

Post-subduction porphyry mineralisation – triggers and magma sources

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Subduction zones and their associated porphyry Cu-Mo deposits (PCDs) in continental settings are often considered in terms of Andean-type orogenies, with magmas generated in a compressional regime via fluid-fluxing of the metasomatized sub-arc mantle. PCDs are also found in regimes where subduction is still active, sluggish, or ceased altogether, but involve significant extension, often as the result of slab rollback, slab tears, and/or slab detachment [1, 2]. This tectonic environment would have a limited role for fluid-fluxing; instead, magmas are generated from partial melts of metasomatized lithospheric mantle, melting of hydrous cumulates from earlier subduction, and/or asthenospheric upwelling.

Where back-arc post-collisional extension is a major cause of magma generation, magmas range from calc-alkaline to shoshonitic. These magmas are commonly referred to as post-subduction, even though subduction can still be ongoing, if in a minor, limited way. In this post-subduction environment, magmas are an important source of mineralisation in porphyry Cu-Au deposits, which notably host significant amounts of critical elements such as Te, and PGE [2].

The Aegean is host to multiple post-subduction magmatic centres and associated PCDs, in tandem with contemporary subduction-related magmatism. It has a well-established but complex tectonic and geodynamic evolution that spans ~35 Myr of magmatism related to subduction roll-back and subsequent extension, making it an excellent natural laboratory to study magma sources and petrogenesis behind post-subduction PCDs.

The island of Lesvos in NE Aegean hosts porphyry Cu mineralisation and barren volcanism. This study reports new U-Pb/Hf data from a sample suite from Lesvos, including porphyry intrusions. The results show progression to more crustal signatures from the barren caldera volcanism, through host rock, the porphyry sample, to the late-stage lava dome. These results are contrary to the hypothesis that post-subduction mineralisation in the Aegean is sourced from mantle sources, with “barren” magmatism sourced from crustal sources [3].

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[1] Richards (2009), *Geology* 37, 247-250.

[2] Holwell et al. (2019), *Nature Communications* 10, 3511.

[3] Schaarschmidt et al. (2021), *Geochemistry, Geophysics, Geosystems* 22, e2020GC009565.