil enclaves are composed of Pl (35-45 vol. %), Sil and glass intimately intergrown (25-35%), Bt (5-15%), Grt (5-10%), glass (former melt phase; 5-10%), Crd (1-5%), Gph (1-2%), Afd (1-2%), and accessory minerals (Apt, Ilm, Mnz, Zrn; <1%). Silicate glass is present in the rock matrix and within most of minerals as melt inclusions (MI). Melt abundance before segregation has been estimated to be ≈30-55% (Cesare et al. 1997). EMP analyses of glasses yielded leucogranitic compositions with small but systematic differences among each textural location (Acosta-Vigil et al. 2007). Recent LA-ICP-MS analyses of glass show differences in trace element composition among each textural location as well. Trace element partitioning during anatexis of enclaves occurred as follows. **Li**: Crd≥melt≥Pl>Bt. **Rb**: Bt>melt. **Cs**: melt≥Bt>Crd. **Be**:Crd>>melt. **B**: melt>Pl>>Bt. **Sr**: Pl>>Afd≥melt. **Ba**: Afd>Bt>>melt≥Pl. **Sc**: Grt>>Bt>>melt. **V**: Bt>>Grt. **Cr**: Bt>>Grt>Pl>melt. **Co**: Bt>Grt≥Crd. **Ni**:

Bt>>Crd≈Pl. **Cu**: Bt≈Pl>melt. **Zn**: Bt>Crd>Grt≥melt. **As**: melt>>Pl. **Nb**, **Ta**: Bt>>melt. **Y**, **Zr**, **Hf**, **U**, **Th**, **REE**: accessory phases (Mnz, Apt Zrn). Considering the above modal abundance of phases in the enclaves, trace element distribution during anatexis occurred as follows. **Li**: melt>Pl>>Bt. **Rb**: melt>Bt. **Cs**: melt>>Bt. **Be**: Crd≈melt. **B**: melt>>Pl. **Sr**: Pl>>melt. **Ba**: Bt>melt>Pl≈Afd. **Sc**: Grt>Bt≈melt. **V**: Bt>>Grt. **Cr**: Bt>>Pl>Grt≈melt. **Co**: Bt>>Grt>melt. **Ni**: Bt>>Pl>melt. **Cu**: melt≈Pl>Bt. **Zn**: Bt>melt>>Grt≈Crd≈Pl. **As**: melt>>Pl. **Nb**, **Ta**: Bt>melt. **Y**, **Zr**, **Hf**, **Th**, **U**, **REE**: accessory phases>>melt, except for Y and HREE hosted also to some extent in Grt (">" means approximately double, ">>" means approximately one order of magnitude larger). Hence, with respect to the starting source rock melt was largely enriched in Li, Cs, B and As, moderately enriched in Rb, likely with comparable concentrations in Be, moderately impoverished in Ba, Sc, Cu and Nb, and largely impoverished in Sr, V, Cr, Co, Ni, Zn, Y, Zr, U, Th and REE. Calculated Zrn and Mnz saturation temperatures are ≈100-200^{o}C lower than those obtained from conventional geothermometry, and for many MI are even lower than the wet granite solidus. The disagreement may be explained by rapid melting and melt solidification right after (i.e. short-lived melting event), and/or armoring of Zrn and Mnz in restitic major mineral phases, and/or rapid (re-)crystallization of restitic phases and armoring of melt in MI.