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GR focus review

Global correlation of the early Cambrian of South Australia: Shelly fauna of the *Dailyatia odyssei* Zone

Marissa J. Betts [a,*], John R. Paterson [b], James B. Jago [c], Sarah M. Jacquet [a], Christian B. Skovsted [d], Timothy P. Topper [e], Glenn A. Brock [a]

[a] Department of Biological Sciences, Macquarie University, Sydney, 2109, Australia
[b] Palaeoscience Research Centre, School of Environmental and Rural Science, University of New England, Armidale, New South Wales 2351, Australia
[c] School of Natural and Built Environments, University of South Australia, Mawson Lakes, South Australia 5095, Australia
[d] Department of Palaeobiology, Swedish Museum of Natural History, Box 50007, SE-104 05 Stockholm, Sweden
[e] Palaeoecosystems Group, Department of Earth Sciences, Durham University, Durham DH1 3LE, UK

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ABSTRACT

A lack of well resolved biostratigraphic data has prevented robust regional and global correlation of lower Cambrian successions from South Australia. A new early Cambrian biostratigraphy, based on data derived from 21 measured stratigraphic sections and drill cores (11 described herein) reveals the abundance and diversity of shelly fauna from the Arrowie Basin, and the value of early Cambrian "small shelly fossils" (SSF) for biostratigraphic studies. Here we examine shelly fauna associated with the youngest of three recently established biozones, the *Dailyatia odyssei* Taxon Range Zone (hereafter *D. odyssei* Zone), and their correlative potential. The *D. odyssei* Zone features a diverse suite of tommotiids, organophosphatic brachiopods, bradoriid arthropods, molluscs and phosphatic problematica. This fauna permits strong correlation (often at species-level) with other major early Cambrian terranes, particularly Antarctica, South China and Laurentia, and suggest a Cambrian Series 2, Stages 3–4 age for the *D. odyssei* Zone. Bradoriids have proven to be useful biostratigraphic tools. Four new species and three new genera are described herein: *Acutobalteus sinuosus* gen. et sp. nov., *Eozhexiella adnyamathanha* gen. et sp. nov., *Manawarra jonesi* gen. et sp. nov. and *Mongolitubulus descensus* sp. nov. The description of *Eohadrotreta* sp. cf. *zhenbaensis* represents the first occurrence of the acrotretoid brachiopod *Eohadrotreta* from Australia.

Contents

* Corresponding author.
E-mail addresses: marissa.betts@une.edu.au, marissa.betts@mq.edu.au (M.J. Betts), jpater20@une.edu.au (J.R. Paterson), jim.jago@unisa.edu.au (J.B. Jago), sarah.jacquet@mq.edu.au (S.M. Jacquet), christian.skovsted@nrm.se (C.B. Skovsted), timothy.topper@durham.ac.uk (T.P. Topper), glenn.brock@mq.edu.au (G.A. Brock).

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1. Introduction

Early Cambrian shelly fossils are abundant, diverse and well preserved in the Arrowie Basin of South Australia. Betts et al. (2016b) formally defined three new biozones based on abundant shelly fossil material collected from 10 stratigraphic sections in the Arrowie Basin. These new shelly fossil zones range from Terreneuvian, Stage 2 to Series 2, Stages 3–4 (Betts et al., 2016b). The lowermost and entirely pretrilobitic *Kulparina rostrata* Zone is succeeded by the *Micrina etheridgei* Zone. Overlying the *M. etheridgei* Zone is the *Dailyatia odyssei* Zone. The base of the oldest trilobite zone in Australia, the *Abadiella huoi* Zone (herein called the *Parabadiella huoi* Zone), occurs within the upper part of the *M. etheridgei* Zone. It is important to note that there is taxonomic and nomenclatural uncertainty surrounding the generic assignment of *Abadiella huoi* from South Australia. Jell (in Bengtson et al., 1990) considered *Abadiella* and *Parabadiella* to be synonyms, but we agree with Landing et al. (2013, p. 159) that the more appropriate name for this index species from Australia and South China is *Parabadiella huoi* (see also Betts et al., 2017), at least until the type species of *Abadiella*, *A. bourgini*, is restudied (including new, better preserved specimens from the type locality). Thus, the oldest trilobite zone in South Australia should now be referred to as the *P. huoi* Zone.

