

# Reconstructing the event stratigraphy from the complex structural–stratigraphic architecture of an Archaean volcanic–intrusive–sedimentary succession: the Boorara Domain, Eastern Goldfields Superterrane, Western Australia

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Two main deformational phases are recognised in the Archaean Boorara Domain of the Kalgoorlie Terrane, Eastern Goldfields Superterrane, Yilgarn Craton, Western Australia, primarily involving south-over-north thrust faulting that repeated and thickened the stratigraphy, followed by east-northeast–west-southwest shortening that resulted in macroscale folding of the greenstone lithologies. The domain preserves mid-greenschist facies metamorphic grade, with an increase to lower amphibolite metamorphic grade towards the north of the region. As a result of the deformation and metamorphism, individual stratigraphic horizons are difficult to trace continuously throughout the entire domain. Volcanological and sedimentological textures and structures, primary lithological contacts, petrography and geochemistry have been used to correlate lithofacies between fault-bounded structural blocks. The correlated stratigraphic sequence for the Boorara Domain comprises quartzo-feldspathic turbidite packages, overlain by high-Mg tholeiitic basalt (lower basalt), coherent and clastic dacite facies, intrusive and extrusive komatiite units, an overlying komatiitic basalt unit (upper basalt), and at the stratigraphic top of the sequence, volcanoclastic quartz-rich turbidites. Reconstruction of the stratigraphy and consideration of emplacement dynamics has allowed reconstruction of the emplacement history and setting of the preserved sequence. This involves a felsic, mafic and ultramafic magmatic system emplaced as high-level intrusions, with localised emergent volcanic centres, into a submarine basin in which active sedimentation was occurring.

**KEY WORDS:** Archaean, Boorara Domain, Kalgoorlie Terrain, stratigraphic architecture, structure, Western Australia.

## INTRODUCTION

The Boorara Domain is a tectono-stratigraphic domain of the highly economic Kalgoorlie Terrane, Eastern Goldfields Superterrane, Archaean Yilgarn Craton, Western Australia (Figure 1) and is important economically because it hosts a number of NiS and Au deposits (e.g. Black Swan and Kanowna Belle mines, respectively: Beckett *et al.* 1998; Hill *et al.* 2004). The Boorara Domain preserves felsic, mafic and ultramafic lavas and intrusions, together with associated primary volcanic-derived clastic deposits and reworked sedimentary deposits. SHRIMP U–Pb zircon dates on the Boorara Domain stratigraphy provide emplacement ages of

between 2708 and 2665 Ma for the sequence. Nelson (1997) provided a date of  $2708 \pm 7$  Ma for a coherent albite-rich dacite (sample 104958) situated centrally within the stratigraphic sequence, and Barley *et al.* (1998) dated the same stratigraphic horizon at  $2706 \pm 5$  Ma. Ross (2002) SHRIMP dated a felsic porphyry that intrudes the upper Boorara Domain sequence at  $2665 \pm 6$  Ma. The domain has undergone two main phases of deformation. Initial south-over-north thrust faulting repeated and thickened the stratigraphy between 2683 and 2672 Ma (Weinberg *et al.* 2003), and subsequent east-northeast–west-southwest shortening produced macroscale folding, interpreted to post-date 2655 Ma (Weinberg *et al.* 2003) based on stratigraphic constraints

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