Ion microprobe dating of Paleozoic granitoids: Devonian magmatism in New Zealand and correlations with Australia and Antarctica

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Abstract

Precise ion microprobe U–Pb zircon ages have been obtained from a representative set of Paleozoic igneous rocks from the Western Province of the South Island, New Zealand. Granitoid rocks forming the Karamea Batholith and related plutons in the Buller terrane all yield crystallisation ages that are indistinguishable within a ± 5 Ma uncertainty at 375 Ma (Middle–Late Devonian). Previous workers have suggested that the batholith was emplaced over a long time interval and comprises rocks ranging in age from 370 to 310 Ma, with the bulk in the Early Carboniferous. Granitoid rocks with Carboniferous ages (~ 330 Ma) do occur further to the west and younger Cretaceous granitoids occur within the Karamea Batholith, but these are not volumetrically significant. A sample from the ultramafic–mafic Riwaka Complex in the adjacent Takaka terrane gave a crystallisation age of 376.9 ± 5.6 Ma (2σ), indicating emplacement coeval with the Karamea Batholith.

The Paleozoic granitoids contain a large amount of inherited zircon, with distinct 390-, 500-600- and 1000-Ma components. The 390-Ma age corresponds to widespread plutonism in the Lachlan Fold Belt in SE Australia. The 500-600-Ma (Ross–Delamerian age) and 1000-Ma (Grenville age) age components have also been observed in granitoids from the Lachlan Fold Belt and in Ordovician metasedimentary rocks from SE Australia and New Zealand. The inherited zircons in the Karamea Batholith could be derived from continental basement at depth, from the incorporation of upper-crustal material into the granitoid magmas, or both.

The Devonian granitoids in New Zealand can now be correlated with rocks of similar age in northern Victoria Land (Admiralty Intrusives) and Marie Byrd Land (Ford Granodiorite) in West Antarctica, in NE Tasmania, and in the central part of the Lachlan Fold Belt in SE Australia. On a reconstruction of the SW Pacific margin of Gondwana, prior to later break-up, it is possible to trace out a semi-continuous magmatic belt in excess of 2000 km in length.

1. Introduction

The Western Province of New Zealand (Fig. 1) represents a disrupted fragment of the Gondwana supercontinent; geological terranes formerly contiguous with those in New Zealand are found in Antarctica, SE Australia and Tasmania (e.g., Cooper and Grindley, 1982; Grindley and Davey, 1982; J.D. Bradshaw et al., 1985; Stump et al., 1986; Cooper and Tulloch, 1992; Gibson, 1992). There are close similarities in the nature and timing of Paleozoic events in all of these regions. However, attempts to match the main features of the New Zealand Paleozoic, in particular the voluminous