

### **The Significance of the Mineralising Magma Composition on the Diagnostic Exploration Criteria for Porphyry Copper Deposits**

**Ross Large**<sup>1</sup>, Imants Kaverlieris<sup>2</sup>, David Royle<sup>3</sup>, Terry Hoschke<sup>4</sup>

<sup>1</sup>University Of Tasmania, Hobart, Australia, <sup>2</sup>Plus Minerals LLC, Ulaanbaatar, Mongolia,

<sup>3</sup>Consultant, Brisbane, Australia, <sup>4</sup>Consultant, Perth, Australia

Recent research on alteration assemblages of porphyry copper deposits using large multielement datasets has led to the recognition of three groups of porphyry copper deposits: diorite group, granodiorite group and monzonite group (Large, 2025). These groups have different alteration mineral assemblages, Au/Cu ratios, tonnage-grade characteristics and geophysical signatures.

The diorite group, having the lowest K and highest Ca & Fe content of the three groups, constitute around 40% of all porphyries, commonly have an albite-rich copper core zone with biotite but less K-feldspar, and more elevated chlorite, magnetite, pyrite, epidote and actinolite in the copper core than the other two groups. They are the most Au-rich and Cu poor, with about 70% of the global group of Au-rich porphyries ( $\text{Au} > 0.4 \text{ g/t}$ ), and have the lowest mean tonnage of 735 Mt.

The granodiorite group, with higher K and lower Ca & Fe than the diorite group, also constitute about 40% of all porphyries, display moderate K-feldspar alteration in the copper-zone, with outboard sericitic alteration. They have lower mean Au content than the other groups comprising only 10% of the global group of gold-rich porphyries. However, they form 47% of the Cu-rich porphyries ( $\text{Cu} > 0.5\%$ ), all the Cu-Mo porphyries, commonly lack a magnetite-bearing core and have the greatest mean size of 1001 Mt.

The monzonite group (commonly called alkalic) constitute about 10% of all world-wide porphyry copper deposits and display intense potassic alteration in the Cu-Au-bearing core. They comprise about 20% of the global group of gold-rich porphyries ( $\text{Au} > 0.4 \text{ g/t}$ ), have a mean tonnage of 790 Mt, low pyrite content and elevated hematite/magnetite ratio in the copper core.

Ref: Large, RR., in press, Simple graphical tools to understand the relationship between porphyry composition, hydrothermal alteration, mineralogy and copper-gold grades in porphyry copper deposits: Ore geology Reviews