

STRUCTURE AND METAMORPHIC PETROLOGY OF THE FORTH METAMORPHIC COMPLEX

ROB LEWIS

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Geology department.
University of Tasmania



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ABSTRACT

The Forth Metamorphics outcrop in the lower reaches of the Forth River, Northern Tasmania and comprise a banded garnetiferous schist and quartzite, interlayered with sub-ordinate orthoamphibolites of tholeiitic MORB-type affinity. Geochemical and sedimentological constraints are consistent with a passive continental depositional environment and the sequence has been regionally metamorphosed during a two-phase tectono-metamorphic event.

An early isoclinal fold phase (D1) produced a penetrative muscovite foliation but is largely overprinted by the dominant S2 schistosity. High temperature, relatively low strain quartz mylonites developed in narrow zones during west-directed D2 transport and are separated by domains of west vergent isoclinal F2 folds.

Microprobe analyses of stable pelitic and metabasite assemblages have been used in conjunction with traditional/dataset thermobarometric methods and phase equilibrium constraints to estimate P-T conditions during D2.

Peak conditions of 700°C \pm 50°C and 13 kb \pm 2 kb for kyanite-garnet-biotite schists in the Forth Valley are matched by independent estimates for garnet amphibole plagioclase assemblages and the latter preserve an early garnet-clinopyroxene-albite assemblage indicating conditions of 660°C and 11 kb during core growth. These results are supported by semi-quantitative P-T modelling of local calcite-altered garnet clinopyroxene zoisite interbands, which formed in a locally H₂O-poor environment during compression/heating from 675°C 9-11 kb to peak conditions of 740°C and 13-15 kb.

Significant P-T zonation is indicated by the spatial distribution of pelitic assemblages and peak temperatures some 100°C lower are inferred for staurolite-chloritoid bearing schists in the western half of the area. Paragonite and chloritoid textures in these units are consistent with breakdown of glaucophane, and may indicate an early high P-low T history.

Late sphene and possibly albite developed during decompression but the preservation of substantially unretrogressed high grade assemblages indicates rapid late-D2 uplift and cooling. In the Forth Valley, garnet amphibolite assemblages preserve geochemical and textural evidence of late-D2 K-metasomatism. The alteration is confined to a 300m wide local high strain zone along the contact with adjacent pelitic schists and thermometry results indicate post-peak conditions of around 600°C.

The P-T history of the Forth Metamorphics is similar to that of the Collingwood River eclogites and may have developed during Precambrian partial subduction of a passive continental margin.

Serpentine bodies, enclosed within the metamorphics have minor structures consistent with early west-directed emplacement. The structural setting and geometry of these bodies has been modified by an east-directed thrust event of probable Devonian age, which produced a spatially restricted crenulation cleavage and minor folds in the metamorphics.

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