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Micro- to arc-scale geochemical evaluation of plutonic-volcanic records across the Sunda-Banda Arc

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Magmatic arcs host large explosive eruptions and economic deposits of critical metals such as copper, which accumulates mainly in porphyry copper deposits. Assessing magmatic architecture and processes is important for the development of volcanism and ore deposits. However, variations in magma plumbing architecture across arc systems remain poorly constrained. In this contribution, we propose to evaluate the mineral, geochemical, and textural records of crystal cargoes from active volcanoes along the Sunda-Banda Arc in Indonesia. The Sunda-Banda region hosts several volcanic centres of varying degrees of alkalinity and source components, which could lead to distinct magmatic architectures, volcanic eruptions, and copper fertility. The interplay between geodynamics and active volcanism along the arc enables us to evaluate the magmatic connections between porphyry copper deposits and active volcanoes.

Preliminary geochemical analyses of volcanic whole rock and groundmass samples show that geochemical signatures may be associated with differences in slab depth and transitions in subduction morphology. We propose to further this line of research by analyzing the volatile content and magmatic histories in zoned crystals and volatile-bearing phases to evaluate the copper accumulation potential of rocks from active volcanoes and porphyry copper deposits. Recent advances in micro-analytical geochemical techniques e.g. LA-ICP-MS trace element mapping of magmatic phases, and thermodynamic modelling of storage conditions and volatile systematics, means we can track micro-scale magmatic histories relevant to volcanism vs. copper enrichment.

We will analyze a suite of rocks from several volcanic centres along the Sunda-Banda Arc. Results will be integrated into the macro-scale geodynamic context, requiring multidisciplinary collaboration between volcanology, geochemistry, and geodynamics. Implications of our research can advance not only current understanding on ore mineralization processes, but also volcanic hazard mitigation and crustal dynamics.