

Early sulphide saturation is not detrimental to porphyry Cu-Au formation: evidence from Tongling, China

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The influence of magma metal content on the potential to produce porphyry Cu (-Mo, Au) deposits is strongly debated. Because Cu is chalcophile, early sulphide saturation is usually considered to be detrimental to the mineralization potential. Here we demonstrate based on amphibole-rich cumulate xenoliths and amphibole megacrysts from the Tongling porphyry(-skarn) Cu-Au mining district in SE China that this is not necessarily the case. Age data combined with petrological and geochemical evidence suggest that these samples are fractional crystallization products of mafic magmas that stalled in the middle crust, whereas the mineralizing magmas at Tongling represent the residual liquids after cumulate formation. Importantly, the cumulates and amphibole megacrysts are rich in magmatic sulphides, which sequestered most of the original amount of Cu present in the mafic magmas. That the residual silicate liquids nevertheless were able to produce major porphyry(-skarn) Cu-Au deposits implies that cumulate formation and associated loss of metals did not inhibit their fertility. In fact, the common association of porphyry Cu (-Au) deposits with high Sr/Y magmas suggests that amphibole fractionation at depth even enhances the mineralization potential.