The geological setting of the Edale Shear Zone, central Yilgarn Craton

by

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The Edale Shear Zone (ESZ) is a regional-scale, north-northwesterly trending, strike-slip structure in the central part of the Southern Cross Granite–Greenstone Terrane. It forms the northern segment of the Evanston–Edale arcuate structure (Chen et al., 2001) and extends for more than 100 km from north of Sandstone south-southeast to the Illaara greenstone belt. A significant section of the ESZ is exposed on the Everett Creek 1:100 000 map sheet (EVERETT CREEK), where it ranges from 7 to about 12 km wide. Here, the ESZ can be broadly subdivided into three parts (Fig. 1), which from west to east are:

(i) the poorly exposed North Cook Well greenstone belt (Griffin et al., 1990), dominated by a banded iron-formation unit, with basaltic amphibolite and ultramafic rocks;

(ii) a zone of strongly deformed granitoid gneiss and monzogranite (the White Cloud Gneiss Zone of Stewart et al., 1983) intruded locally by a weakly to moderately foliated, late syn-kinematic leucogranite;

(iii) the Maynard Hills greenstone belt (Stewart et al., 1983), which comprises strongly foliated and recrystallized basaltic amphibolite, pyroxenite, and gabbro, and abundant metasedimentary rocks, mainly quartzite and para-amphibolite. All these rock types are intimately interleaved with pegmatite-rich monzogranite.

The ESZ is flanked by foliated, locally porphyritic, monzogranite. The deformation decreases in intensity away from the shear zone, and at a distance of between 1 and 2 km the monzogranite is undeformed. A north-northwesterly trending, vertical to steeply dipping foliation is subparallel to the gneissic banding. Kinematic indicators (e.g. asymmetric feldspar porphyroclasts in the granitoid rocks, S-C fabrics in muscovite quartzite) consistently indicate a sinistral shear sense, but the absence of marker units precludes assessment of the amount of displacement.

Quartzite units in the southern part of the Maynard Hills greenstone belt preserve evidence of two deformation events (D_1, D_2) preceding the main shearing event (D_3). Folding of an S_1 foliation in amphibolite and quartz–mica schist around mesoscale symmetric folds, with axes commonly moderately plunging to the south, is attributed to D_2 east–west compression. This fabric is consistent with the regional structural history that has been proposed for the central part of the Southern Cross Granite–Greenstone Terrane (Chen and Wyche, 2001). Following the D_3 shearing event, late brittle deformation resulted in east-northeasterly joints and faults. The ESZ is also crosscut by late, probably Proterozoic, mafic dykes and sills.

Metasedimentary rocks of the Maynard Hills greenstone belt provide the best indications of metamorphic grade, with predominantly middle amphibolite-facies mineral assemblages. Massive to thinly bedded para-amphibolites have annealed assemblages of hornblende, clinopyroxene, calcic plagioclase, biotite, minor quartz, and accessory opaque minerals. Some intercalations are rich in cummingtonite, whereas calc-silicate layers are dominated by diopside, plagioclase, and epidote. Garnet and some andalusite are well developed in some para-amphibolitic horizons. Andalusite is common in recrystallized feldspathic sandstone and in some muscovite quartzite, whereas grunerite is typical of magnetite quartzite units. Pinite after cordierite is present in muscovite–quartz–plagioclase schist, and in some hornblende–plagioclase gneiss. Most of these metamorphic minerals grew syn-kinematically, with peak metamorphic conditions probably reached during D_3, and with hornblende, biotite, muscovite, and epidote continuing to form after the period of most intense deformation.

Sensitive high-resolution ion microprobe (SHRIMP) U–Pb analyses of detrital zircons from quartzite samples from the Maynard Hills indicate a maximum depositional age of 3131 ± 3 Ma (Nelson, in prep.) for the precursor to the quartzite. Several populations of older zircons in the same samples yielded ages of 3318 ± 7 Ma, 3375 ± 4 Ma, 3470 ± 8 Ma, and 3681 ± 6 Ma, with one zircon being dated at 4351 ± 7 Ma. There are no known rocks in the area from which these old zircons could have been derived, the oldest dated rock in the region being the c. 3023 Ma Deception Hill Porphyry (Nelson, 1999), exposed about 150 km to the south-southwest. Similar zircon profiles to those from Maynard Hills have been observed in quartzite units of the Illaara greenstone belt, about 100 km to the south-southeast, and in metasedi-

