Tracing multiple metal sources in a regional plumbotectonic model of the Cycladic Mineral District, Greece

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The Hellenic volcanic arc system in Greece is a natural laboratory to investigate recent and active hydrothermal systems in an attempt to understand metal sources that are accessed within a rapidly evolving geodynamic framework. Subduction of the African plate beneath continental Europe created an extensional back-arc setting accommodated by low-angle, shallow crustal detachments, hosting economically viable mineral deposits that are temporally and spatially associated with Miocene granitoids. In the western Cyclades a low temperature base-metal sulfide composition (Gn, Py, Sp, minor Ccp) is found in Miocene carbonate replacement (e.g. Lavrion District) and skarn deposits (e.g. Serifos), as well as in Quaternary intermediate sulfidation epithermal deposits (e.g. Milos) along the active volcanic arc. Sub-epithermal steeply dipping quartz- and barite-veins in the eastern Cyclades (e.g. Tinos, Antiparos, Mykonos) show a similar ore mineral assemblage; however, the overall concentration of base-metal sulfides is lower. A complete survey of galena occurrences from the Lavrion peninsula in the north, across the Cycladic Islands to the active volcanic arc in the south has been carried out. Existing Pb-isotope data on galena compiled from archaeometry studies, reveal significant differences in Pb sources, showing lower $^{206}Pb/^{204}Pb$-ratios of galena from mineral occurrences in the eastern Cyclades (<18.85: Tinos, Syros, Antiparos) than in the western Cyclades (>18.85: Lavrion, Serifos, Kea, Milos). Galena from Sifnos shows the lowest Pb-ratios (~18.73) and Santorini, along the active volcanic arc, the highest Pb-ratios (~18.97). It appears that a regional metal source with a radiogenic Pb-signature formed the mineral occurrences in the volcanic arc and back-arc of the western Cyclades. On the other hand, multiple metal sources with a less radiogenic and heterogenic Pb-signature formed the deposits in the eastern Cyclades. A regional plumbotectonic model constrained by new LA-Q-ICP-MS Pb-isotope analyses, in combination with the trace element signature of galena from mapped vein systems, will provide new insight into the spatial and temporal variation in crustal sources of Pb in the evolving volcanic arc to back-arc system.