Contact Metamorphosed Granitoids: Their Metamorphic Zonation, Correlation With Associated Hornfelsic Isograds And Implications Upon Emplacement Mechanisms In The New England Batholith

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The author wishes to dedicate this thesis to the late Mr. R. Beaugeais, who made all probe slides, (often at short notice) and helped greatly in the thinsection work. He is especially remembered for his warmth, good nature and own particular brand of humour

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D. REFERENCES AND APPENDICES

ABSTRACT

Petrological and structural studies of the contact metamorphic effects of one granite upon another and the surrounding hornfels have been performed within the aureoles of two granitoids (the Bendemeer Adamellite, 41 km NE of Tamworth and the Gwydir River Adamellite, 30 km W of Armidale) in the Southern New England Batholith. The Bendemeer Adamellite is known to intrude (Chappell,1978) the Banalasta Adamellite, an S-type, microcline bearing pluton and the Gwydir River Adamellite likewise intrudes (Ransley,1970) the Yarrowyck Granodiorite, an I-type, orthoclase bearing pluton containing weak deformation associated with spaced micro-shear zones. Correlation of contact metamorphism in both the aureoles examined reveals essentially identical metamorphic zonations.

A mineralogical and microstructural examination of the metagranites away from the later intrusives reveals a regional unaffected zone (4 km in the Banalasta Adamellite and 1.5km in the Yarrowyck Granodiorite), a low grade strained zone (1.5-4 km, Banalasta Adamellite and 350-1200 m, Yarrowyck Granodiorite), characterised by high K-feldspar triclinicities and deformational microstructures and a high grade annealled zone (less than 1.5 km, Banalasta Adamellite and less than 350m Yarrowyck Granodiorite), characterised by low K-feldspar triclinicities and recovery and recrystallisation microstructures. The hornfelsic rocks in both areas record metamorphic changes within the intruding pluton's thermal envelope up to the hornblende-hornfels facies (the pelites recording grades up to the cordierite - K-feldpsar facies and metabasalts recording prograde changes from blue-green, fibrous actinolitic hornblende to brown, granoblastic tschermakitic hornblende), enabling a finer subdivision of the high grade zone.

This study has revealed two distinct, emplacement - induced domains within the aureoles; an outer strained envelope recording minor ductile deformation; and an inner envelope of continuous thermal annealling during emplacement.

The discordant nature of the intruding pluton's contacts, low contact temperatures (650 degrees celcius) and maximum shortening less than 17.9 %, preclude emplacement mechanisms by either doming (Castro, 1987); melt zoning (Ahern, 1981) or ballooning diapirism (Bateman, 1985) respectively. The meridonal trend of the plutonic suites of the New England Batholith (sub-paralleling the major regional faults and a once convergent plate margin), the metamorphic zonation outlined and its implications upon emplacement induced deformation and thermal annealling and only minor shortening, favour a regional emplacement mechanism of dyke propagation at depth and a proposed high-level mechanism of stoping and associated late stage diapiric processes for the two I-type plutons studied.