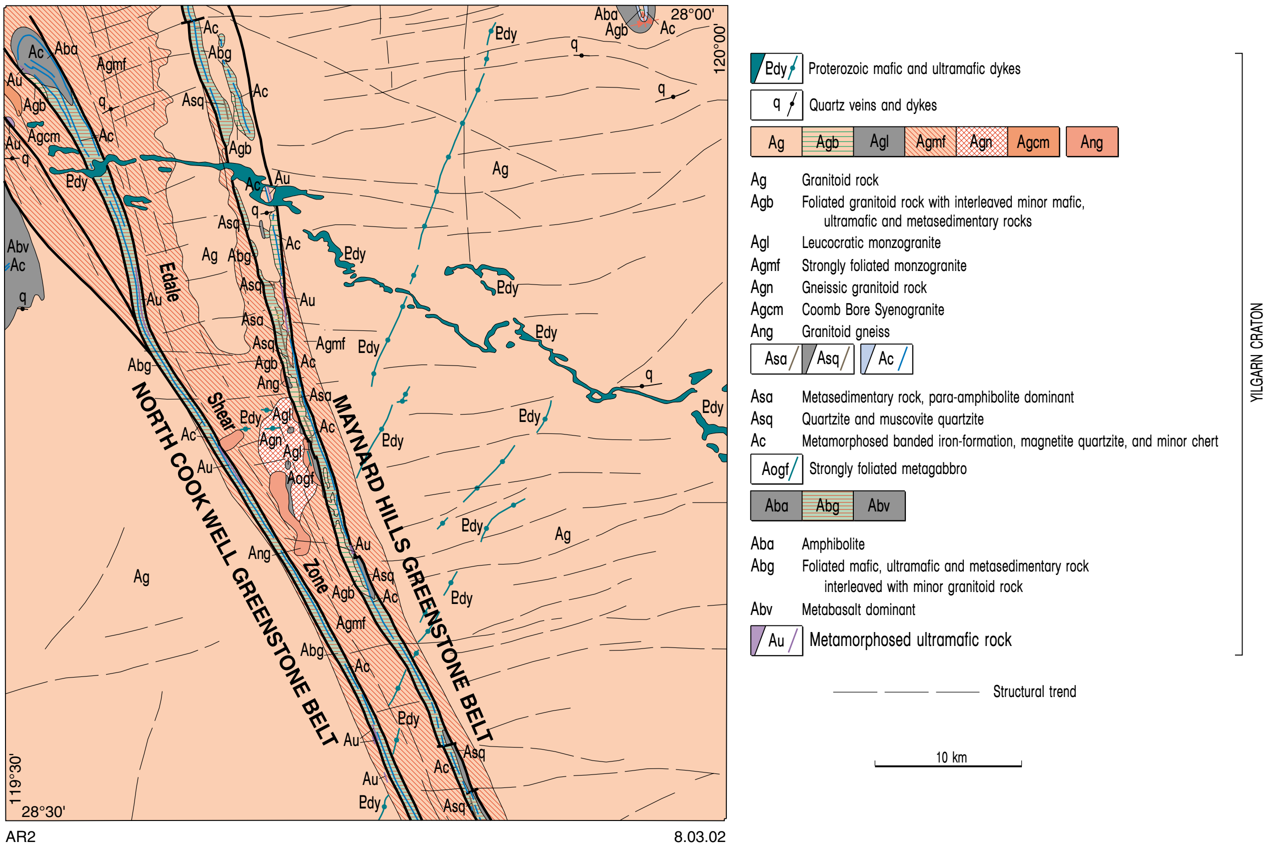

Figure 1. Simplified interpreted geology of the Edale Shear Zone on Everett Creek

mentary rocks of the Narryer Terrane, about 400 km to the northwest, suggesting derivation from a common source.

A deformed granodiorite in the northern part of the ESZ has a SHRIMP U–Pb zircon age of 2691 ± 3 Ma (Nelson, in prep.), which is consistent with the regional age for D_2 syn-kinematic intrusions. An undeformed porphyritic monzogranite to the east of the ESZ has a SHRIMP U–Pb zircon age of 2665 ± 8 Ma (Nelson, in prep.). This granite becomes progressively more deformed towards the shear zone, and may be a late-D_2 or syn-D_3 intrusion, probably coinciding with peak metamorphism.

Open-file statutory mineral exploration reports held in the WAMEX (Western Australian mineral exploration) database at the Department of Mineral and Petroleum Resources report gold from silicified sericite schists crosscut by pyrite–chlorite–tourmaline–barite veins on the eastern side of the ESZ, from quartz veins and reefs at 45° to the main structural trend on the western side of the ESZ, and from sheared basaltic rocks and quartz veins in the Maninga Marley mining centre. The area has also been explored for uranium in calcrete and channel-fill sediments along palaeodrainage lines, and for kimberlitic indicator minerals.

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