The Geological Footprint of Alteration and Mineralization at the High-Grade Resolution Porphyry Cu-Mo Deposit, Arizona

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The Laramide Resolution Cu-Mo porphyry deposit is one of the world's largest and highest grade hypogene copper deposits. Four major paragenetic stages contributed to copper mineralization. Stage 1 was related to the emplacement of rhyodacite porphyries and magmatic-hydrothermal associated with chalcopyrite and molybdenite mineralization. Stage 2 was associated with the emplacement of inter-mineralization quartz- porphyries and hydrothermal breccias produced chalcopyrite and bornite mineralization with phyllic alteration (white mica - quartz - pyrite - anhydrite - APS). Stage 3 advanced argillic alteration (topaz - pyrophyllite - dickite - kaolinite - APS) was associated with late-stage hydrothermal breccias. Stage 4 produced a leached cap and supergene chalcocite enrichment zone for up to 300 m beneath the Tertiary volcanic rocks. Resolution has a highly productive and strongly telescoped hydrothermal system with multiple paragenetic events adding significant mineralization–a key to high grade hypogene hybrid porphyry-HS deposits.

Distinctive alteration zoning patterns and changes vein types and abundances define a geological footprint to Resolution that extends up to 6 km laterally from the ore zone. There is a transition from distal chlorite (> 4 km) to medium epidote - albite - pyrite (2-4 km) to proximal K-feldspar - biotite alteration (< 2 km). Stage 2 formed deep-seated phengite alteration overprinting potassic alteration in the core of the deposit and transitioned upwards (400 m) to pyrite-rich muscovite alteration. Lateral transitions from phengite outwards to illite – phengite (> 1.5 km) and muscovite alteration assemblages (> 0.5 km) occur around the main 1 km wide phyllic upflow zone that overprinted the potassic-altered core. Stage 3, advanced argillic alteration is restricted to domain of 500-m wide. It is structurally-controlled and overprinted phyllic alteration. Dickite – topaz – zunyite assemblages transitions outwards to kaolinite at 200 m, and hinsdallite transitions upwards at 200 m to svanbergite and woodhousite.