
Hematite/barite alteration in the Owen Conglomerate at North Lyell

IAN HART

Centre for Ore Deposits and Exploration Studies, University of Tasmania

The intense hematite/barite alteration associated with bornite-rich ore at North Lyell transgresses the volcanics / conglomerate contact (the Great Lyell Fault), suggesting that ore deposition and the related alteration occurred after deposition of the Owen Conglomerate (i.e. post Late Cambrian–Early Ordovician). Many authors have accepted a Devonian hydrothermal event coincident with the Tabberabberan Orogeny, remobilising pre-existing Cambrian chalcopyrite mineralisation and forming zones of bornite enrichment in areas where the acidic, reduced volcanic(?) fluids reacted with the oxidised connate waters from the overlying Owen Conglomerate. This appears to have occurred where major conduits (such as the intersection between the Great Lyell Fault and North Lyell Fault) were available to focus the upwelling fluids to this redox front.

The timing of the alteration and mineralisation should be reflected in the extent and type of alteration observed within the overlying siliciclastic Owen Conglomerate and Gordon Limestone Group. Total hematisation of the Owen has occurred in areas adjacent to the Great Lyell Fault (GLF) near North Lyell and Lyell Tharsis, and a progression through to slightly hematitic, relatively unaltered conglomerate may be observed away from the main zone of alteration. Barite occurs within the intensely-altered conglomerate, with whole rock compositions of up to 15% barite which decreases quickly away from the main alteration zone.

Geochemical analysis of samples from the alteration zone shows that there are three main assemblages which define a geochemical signature for the alteration fluids. These include a sericitic dominated assemblage ($\text{Al}_2\text{O}_3 + \text{K}_2\text{O} + \text{Cr} + \text{Rb}$), a phosphate / hematite dominated assemblage ($\text{Fe}_2\text{O}_3 + \text{P}_2\text{O}_5 + \text{La}$), and a barite dominated assemblage ($\text{Ba} + \text{Sr}$). These assemblages may be found within the Upper Owen (Pioneer Beds) and are suspected within the overlying highly-weathered Gordon Limestone. The mineralisation within the Owen, moving away from the GLF, reflects the evolution of the alteration fluids, showing the trend from the volcanic rocks, which exhibit a low–medium pH, low $f\text{O}_2$, sulphide-dominated environment, to the low pH, high $f\text{O}_2$, oxide-dominated red bed environment of the conglomerate.

Chlorite microprobe analyses broadly define a declining temperature of formation away from the volcanic-conglomerate contact, with the high iron content of the rocks (and alteration fluids) being reflected in the chlorite composition. Minor aluminium and iron phosphates have been found replacing euhedral pyrites within the more highly altered Owen Conglomerate. This is thought to represent a modification of the circulating fluids to a more acidic-oxidised mix, rich in hematite and phosphate near the GLF, grading to a more sericitic / hematitic mix away from the fault.