Paper Number: 1672

Structural Architecture of the CSA Cu-Ag (Pb-Zn) Deposit – A New Prospective on the Formation of the Cobar Mining Field, NSW, Australia

Kyne, R.[1], Berry, R.[2] and Gemmell, B.[2]

[1] iCRAG (Irish Centre for Research in Applied Geoscience), University College Dublin, Belfield, Dublin 4, Ireland (rkyne@icrag-centre.org)
2 CODES (ARC Centre of Excellence in Ore Deposits), University of Tasmania. Private Bag 126, Hobart, Tasmania, Australia, 7001

The CSA Cu-Ag (Pb-Zn) mine, located 11km NNW of Cobar in central NSW, is one of Australia's highest grade copper deposits. Historically workers have attributed its nearly vertical pipe-like ore bodies to the intersection of two regional faults, the Cobar and the Plug Tank. While the position of the deposit within the hanging wall of the Cobar fault is directly along strike from the Plug Tank Fault there is no observable evidence that these faults intersect both through the geophysics and within the mine site itself. Structural analysis of drill core and underground mapping in conjunction with 3D stress modelling were employed as a means of understanding the controls on mineralization geometrically and spatially) within the deposit and the Cobar region. Analyses showed the presence of folding as well as orthorhombic fault arrays within the deposit which, when activated during regional compression, focused the ore forming fluids into damage zones along the intersections of these faults to form sub-vertical pipe-like ore bodies.

Structural analyses continued on from the work of Jeffries [1], who looked at the top 300 m of the deposit, showed a significant change in regional cleavage from 80°/090° at surface to 80°/264° at depths greater than 300 m. This change suggests that the hanging wall of the reverse Cobar Fault was dragged and rotated as it moved upwards during regional compression. Analysis of three major lineations present within the deposit showed the following: 1. Measured intersection lineation's suggest that the regional S_2 cleavage overprints early folding, 2. Chlorite stretching lineations favour a dip-slip strain history over the widely accepted transpressional regime and 3. Chlorite Slickenlines indicate late strike-slip faulting which overprints all other structural features of the deposit.

To understand the spatial location of the CSA deposit a regional stress model was constructed using Poly3D a boundary elements method (BEM) based program. The effect of the two regional faults (the Plug Tank and Cobar) on the stress fields surrounding the location of CSA were modeled by applying a horizontal σ_1 stress of 200 MPa directly EW. The σ_1 stress was calculated using twinning within calcite grains to determine the palaeostress at the time of peak mineralization. When a σ_1 = 200MPa was applied with an azimuth of 90°, dilation was achieved along the lines of intersection of the orthorhombic fault arrays allowing for the formation of the deposit.

The CSA deposit was found to form epigenetically from hydrothermal fluids migrating up areas of high strain. These areas of high strain formed as a result of regional compression responsible for the formation and activation of orthorhombic fault arrays in the hanging wall of the Cobar Fault. Boundary element modelling showed that the spatial location of the deposit is likely the result of the geometry and movement of the Plug Tank and Cobar faults in response to regional compression producing zones of dilation.

Modelling and regional geophysics have shown that regional faults do not need to intersect to produce the deposits within the Cobar Mining Field, but their geometries can be used as targeting tools for other areas of potential mineralization within the region.

References:

[1] Jeffries, S. (1994) *Unpublished MSc thesis, Australia, University of Tasmania.*