Zircon-Hosted Melt Inclusions in Porphyry Systems

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Porphyry copper deposits (PCDs) are magmatically-derived geochemical anomalies that concentrate economic quantities of metals in the crust. It is generally agreed that PCD formation requires highly fractionated hydrous arc magmas, oxidised conditions and the exsolution of magmatic volatile phases (MVPs) which extract Cl, S and metals from the magma leading to ore precipitation. Studies have used fluid inclusions to track ore-metal element partitioning between silicate melts and MVPs; however, there is a significant gap in our understanding of the metal and volatile budgets of the parental, pre-mineralisation porphyry magmas.

Melt inclusions hosted by quartz[1,2], plagioclase[2] and pyroxene[2] have been used to determine porphyry melt compositions. Such studies are limited however, as corrosive magmatic-hydrothermal fluids associated with porphyry intrusions frequently destroy primary mineral assemblages and alter whole-rock compositions. This alteration prohibits determination of parental melt compositions, a key parameter in understanding ore-forming systems.

Zircon is ubiquitous in evolved porphyry intrusions, and with its refractory nature and insolubility in acidic fluids, it makes an ideal mineral host for melt inclusions. We have recently identified abundant glassy and crystalline melt inclusions (1 – 200 μm) in zircons from porphyry intrusions in Chile, which will form the basis of this study. We propose that melt inclusions within zircon represent vestiges of the late porphyry melt and may be analysed to establish the initial magmatic volatile contents, chemistry and therein intensive parameters (P, T, fO_2) of these parental magmas. To our knowledge, there are no published data on the use of zircon-hosted melt inclusions in the context of PCDs, but these inclusions are promising recorders of processes occurring during the magmatic stages of PCD evolution.

[1] Student and Bodnar (2004), *TCM* **42**, 1583-1599.
[2] Halter *et al.* (2005), *MD* **39**, 845-863.