

What Controls the Geometry of Ernest Henry Ore Shoot?

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Ernest Henry Cu-Au deposit represents a blind IOCG breccia pipe plunging south. Here, we recognise boudinage, stretching lineation and folding as important structures governing its linear, pipe-like development. Elongation axes of these structures are consistently parallel to the ore shoot. They underscore a fundamental geometric relationship that must be reconciled within breccia-based models.

Boudinage features include neck veins, foliation boudinage, disaggregation breccia, and small ragged ductile fractures called birdswing veins. Elongate amygdules, phenocrysts and breccia clasts define a stretching lineation aligned with boudin extension axes. High strain zones show streaky elongation banding and L or L-S fabrics. Strain is constrictional. Elongations are up to 400% or more.

Foliation bends from SE-dipping near surface to steeply W-dipping and overturned at depth. Continuous bending defines a broad fold hinge along which the ore shoot is aligned. Ore breccia itself is not a discordant pipe but seems stratigraphically conformable and has a twisted curvilinear shape mimicking the fold hinge. The fold axis is subparallel to boudinage and may suggest transtensional folding with elongation and dilation along the hinge zone.

Deeper down, ore breccia resembles volcanoclastic rock, and the textural distinction between these rocks is blurred. New 3D modelling shows that they occupy the same folded stratum in the volcanosedimentary pile.

In our model, ore breccia development overlapped with syn-boudinage disaggregation and involved metasomatic replacement of 'apparent volcanoclastics' along the fold hinge zone. Evolving rheology contrasts influenced strain and fluid partitioning. Despite alteration complexity, there is strong evidence for geometric continuity of elongation fabrics across the ore breccia. Thus, boudinage and pseudobreccia processes help explain ore breccia, whereas a breccia-pipe per se does not explain the boudinage or fabric continuity.

Our observations are consistent with a fold or flexure-controlled replacement model for Ernest Henry. This draws comparison to neighbouring deposits E1 and Monakoff.