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Structure of the Beaconsfield and Lefroy Goldfields

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Abstract

Gold mineralisation at Beaconsfield and Lefroy is related to the the second of two regional deformation events which affected the Lower Palaeozoic rocks of the region.

INTRODUCTION

A recent study of the structure of the Lower Palaeozoic rocks of northern Tasmania has linked the younger of two phases of deformation in both the Western Tasmania Terrane and the Eastern Tasmania Terrane into a single Middle Devonian thrust movement with associated folding (Powell and Baillie, 1991). That work concluded that recumbent or near-recumbent folds in the Pipers River region represented rotation of earlier upright folds on ramps in a postulated sole thrust, and that the mid-Devonian imbricate thrust zone near Beaconsfield was either the frontal thrust system or a splay off the sole thrust.

This report investigates the possible relationship between gold mineralisation at Lefroy and Beaconsfield and the new structural interpretation.

LEFROY GOLDFIELD

The Lefroy goldfield was discovered in 1872 and worked until 1896. The geometry of the structure is shown in Figure 1. Auriferous veins strike 075° and dip steeply south (up to 65° from the vertical). Groves (1965) considered that 075° fractures were the oldest and predated 055° and 145°-trending joints, which he regarded as possible conjugate shears.

Auriferous veins lie *en echelon* in a NW to NNW-trending zone about 0.8 km wide, parallel to the strike of bedding (320–340°) which is generally dipping westerly at 30–50°, although these beds are probably overturned (Powell and Baillie, 1991). Auriferous reefs are concentrated "... in a belt of softer country trending NW between border rocks to the east and west" (Hughes, 1953, p. 1239).

Hughes (ibid.) also notes that the "... auriferous reefs were intersected by two younger systems of faults, trending NW-SE and NE-SW respectively. These faults had a low W-dip, and a predominantly horizontal movement".

Powell and Baillie (1991) determined F_1 axes trending subhorizontally towards 140° with an axial-surface cleavage, S_1, dipping very gently to the SSW. This first generation of folds is deformed by crenulation folds, F_2, trending towards 150° to 160°, with an axial surface cleavage, S_2, dipping 68° towards 070°. The auriferous veins are close to perpendicular to S_2, and can thus be interpreted as extension fractures opened under the same system of stresses which produced F_2 and S_2. In this case σ_1 = 22/250°, σ_2 = 66/100° and σ_3 = 11/345°, to a first approximation (assuming S_2 is perpendicular to σ_1, and that σ_1 and σ_2 lie in the plane of the auriferous veins).

Whether the younger NW and NE-trending faults are related to this system of stresses can not be determined without further precise information on attitude and displacement.

BEACONSFIELD GOLDFIELD

The Tasmania Reef was discovered in 1877 and worked until 1914. Geometry of the structure is shown in Figure 2. Conglomerate, slate and limestone beds (Cabbage Tree and Flowery Gully Formations) dip between 45° and 65° to ENE, and strike NNW, with younging to the northeast.

The Tasmania Reef strikes N48°E and dips steeply southeast. In places the reef splits into two branches which enclose a heavily veined "horse" of sandstone. The reef is cut by two main faults striking 325° and 320°, which are reverse faults dipping steeply to the SW. Displacement of the Tasmania Reef is 70 m in plan view; displacement on the conglomerate beds is 300 m.

Assuming a reverse fault dip of 80° to the SW, a dip of 55° SE on the Tasmania Reef, and conglomerate beds dipping 55° towards 065°, then the pitches of the reef and the beds in the fault plane are 55° SE and 12° SE respectively.

The comment by Noldart and Threader (1979, p. 73) that "... sloping outlines as shown on the mine longitudinal sections ... indicate an overall plunge of the orebody to the northeast at 55°" is interesting, as the line of intersection of the assumed average bedding attitude pitches 57° to NE in the plane of the reef. Presumably there is a significant bedding control on the ore grades in the Tasmania Reef. The range of attitudes of shallower shoots (35–50°) could be accounted for by a range of attitudes of bedding.

DISCUSSION

Although further detailed work is required, there are clearly broad correlations between the regional structure and the orientation of gold-bearing veins. A number of generalisations may be made:

1. The veins (reefs) in both goldfields strike NE, and dip steeply to the southeast.

2. In the Lefroy goldfield, the vein orientation is geometrically related to F_2 and S_2, and in the Beaconsfield goldfield the vein system appears to be related to a SW-directed thrust system. Powell and Baillie (1991) have independently related F_2 with the Beaconsfield thrusts.

3. The geometry of the veins suggests they are extensional veins, perpendicular to F_2 and the high-angle reverse faults at Beaconsfield.

