Geology, Geochemistry and Mineralogy of Epithermal gold ores, Moonlight Prospect, Pajingo, North Queensland.

Mineralogical-geochemical study of the prospect, with emphasis on the speciation, textures and distribution of precious metals

Matthew W. Paul[1]

[1]*School of Earth and Environmental Sciences, University of Adelaide, North tce, SA 5000.*

1160405

Supervisor: Nigel Cook

Co-supervisor: Cristiana Ciobanu

Contents

Geology, Geochemistry and Mineralogy of Epithermal gold ores, Moonlight Prospect, Pajingo, North Queensland

Mineralogical-geochemical study of the prospect, with emphasis on the speciation, textures and distribution of precious metals

ABSTRACT

The Moonlight deposit is a recent discovery peripheral to the Pajingo mine, located in the Drummond basin, North Queensland. The study has addressed ores and host rock in four drillcores from the upper part of the epithermal mineralization at Moonlight to determine the mineralogical and geochemical character of the mineralisation and associated alteration. Sampling was focussed on high-grade and sulfide-rich intervals. The chosen approach gave particular focus to the speciation, textures and distribution of precious metals at Pajingo and the implications of the different pyrite textures and mineral chemistry, with respect to both conditions of ore formation and the role of pyrite as a gold carrier.

Moonlight ore is largely located within altered andesites and brecciated epiclastic rocks. Veins, marked by coarse chalcedony crosscut the epiclastics. There is evidence for a sinter above the ores, indicating formation within a sub-basin and for propylitic and argillic alteration alongside the dominant silicification.

Pyrite from both high- and low-grade sulfide-bearing intersections was analysed by laser-ablation inductively-coupled mass spectroscopy. It was found to contain an average of 69.8 ppm Au, suggesting that 'invisible gold' in pyrite contributes significantly to the overall gold balance, even if it is subordinate to visible gold. Au:Ag ratios in analysed electrum varied from 60:40 to 40:60, suggesting that there is some considerable risk of slow-floating Ag-rich electrum. Silver is present as native silver, acanthite (Ag_2S), naumannite (Ag_2Se), polybasite $[(Ag,Cu)_6(Sb,As)_2S_7][Ag_9CuS_4]$, pyragarite ($Ag_3SbS_3$) and minor hessite ($Ag_2Te$), as well as in solid solution and/or inclusions in pyrite.

Pyrite textures observed in the study are diverse and indicate that the epithermal system that generated the Moonlight deposit was complex and possibly multi-phase. Variation in assemblages and mineral chemistry implies substantial evolution in the physicochemical parameters of the ore-forming fluid during the life of the hydrothermal system. LA-ICPMS element mapping of a complex, zoned pyrite grain showed a core enriched in Co, Ni and Sb; onto this is superposed As, Au. Resorbtion and overgrowths indicate that the pyrite has been reworked. A characteristic 'dirty', feathery pyrite is of replacement origin and may have pseudomorphed chlorite that resulted from an earlier propylitic alteration.

No direct evidence was found to substantiate the working mine model in which high-grade 'bonanza' veins are predicted at depth, however observations of lithologies from the level investigated in this study are consistent with the model. The high Ag content of the Moonlight ores, together with a distinct base metal presence (sphalerite, tetrahedrite) could mean that the Moonlight system is more distal to the fluid source than Vera-Nancy and was possibly formed at somewhat cooler temperatures on the flank of the main volcanic system.