sulphides, in which sphalerite generally predominates, occurring within conformable intercalations of phyllite at a (?) facies change from volcanics to sediments. Some of these sulphides are finely laminated and some of the pyrite is framboidal.

Overall, the geological setting indicates that mineralisation occurred at a time of relatively quiescent extrusive volcanism during development of an explosive andesitic volcano. It is believed to be of exhalative origin, related to hydrothermal activity following extrusion of the lavas, with the sulphides precipitating preferentially in the hot muds close to the flows. Much of the hydrothermal activity was presumably oxidising and accompanied by precipitation of abundant specular hematite. Locally, however, sulphides were precipitated where reducing (solfataric) conditions developed, and where this occurred much of the hematite was reduced to magnetite. Subsequent metamorphism and folding has remobilized much of the chalcopyrite into shears to form the high grade shoots.

GOLD AND PYROPHYLLITE MINERALIZATION IN THE DEVONIAN ACID VOLCANICS OF THE YALWAL-EDEN BELT

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The acid volcanics occur mainly at the base of a gently folded sequence of continental sediments and basic volcanics.

Mineralization of the Yalwal Goldfield is developed in both acid volcanics and the adjacent metasediments. The rocks have been intensely altered to siliceous, aluminous compositions. Auriferous pyrite and rare free gold occur mainly in siliceous alteration zones. Andalusite-rich assemblages represent essentially isochemical contact metamorphism of the altered rocks by a nearby Carboniferous granite. Most of the gold has been won from oxide-clay-rich material near the present topographic surface or a pre-Permian erosion surface.

The pyrophyllite-rich rocks at Back Ck. (and elsewhere in the Pambula district) form lenticular, elongate bodies, near vertical and cross cutting local stratigraphic layering. Host rocks are mostly rhyolitic breccias. A central (commonly schistose) pyrophyllite-rich zone is succeeded outwards by zones dominated by the following assemblages: qtz-Kmica (± pyrite), Kmica-qtz-alb., grading into weakly altered volcanics (qtz-Kspar-alb.-Kmica-chlorite ± epidote). Sulphides are developed in the siliceous-Kmica zone.

Intense local alteration, responsible for the aluminous, alkali-depleted compositions, has occurred prior to the deposition of the overlying sediments and volcanics. Near surface conditions (in the kaolinite stability field) may be inferred for the alteration akin to those presently operative in geothermal/hot spring systems in young volcanic terrains. Large volumes of aqueous solutions passing through fracture zones in the more permeable rocks have produced the alteration zoning by progressive reaction with wall rocks. Cooling and boiling of the solutions as well as oxidation of sulphur-bearing species have influenced the solution chemistry and deposition of auriferous pyrite and gold. Gold has probably been derived from both the acid volcanics and underlying sediments.

The pyrophyllite-bearing assemblages formed during later regional alteration of prehnite-pumpellyite grade ($\sim 300^\circ C$, 1 kb, $a_{H_2O} > 0.3$), the high geothermal gradient involved resembling those of modern regional geothermal systems. Economic gold deposits resulted from supergene processes.

CHEWTON GOLDFIELD AND WATTLE GULLY MINE: A MODEL FOR GOLD-QUARTZ MINERALIZATION IN SLATE BELTS

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The Mt Alexander-Chewton-Fryerstown mineralized belt occurs in a L-Mid Ordovician turbidite sequence ($\sim$ 600 m thick) comprising quartz-rich sandstones, greywackes and slates. On the basis of detailed structural and stratigraphic mapping the region is divided into three N-S trending structural blocks bounded by high angle reverse faults. The strongly deformed western block is characterized by tight folding, strong development of slaty cleavage and numerous westerly dipping reverse faults on eastern anticlinal limbs. This block contains the goldfields.

Pre-granite, auriferous fault- and spur-quartz reefs occur around Chewton, with saddle reefs and spurs more abundant in the older rocks near Fryerstown. The Wattle Gully Mine (Chewton) is developed on massive quartz veins in a steeply west-dipping reverse fault system. Quartz bodies are most voluminous and gold values high where the fault system abuts black, carbonaceous slates. Wall rock alteration is minimal, and assemblages developed (Kmica-chlorite-ankerite) are similar to those in the adjacent slates.

Deposition of quartz and gold from aqueous solutions traversing the fault system has been influenced by mixing with solutions derived from wall rocks — these having relatively high P_{CO_2}, P_{CH_4} etc. due to equilibration with carbon. In this fashion quartz is deposited by decrease in a_{H_2O}, aqueous gold (? chloride) species by reduction, and sulphides through increased activity of sulphide species. Aqueous solutions were close to equilibrium with Kmica-chlorite-ankeritic carbonate.

Metamorphically-layered slates of the district have suffered substantial loss of SiO_2 and redistribution of other components during cleavage development and prehnite-pumpellyite grade regional metamorphism. It seems probable, then, that SiO_2, Au and base metals in the quartz reefs have been derived from the sedimentary sequence through deformation and regional metamorphism, with aqueous transport and deposition controlled by dilative structures (reverse faults, fold hinges) and lithological units such as carbonaceous slates.