

Metal resource potential of modern sea-floor massive sulfides at Kolumbo shallow-submarine arc-volcano (Santorini), Greece

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A potential target setting for Europe to secure sustainable access to precious and modern technology metal resources is modern sea-floor massive sulfides (SMS) located on submarine arc-volcanoes. EPMA and LA-ICP-MS analyses of SMS from Kolumbo, the only known SMS deposits associated with thinned continental margin volcanism [1], show that pyrite, galena, sphalerite and Pb-Sb-sulfosalts are variably enriched in minor metal (loids) (MLS) like Au, Ag, Hg, Sb, Tl, As, and Cu; spiky intensity peaks in LA spectra confirm the presence of submicron-sized MLS-bearing mineral particles. SIMS pyrite sulfur isotope analyses, $\delta^{34}\text{S}_{\text{py-SIMS}} = -4.09$ to $+1.89$ ‰, sea-floor degassing of boiling CO₂-rich fluids, mantle-like ³He/⁴He ratios [2], MLS volatility behavior [3], and, Sr-Nd-Hf-Pb isotope constraints [4], together demonstrate that Kolumbo is tapping an enriched mantle source and suggest that mantle volatiles/MLS may play an important role in the MLS endowment on and below Kolumbo's seafloor.

- [1] Kiliyas et al. (2013) *Sci. Rep.* **3**, 2421 [2] Rizzo et al. (2016) *Sci. Rep.* **6**, 28013 [3] Saunders and Bruesseke (2012) *Econ. Geology* **107**, 165–172 [4] Klaver et al. (2016) *Geochem Geophys, Geosyst* **17**, 3254-3273.