Geophysical Research Abstracts
Vol. 14, EGU2012-13462, 2012
EGU General Assembly 2012
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Grampian high-pressure-granulite-facies metamorphism of the Slishwood Division, NW Ireland and its enigmatic eclogite-facies precursor

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The Slishwood Division of NW Ireland is located along the SW margin of the Grampian belt, whose metamorphism and deformation is generally attributed to the collision of outboard magmatic arcs with the Laurentian continental margin during the c. 470 Ma Grampian Orogeny. The unusual metamorphic history of the Slishwood Division (with eclogite-facies and later high-pressure-granulite-facies assemblages) is a unique feature of the Grampian belt and has long been regarded as evidence for pre-Caledonian tectonism, possibly of Grenvillian age.

Detrital zircon U-Pb dating of Slishwood Division metasediments shows that they were deposited after c. 926 Ma, ruling out a Grenville event. A maximum age for the eclogite-facies event is provided by a U-Pb zircon age of 596 $\pm$ 6 Ma for a suite of metabasite intrusives, which exhibit varying degrees of decompression from eclogite- to high pressure granulite-facies or amphibolite-facies assemblages accompanied by the development of migmatitic leucosomes. Zircons in these leucosomes yield U-Pb zircon ages of c. 470 Ma identical to metamorphic zircons in a relatively dry partially decompressed eclogite. Following polyphase deformation, migmatitic leucosomes in metasediments crystallized under high pressure granulite-facies conditions during sinistral transtension. Dating these leucosomes has been challenging because the majority of zircons within them are inherited and generally only thin (< 15 μm) euhedral magmatic zircon overgrowths are present. Careful targeting with the ion microprobe yields U-Pb ages of c. 470 Ma, consistent with a U-Pb zircon age of c. 470 Ma from a cross-cutting granite pegmatite. In addition the high pressure granulite facies mineral fabrics are cut by tonalite bodies also dated at 470 Ma (ref. 1).

Based on these results, we interpret the Slishwood Division as a Neoproterozoic metasedimentary sequence deposited after c. 926 Ma on what became a microcontinental fragment that detached from Laurentia during the opening of the Iapetus ocean. This rifting event produced a suite of metagabbroic intrusives at c. 596 $\pm$ 6 Ma. Burial of the microcontinent to depths of at least 45 km (ref. 2) resulted in eclogite facies metamorphism. Partial decompression to high pressure granulite conditions (c. 33 km depth) occurred during or before subduction-related magmatism that produced the tonalites. Docking of the Slishwood microcontinent took place during the Grampian collision. Potentially the entire metamorphic history took place with a few million years close to 470 Ma.

References

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