Platinum-group element geochemistry used to determine Cu and Au fertility in the Northparkes igneous suites, Australia

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In this study, we analysed the PGE geochemistry in the barren and ore-associated suites of the Northparkes Cu-Au porphyry region. The concentrations of Pd in the barren suite decrease continuously during fractional crystallization (Fig. 1). This is attributed to early sulfide saturation. Palladium in the ore-associated suite, in contrast, first increases with fractionation then decreases abruptly at 1.2 wt.% MgO (Fig. 1). The sharp decrease is attributed to the onset of sulfide precipitation.

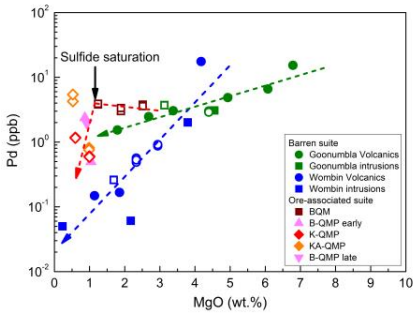

Figure 1: Comparison of Pd against MgO for barren volcanic and intrusive rocks, and the ore-associated intrusions.

We suggest that the early sulfide saturation locked most of the Cu and Au in a sulfide phase in the cumulus pile of a deep parental magma chamber, so that when the magma reached volatile saturation, it did not have access to the Cu and Au. This contrasts with the relatively late sulfide saturation in the ore-associated suite, which was followed shortly afterwards by volatile saturation. The short crystallization interval between immiscible sulfide and volatile saturation allowed some Au and Cu to be stripped from the evolving magma. Gold, with its higher partition coefficient into immiscible sulfide melts, was more affected than Cu. The result is a Cu-Au deposit.