PETROGENESIS OF THE TASMANIAN GRANITOIDS

by

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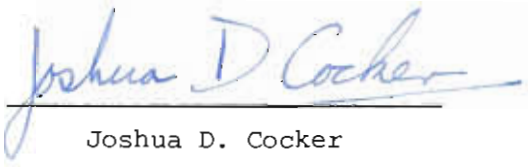

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ABSTRACT

This study of Tasman Orogenic Zone granitoid rocks in Tasmania is mainly concerned with the petrogenesis of a suite of garnet- and cordierite-bearing, aluminous granites. These granites and the associated hornblende-biotite granodiorites are contact-aureole plutons of Devonian age, emplaced in paratectonically deformed Palaeozoic rocks.

The garnet- and cordierite-bearing granites are highly aluminous, have a restricted range of SiO_2 contents (70-76 percent), high K_2O/Na_2O ratios and low Na_2O, FeO, MgO and CaO contents. The granodiorites have a wider range in SiO_2 contents (60-72 percent) and higher Na_2O, FeO, MgO and CaO contents. The compositions of mafic phases are specific to each pluton. Euhedral to subhedral garnets in the aluminous granites are almandine- and pyrope-rich, with grossular and spessartine components totalling less than 5 mole percent. The primary biotite, which is compositionally distinct from subsolidus biotite replacing garnet and cordierite, is Fe- and Al-rich (octahedral Al contents 0.8 - 1.1). Cordierite has Mg/(Mg+Fe) ratios ranging from 0.18 to 0.64. Core compositions of plagioclase in the aluminous granites are in the range An35-An50.

The stability fields of the mafic phases define the early crystallization history of the garnet- and cordierite-bearing granites. At pressures less than ∿10 kb., the assemblages garnet-biotite, garnet-cordierite-biotite and cordierite-biotite represent progressively lower equilibrium pressures for near-liquidus phase assemblages at temperatures in the range 800 - 900°C (Green, 1976). Cooling, probably during ascent, is recorded by zoned garnets. The lack of primary muscovite suggests that most of the granite plutons completed crystallization high in the crust, at pressures

less than 2-3 kb.

Strontium isotopic analyses of the granitoid plutons in eastern Tasmania yield ages from 400 to 370 m.y. Initial Sr^{87}/Sr^{86} ratios for the granites range from 0.705 to 0.714, whereas 0.705 to 0.708 is the range of initial ratios for the granodiorites. A few oxygen isotopic results for pervasively altered biotite granites are consistent with a magmatic source for the hydrothermal fluids that caused their alteration.

Field, mineralogical and compositional data all emphasise the individuality of each pluton. Field and strontium isotopic data suggest that their compositions are little modified by assimilation and there is little evidence for a genetic relationship between plutons. The Tasmanian granitoid plutons are considered to have crystallized from separate magmas each derived by partial melting of different source rocks. A pelitic crustal source for the aluminous granites is supported by high initial Sr^{87}/Sr^{86} isotopic ratios, by highly siliceous and aluminous compositions and by the stability fields of mafic phases. A mafic igneous, crustal source for the granodiorites is supported by relatively low initial Sr^{87}/Sr^{86} isotopic ratios, by major oxide compositions which are richer in Na_2O and CaO than the aluminous granites, and by the occurrence of distinctive hornblende-biotite diorite inclusions, which are interpreted as relict blocks of source rock.

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