The connection between high K melts and Au deposits: Evidence from natural and experimental systems

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It has long been suspected that K-enriched melts are efficient carriers of Au. This assumption is the result of clear spatial/temporal associations between Au deposits and High-K (or shoshonitic) intrusives in the deposits of Lihir Island (Muller et al., 2001), Bajo de la Alumbrera, Argentina (Muler and Forrestal, 1998), Quesnilla, BC, Canada (Barrie, 1993) and in the Lower Yangtze region of China (Zhou et al., 1996) and others. However, no direct link has been made between the high K nature of these melts and their Au endowment.

As a test of this hypothesis, we analysed Au by LA-ICPMS in clinopyroxene-hosted melt inclusions from an ore-associated dyke at the Masbate Gold Deposit in the Philippines. Pyroxenes were re-equilibrated at 1100 °C for 24 h in a controlled gas mixing furnace, quenched in water and polished to expose glassy, homogenised ultrapotassic (8–11wt% K2O) inclusions. All inclusions analysed contain high levels of dissolved gold (up to 20 ppm Au).

To independently test this empirical link, we equilibrated hydrous rhyolitic glasses of variable K contents (plus either FeS or NaCl) with Au capsules in internally-heated pressure vessels. At constant water content, temperature, pressure, fO2 (controlled by H–Ar mixtures) the addition of K2O increases Au solubility by nearly an order of magnitude. In runs with FeS only, Au content increased from 0.08 ppm Au (@1.6% K2O) to 0.66 ppm Au (@ 6.1% K2O). These analyses and experiments do not explain the mechanism for increased Au solubility, but they do strengthen the link. Furthermore, in terranes where pervasive alteration obscures primary igneous compositions, melt inclusions may provide the best information, and may provide a valuable exploration tool.

References

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40 Ar/39 Ar dating of Neogene pseudotachylytes

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If fresh, abundant, and formed over a sufficiently long time interval, 40 Ar/39 Ar dating of pseudotachylytes provides a means of assessing the active histories of exhumed faults. Due to the combination of generally low K-content and young formation age, the 40 Ar/39 Ar dating of Neogene pseudotachylyte is analytically difficult. Moreover, interpretation of ages is complicated by different extraneous and radiogenic argon isotope sources reservoirs and by the intimate coexistence of unmelted clasts, neoformed minerals, and frictional glass. High-spatial resolution UV-laser ablation 40 Ar/39 Ar geochronology of pseudotachylytes, together with careful textural and chemical characterization, provides a means of precisely dating these fossil paleoseismic events.

We report results of UV-laser ablation 40 Ar/39 Ar geochronology on Neogene pseudotachylyte from tectonically active areas in Japan and the Swiss Alps. Our data yield age probability plots together with careful textural and chemical characterization, providing the best information, and may provide a valuable exploration tool.