ABSTRACT

Thirty square miles of the Haast Schist within The Bendigo area, including the quartz-gold lodes of the Bendigo mining area, were investigated. Although previously mapped as Chlorite IV Subzone of the Greenschist Facies, this area is now considered to be in the Biotite Zone.

Three principal phases of deformation were recognised on the basis of mesoscopic structures. The dominant structures on a mesoscopic scale were produced during the second phase, and are related to a macroscopic Phase II recumbent isocline or nappe facing north-east, with a hinge zone west of the Rise and Shine Shear Zone. This hinge zone is mapped throughout the area. Tectonic profiles indicate that the axial surface of this structure is flexured, although no mesoscopic evidence of this was found.

Two major faults are mapped. The already documented, mineralised Rise and Shine Shear Zone separates schist which has suffered extreme flattening perpendicular to S_2 in the northeast, from schist characterised by abundant tight F_2 folds in the southwest. The Green Valley Fault is here proposed for structural discontinuity in the southwest corner of the Bendigo area. It separates a zone of abundant greenschist and piemontite schist horizons in the southwest, from the more common coarsely laminated, quartzofeldspathic schist in the northeast.

As far as exposure allows, the quartz-gold and quartz-scheelite-gold lodes in the area are described. Fluid inclusions in the lode quartz are studied with a view to elucidating the origin of the mineralised quartz lodes. The undeformed nature of the quartz lodes suggests lode formation occurred after the peak of deformation and metamorphism, i.e. at temperatures and pressures below Biotite Zone metamorphism conditions of 440°C ± 20°. Homogenisation experiments on fluid inclusions produce homogenisation temperatures of 260° - 230°C, but a pressure correction must be added. The lodes are considered to have formed between 350°C and 440°C at pressures between 2 and 4 Kb.

A partial chemical analysis of inclusion fluid is presented, and this suggests that the lodes resulted from passage of dilute saline solutions, in which gold and tungsten were carried as complexions and heteropoly acids, from country schist at grades of metamorphism above the Biotite Zone, through pre-existing or contemporaneous fissures and shear zones. The lodes have been supergene enriched during Tertiary weathering, but the primary, sulphide-rich ore appears to have been concentrated from the original country schist, the concentration factor being of the order of 2000. The vertical lodes have formed parallel to F_2 fold axes, within the hinge zone of F_2 nappes. This may have resulted from the passage of ore-forming solutions through diffuse zones parallel to S_1 on the limbs of the

macroscopic F2 nappe, until near the hinge zone, a strong vertical anisotropy parallel to S1 enveloping surface, allows comparatively rapid vertical passage upwards. Mineralisation appears to have been accompanied by local shearing which produced crushed zones of quartz and scheelite in the lode quartz. The above origin explains the occurrence of mineralised quartz lodes both parallel and perpendicular to the dominant foliation in the Haast Schist of Otago.