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Potassic magmas are not unusually gold-rich

JIA CHANG[1], ANDREAS AUDETAT[2] AND THOMAS PETTKE[3]

[1]China University of Geosciences
[2]University of Bayreuth
[3]University of Bern

Approximately 40% of the largest Au-rich porphyry and epithermal ore deposits on Earth are related to potassic igneous rocks, which comprise only 5–10% of arc igneous rocks. Hence, potassic source magmas are commonly assumed to have been unusually Au-rich or to have contained high Au/Cu ratios. We obtained Au concentrations and Au/Cu ratios in melt inclusions analyzed from more than a dozen of mafic to felsic potassic igneous rocks worldwide using state-of-the-art laser-ablation inductively-coupled-plasma mass-spectrometry. We also performed piston cylinder experiments to constrain the behavior of sulfides during mantle partial melting and subsequent magma fractionation. The results suggest that mafic potassic magmas contain only 2–7 ng/g Au, despite common sulfide exhaustion during mantle partial melting. Both the absolute Au concentrations and Au/Cu ratios are comparable to those of mafic calc-alkaline magmas. Moreover, Cu/Au ratios vary little during subsequent magma differentiation, because magmatic sulfide precipitation is dominated by monosulfide solid solution that is relatively poor in Au and Cu. In conclusion, the close association of Au-rich ore deposits with potassic magmas is not due to Au enrichment in the magmas that sourced the ore fluids, but rather due to selective Au precipitation mechanisms at the hydrothermal stage.