Australian Journal of Earth Sciences (2008) **55**, (605–621)

Geochronology, paleomagnetism and magnetic fabric of metamorphic rocks in the northeast Fraser Belt, Western Australia*

B. DE WAELE† AND S. A. PISAREVSKY‡

Tectonics Special Research Centre, University of Western Australia, 35 Stirling Highway, Crawley, WA 6009 Australia.

The first zircon U–Pb SHRIMP dating on high-grade meta-igneous units in the northernmost parts of the Fraser Belt along the southern margin of the Western Australian Yilgarn Craton, reveal crystallisation ages between 1299 ± 10 and 1250 ± 23 Ma. A small number of older xenocrystic zircons, incorporated in some samples, indicate the presence of Late Paleoproterozoic crust in the region. Zircon that crystallised within a melt accumulated in the neck of a boudinaged mafic unit was dated at 1296 ± 4 Ma, indicating that the emplacement of the igneous protoliths took place syntectonically. The anisotropy of magnetic susceptibility of the granulites indicates minimum axes with a mean inclination of 4° towards 130°, corresponding to a nearly vertical southwest–northeast (50–230°) magnetic foliation. This is very close to the structural trend of the Fraser Belt suggesting that the magnetic fabric was acquired syntectonically, during the collision between the Yilgarn and Gawler Cratons. The paleomagnetic data on the granulites overlap with published poles for various 1.2 Ga units in the Albany Belt and the 1.2 Ga Fraser dykes, possibly suggesting that the remanence was acquired during the second stage of the Fraser tectonism. A younger magnetisation component resembles a pole of uncertain age published for Bremer Bay in the Albany Belt.

KEY WORDS: Fraser Belt, geochronology, magnetic fabric, metamorphic rocks, paleomagnetism, SHRIMP, uranium–lead dating, Western Australia, zircon.

INTRODUCTION

The Albany–Fraser Orogen is a Mesoproterozoic belt that occurs along the southern and southeastern margins of the Archean (3000–2600 Ma) Yilgarn Craton of Western Australia (Figure 1, inset). The belt is considered a curvilinear collision zone between the Yilgarn Craton and East Antarctica (Mawson Land) to form the Albany Belt, and collision between the Yilgarn Craton and the Gawler Craton to form the Fraser Belt (Dawson *et al*. 2002; Fitzsimons 2003). Because of the fact that tectonism in the Albany–Fraser Orogen is believed to be coeval across the entire orogen, it is generally assumed that the Gawler and East Antarctic blocks formed a coherent cratonic unit called the Mawson Craton (Myers 1993), which collided *en masse* with the Yilgarn Craton. Moreover, based on broad similarities in the tectonothermal events recognised in the central Australian Musgrave Complex (Camacho & Fanning 1995; Camacho *et al*. 1997; Camacho & McDougall 2000), and those occurring in the Albany-Fraser Orogen (Nelson *et al.* 1995; Clark *et al.* 2000), it has been suggested that this collision involved a West Australian–North Australian cratonic assemblage, with the formation of a Pan-Australian Mesoproterozoic orogen we will refer to as the Albany–Fraser–Musgrave Orogen.

To date, geochronological data cover only the Albany Belt and southernmost parts of the Fraser Belt, while parts of the Musgrave Complex have only very recently attracted scientific interest (Howard *et al*. 2005), resulting in a patchy geochronological database precluding detailed correlation. This paper presents new zircon U–Pb geochronological data for the northernmost parts of the Fraser Complex (north of 30°S) and associated gneisses, providing a robust geochronological framework for this part of the orogen.

Previous paleomagnetic studies in the Albany Belt (Pisarevsky & Harris 2001; Pisarevsky *et al*. 2003) revealed two stable remanence components. The predominant steep remanence corresponds to *ca* 1200 Ma,

*Appendix 1 [indicated by an asterisk (*) in the text and listed at the end of the paper] is a Supplementary Paper; copies may be obtained from the Geological Society of Australia's website (<http://www.gsa.org.au>) or from the National Library of Australia's Pandora archive (<http://nla.gov.au/nla.arc-25194>).

†Corresponding author and present address: British Geological Survey, Kingsley Dunham Centre, Keyworth NG12 5GG, UK (bdewaele@bgs.ac.uk).

‡Present address: School of Geosciences, University of Edinburgh, Grant Institute, The King's Buildings, West Mains Road, Edinburgh EH9 3JW, UK.

ISSN 0812-0099 print/ISSN 1440-0952 online
DOI: 10.1080/08120090801979112