4. The timing of this deformation is younger than the intrusion of the granodiorite phase of the Scottsdale batholith, but older than the leucocratic phases further east (Powell and Baillie, 1991), so that the ore fluids could be related to metamorphism at depth causing the fluids to circulate.

5. In both locations, the auriferous veins are in the "softer", more ductile, lithological units, suggesting perhaps that high pore pressures pertained in the relatively impermeable pelitic units, thereby enabling relatively small deviatoric stresses to cause extension failures under pore pressures approaching high lithostatic load.

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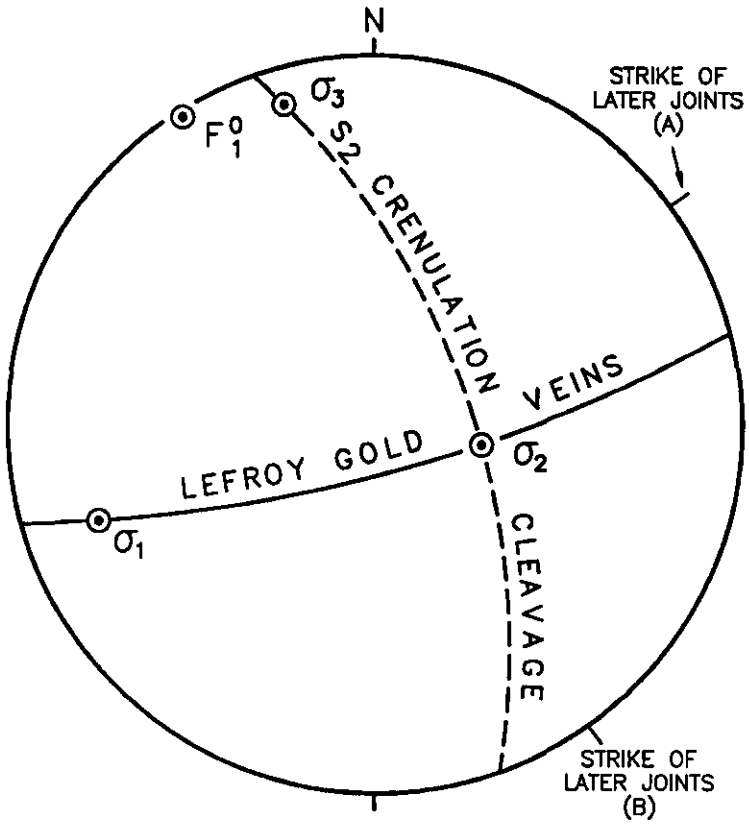

Figure 1. *Geometry of structure of the Lefroy goldfield*

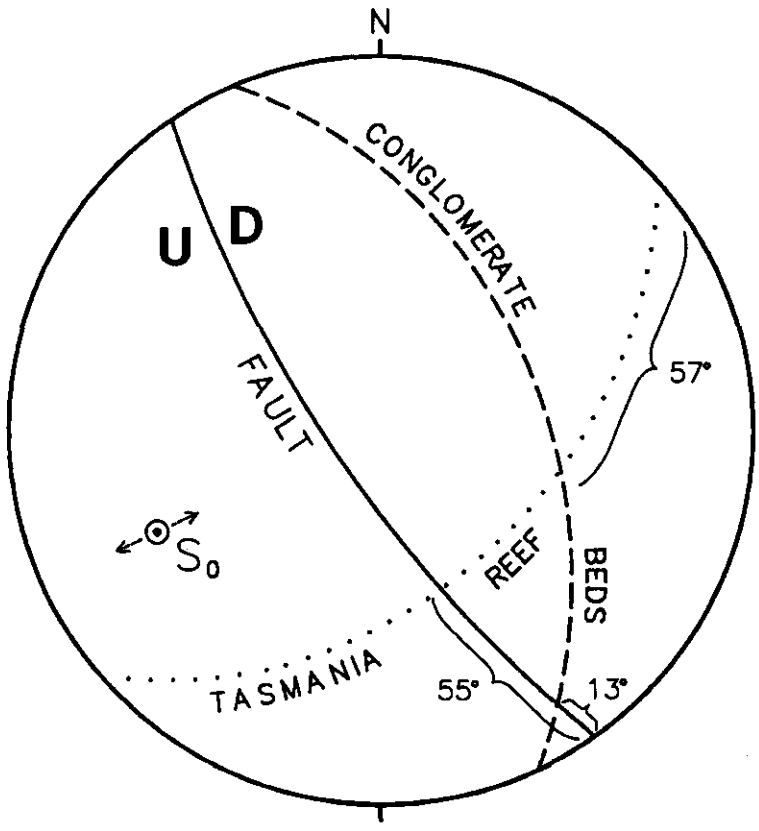

Figure 2. *Geometry of structure of the Beaconsfield goldfield*