The Palaeoproterozoic tectonic evolution of the southern margin of the Capricorn Orogen, Western Australia

by

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The Capricorn Orogen is a major Proterozoic tectonic zone that developed between the Archaean Yilgarn and Pilbara Cratons. New 1:100 000-scale geological maps have been produced from the southern part of the Orogen (MARQUIS — Sheppard et al., in press a; MOORARIE — Occhipinti and Myers, in press; ERRABIDDY — Occhipinti and Sheppard, 1999; LANDOR — Sheppard and Occhipinti, in press), with several others in the process of being compiled (GOULD, GLENBURGH, and ERONG). This detailed mapping, combined with geochemical data (Sheppard et al., in press b) and new geochronological results (Nelson, 1998, in prep.), has defined two major Palaeoproterozoic tectonic events: one at 2000 to 1975 Ma and a second at 1830 to 1780 Ma.

The southern part of the Capricorn Orogen (Fig.1) includes the Palaeoproterozoic volcano-sedimentary Bryah and Padbury Basins, medium- to high-grade latest Archaean to Palaeoproterozoic meta-igneous and metasedimentary rocks of the Gascoyne Complex, and the Yarlarweelor gneiss complex, which consists of reworked Archaean crust of the Yilgarn Craton. The boundary between the Yilgarn Craton and the Gascoyne Complex is marked by the Errabiddy Shear Zone.

Tonalites and monzogranites were intruded into the southern Gascoyne Complex at c. 2000 Ma. There is evidence of latest Archaean to earliest Palaeoproterozoic crust with an age of c. 2500 Ma reported by Nutman and Kinny (1994) from granitic gneiss in the Carrandibby Inlier. Calc-silicate and pelitic schists and gneisses of the Camel Hills Metamorphics outcrop between the Gascoyne Complex and the Yilgarn Craton, and were deposited at c. 2000 Ma. The calc-silicate rocks contain Archaean detrital zircons that were apparently derived from the Yilgarn Craton. However in the pelitic rocks, early Palaeoproterozoic zircons dominate the detrital population and must have had a different source region.

The c. 2000 Ma tonalites and monzogranites were heterogeneously deformed before being intruded by voluminous granodiorite and monzogranite at c. 1975 Ma. The 2000 to 1975 Ma granitic rocks do not intrude the Archaean Yilgarn Craton and are interpreted as a separate Palaeoproterozoic terrane which may represent a convergent continental margin that developed above a northwesterly dipping subduction zone. Magmatism accompanied high-grade metamorphism, with the local migmatization of pelitic rocks taking place at the same time as the formation of a layer-parallel tectonic fabric. Deformation and metamorphism may reflect collision of this Palaeoproterozoic terrane and the Yilgarn Craton at c. 1970 Ma. The northern edge of the Yilgarn Craton was intruded by post-collisional monzogranites at c. 1960 Ma. This collisional event is significantly older than the c. 1840 to 1800 Ma Capricorn Orogeny of Tyler et al. (1998) and is named the Glenburgh Orogeny.

The Bryah Basin outcrops to the east of the Gascoyne Complex and records a history of mafic to ultramafic volcanic and intrusive activity followed by the deposition of sedimentary rocks (Pirajno et al., 1998). It may represent a back-arc basin developed during convergence that involved the southward subduction of oceanic crust between the Pilbara and Yilgarn Cratons between c. 1960 and 1830 Ma

The c. 1830 to 1780 Ma event is equated with the final stages of the Capricorn Orogeny, which has been interpreted as reflecting the collision between the Archaean Yilgarn and Pilbara Cratons (Tyler and Thorne, 1990). Extensive felsic magmatism occurred throughout the southern part of the Capricorn Orogen between c. 1830 and 1780 Ma. In the Yarlarweelor gneiss complex Archaean granitic gneiss was intruded at c. 1810 Ma by sheets and veins of leucocratic granite (Occhipinti et al., 1998). Intrusion took place parallel to an Archaean gneissosity that is reorientated by Palaeoproterozoic east- to northeast-trending tight to isoclinal upright folds. Locally, the granites cut the gneissosity but are also seen to be folded with it. The c. 1810 Ma granites were emplaced during upper amphibolite facies metamorphism and locally show incipient partial melting. In contrast, the c. 1800 Ma granites form dykes and large sheet-like bodies intruded into major east-southeasterly trending fault zones that cut the c. 1810 Ma granite. The younger granites contain sericitized feldspar and chlorite (after biotite) indicating a greenschist facies metamorphic overprint.

