Reconciling the structural and metamorphic record of orogeny in central western New Hampshire through microstructure and garnet isopleth thermobarometry

Volume 1

Thesis submitted by
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for the degree of Doctor of Philosophy
in the School of Earth Sciences
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Thomas Evans November 2004

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THESIS ABSTRACT

This thesis consists of four sections, each a stand-alone body of work intended for publication in international journals. The sections are ordered such that they progress in a logical fashion; the first two sections form an introduction to the new analytical techniques developed and utilised within this thesis, the remaining two sections present data and geological interpretations derived from the application of these techniques. Volume 1 contains the text and reference list, whilst Volume 2 contains the figures and appendices.

Section A describes the technique of garnet isopleth thermobarometry, and outlines methods for analysing the relative contributions of the sources of error inherent to this technique. Additionally, some insights into the significance of common compositional variations within garnet are provided and discussed.

Section B describes a method for calculating the changes in composition of the chemical system from which garnet is growing that are caused by crystal fractionation of garnet. This section has been published in The Journal of Metamorphic Geology (Evans, 2004), and is presented here unchanged.

Section C utilises the methods described in the first two sections to determine a metamorphic history for the Garnet Hill and Salmon Hole Brook synclines of central western New Hampshire, USA. The thermal regime of the region during metamorphism was found to be characterised by localised, transient thermal heterogeneities. Two distinct episodes of metasomatism were also defined.

Section D utilises the methods described in the first two sections to test a previously defined relative timing scheme for porphyroblast growth that was based on Foliation Intersection Axes preserved within porphyroblast (FIA). Additionally, a tectonic model for central western New Hampshire is presented that explains several key geological features of the region that contradict many of the existing tectonic models.

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