The base of the *Dailyatia odyssei* Zone and the faunal composition of the zone was originally based on range data compiled from four stratigraphic sections (Betts et al., 2016b, figs. 2, 5, 8–9). This paper presents new biostratigraphic data from an additional nine measured stratigraphic sections and two drill cores to more clearly define the boundaries and improve the correlative potential of the *D. odyssei* Zone. This biozone can now be clearly identified in subsurface drill cores and outcropping stratigraphic sections from the Stuart Shelf (west of the Arrowie Basin), as well as thick carbonate dominated successions across the central wedge of the Arrowie Basin, and the Benagerie Ridge in the east (Fig. 1). These new data provide a robust and comprehensive biostratigraphic database for defining the *D. odyssei* Zone in South Australia. In addition to AJX-M, MMT, WILK and MOG (see Betts et al., 2016b), the *D. odyssei* Zone is present in (from west to east) the

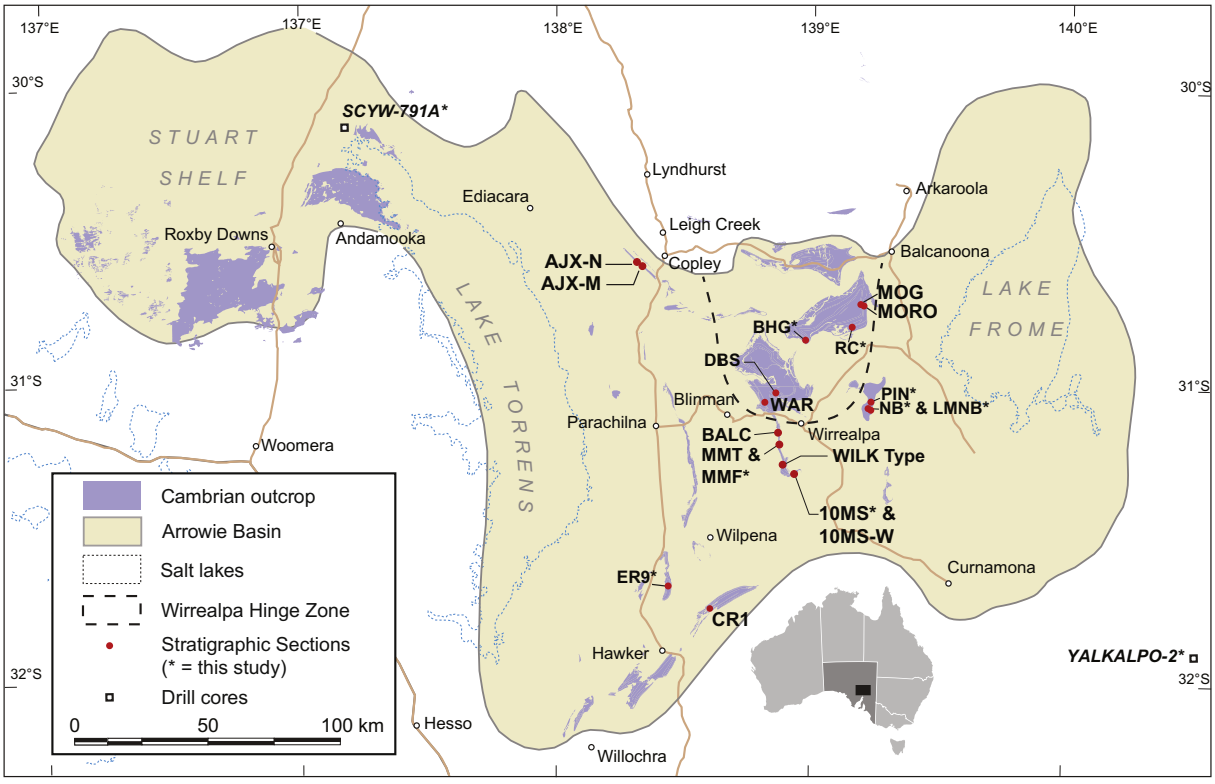

Fig. 1. Extent of the Arrowie Basin, South Australia showing Cambrian outcrop and locations of all measured sections and drill cores used in the present study and Betts et al. (2016b). Sections and drill cores included herein are denoted with an asterisk.