The change in deformation regime from ductile to brittle, and the coincident drop in metamorphic grade from upper amphibolite to greenschist facies, implies that tectonic uplift took place between 1810 and 1800 Ma in the southern part of the Capricorn Orogen. This involved thrusting of the Yarlarweelor gneiss complex over the Yilgarn Craton, and reactivation of the Errabiddy Shear Zone. The Padbury Basin probably developed as a foreland basin (Martin, 1994). The low-grade meta-sedimentary and meta-igneous rocks of the Bryah and Padbury Basins were tectonically interleaved with the Yarlarweelor gneiss complex during this event. The voluminous biotite and muscovite-bearing monzogranites and syenogranites that intruded into the Yarlarweelor gneiss complex and Gascoyne Complex are consistent with syn- to post-collisional magmatism.

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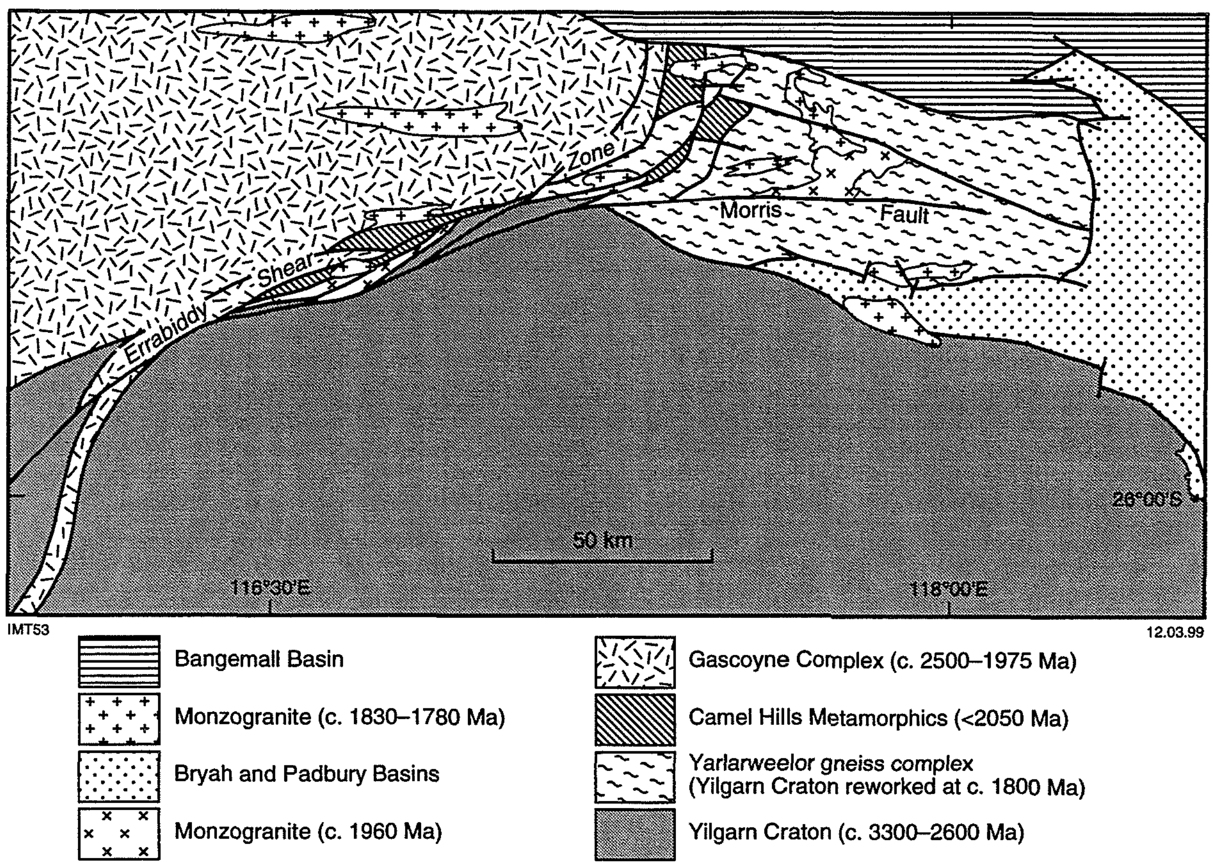

Figure 1. Geology of the northwestern Yilgarn Craton and southern Gascoyne Complex