

Tectonic evolution of the Mesoproterozoic Albany-Fraser Orogen and Neoproterozoic Leeuwin gneiss complex, southwestern Australia: Australian portions of Antarctic – Australian orogens

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The Albany-Fraser Orogen is exposed for 800 km along the southern coast of Western Australia. The orogen resulted from the collision of a West Australian continent with a South Australian – East Antarctic continent at c.1300 Ma. The orogen was split longitudinally during the rifting of Australia from Antarctica at c. 100 Ma, and the southern part of the orogen is exposed along the adjacent coast of Antarctica in Wilkes Land and the Bunge Hills.

The Albany-Fraser Orogen is truncated to the west by the Darling Fault and juxtaposed against the Neoproterozoic Leeuwin gneiss complex. This complex strikes north-south and is exposed for 100 km along the southwestern coast of Australia. The Leeuwin Complex was truncated to the south by the opening of the Southern Ocean, and the southern continuation of this gneiss complex is exposed in the Prydz Bay – Denman Glacier region of Antarctica.

This presentation will provide an overview of the tectonic and magmatic evolution of both the Albany-Fraser Orogen and Leeuwin Complex, and draw comparisons with their Antarctic equivalents.

The Albany-Fraser Orogen mainly consists of orthogneiss and granite. The orthogneiss was mostly derived from c. 2630 and 1700 – 1600 Ma granitic protoliths that were intensely deformed at c.1300 Ma. These rocks, together with c.1300 Ma gabbro and granite, were stacked in thrust and duplex structures a few kilometres thick and hundreds of kilometres long, at deep crustal levels. Locally derived granitic melts formed in low strain zones during the peak of metamorphism.

Between c.1300 and 1280 Ma, the resulting thrust pile was transported northwards and elevated onto the edge of the West Australian continent. Associated tectonic fabrics formed at decreasing metamorphic grades from amphibolite to greenschist facies, and ductile structures were increasingly superceded by brittle structures.

After a tectonically dormant period of 100 million years, there was renewed intrusion of large volumes of granite in the southern part of the Australian portion of the orogen, accompanied by regional dextral transpression between c. 1180 and 1130 Ma.

Most of the Leeuwin Complex was derived from c. 780 and 695 Ma granites intruded into Mesoproterozoic anorthosite and c. 1090 Ma granite. The rocks were strongly deformed and converted to granulite facies gneisses at c. 615 Ma, an event that may reflect the amalgamation of an Australian – Antarctic continent with India to form an eastern component of Gondwanaland. These gneisses were intruded by granite at c. 535 Ma, and again deformed and recrystallized in granulite facies during an episode of extension.