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# Syn-orogenic extensional and contractional deformation related to granite emplacement in the northern Tasman Orogenic Zone, Australia

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## Abstract

The Hodgkinson Province of the northern Tasman Orogenic Zone comprises uniform, low-grade metasediments of mid-Palaeozoic age that host numerous Permian granite intrusions. Three widely developed, sequential deformations, D<sub>2</sub>–D<sub>4</sub>, are recognized on the basis of penetrative fabrics and folds, which show clear, regionally consistent overprinting relationships. D<sub>3</sub> and D<sub>4</sub> were contemporary with phases of granite emplacement as shown by relationships of S<sub>3</sub> and S<sub>4</sub> microstructures to porphyroblasts which grew in thermal aureoles adjacent to intrusive contacts. Granitic dyke relationships with S<sub>3</sub> and the deflection of S<sub>3</sub> and S<sub>4</sub> foliation trajectories around plutons support this view. Granites of D<sub>3</sub> and D<sub>4</sub> affiliation have a close spatial relationship and strong geochemical similarities, suggesting that they were closely associated in time. Isotopic dating of granites of D<sub>4</sub> association show that this deformational phase represents the Hunter–Bowen Orogeny which has been recognized as the terminal, Permian–Triassic episode of tectonism for the eastern sector of the Tasman Orogenic Zone. D<sub>3</sub> fabrics are best developed in zones of enhanced metamorphic grade, and are typically subhorizontal or of gentle inclination and associated with recumbent folds when not affected by subsequent deformation. D<sub>3</sub> is attributed to a phase of tectonism linked to the Hunter–Bowen Orogeny but preceding the main episode of compression. Uplift above tracts of rising magma, combined with the thermal weakening of crustal material and the reduction of compressive stress due to plate convergence, sponsored widespread ductile extension at a high crustal level. The zone of failure was a discontinuous carapace above the magmatic front. D<sub>4</sub> is attributed to the main episode of the Hunter–Bowen orogenic compression and involved crustal shortening with the imposition of upright structures and the widespread emplacement of granite. S<sub>3</sub> foliation surfaces have been reoriented in the vicinity of D<sub>4</sub> granite bodies, which behaved as rigid bodies during D<sub>4</sub> compression. The preparation of crustal pathways by D<sub>3</sub> granite was utilized by granites of the D<sub>4</sub> generation with the Hodgkinson Province displaying an intimate interplay of magmatism, stress regime and structural evolution over a time period of perhaps 15–20 Ma. © 1999 Elsevier Science B.V. All rights reserved.

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