1:2 500 000 major crustal boundaries of Western Australia

by

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Abstract

Major crustal boundaries that potentially tap the upper mantle are a major component of some important mineral systems (Korsch and Doublier, 2016). Australia-wide interpretations of such boundaries, or lithospheric architecture, are commonly presented in schematic form in the academic literature and are based mainly on the interpretation of high-resolution potential field geophysical datasets (Kennett et al., 2018) as well as the extensive national network of deep seismic reflection profiles (Kennett et al., 2016). However, the most recent Australia-wide interpretation (Korsch and Doublier, 2015) is now over five years old and does not include some critical new geophysical datasets, and due to the national scale of these interpretations, they also seldom capture the nuances of State-based geological interpretations.

The Major crustal boundaries map of Western Australia (Fig. 1) integrates the most recent geophysical data with current understanding of the geological evolution of the State at a significantly improved level of detail. For the purposes of this interpretation, a major crustal boundary is defined as 'a lithospheric-scale structure that is interpreted to transect the crust to the Moho, and/or a structure within the crust that forms the boundary between interpreted tectonic units at the terrane or province scale'. The primary data sources for identifying these structures are the State tectonic units map and a network of 25 deep seismic reflection profiles. Structures were first identified on seismic reflection profiles then extrapolated along strike and projected to surface following a similar methodology to Korsch and Doublier (2016), although exposed structures have been snapped to mapped faults. Multiscale edge analysis of gravity data was also used to estimate dip and dip direction in areas without seismic coverage. Each feature has a detailed suite of attributes that are described in the associated data dictionary and metadata statement. Following compilation in 2D, the structures were also modelled in 3D in order to validate the crustal architecture and to ensure internal geometric consistency. The 3D model is available as a separate product (Murdie, 2021).

The most useful potential field datasets for interpreting major crustal boundaries were found to be the isostatic residual gravity anomaly map and the map of total magnetic intensity reduced to pole and upward continued to 10 km. Individual boundaries consist of multiple segments according to the specific attributes that define them but individual boundaries can be selected using the 'NAME' or 'DESCRIPTN' field. The depiction of dipping crustal-scale structures in 2D that are largely interpreted from potential field data is a significant limitation of the dataset. The various uncertainties in both the nature, location and timing of structures is therefore conveyed in the 'FEAT_CONF', 'EV_CONF', 'CAP_SCALE' and 'PRECISN_KM' attributes. Links are provided to source data such as published literature and processed seismic sections, where possible. The map also attempts to capture the tectonic history of each structure by assigning up to five formal Tectonic Events as defined in the ENS database, although these are limited by uncertainties in understanding of the events themselves.

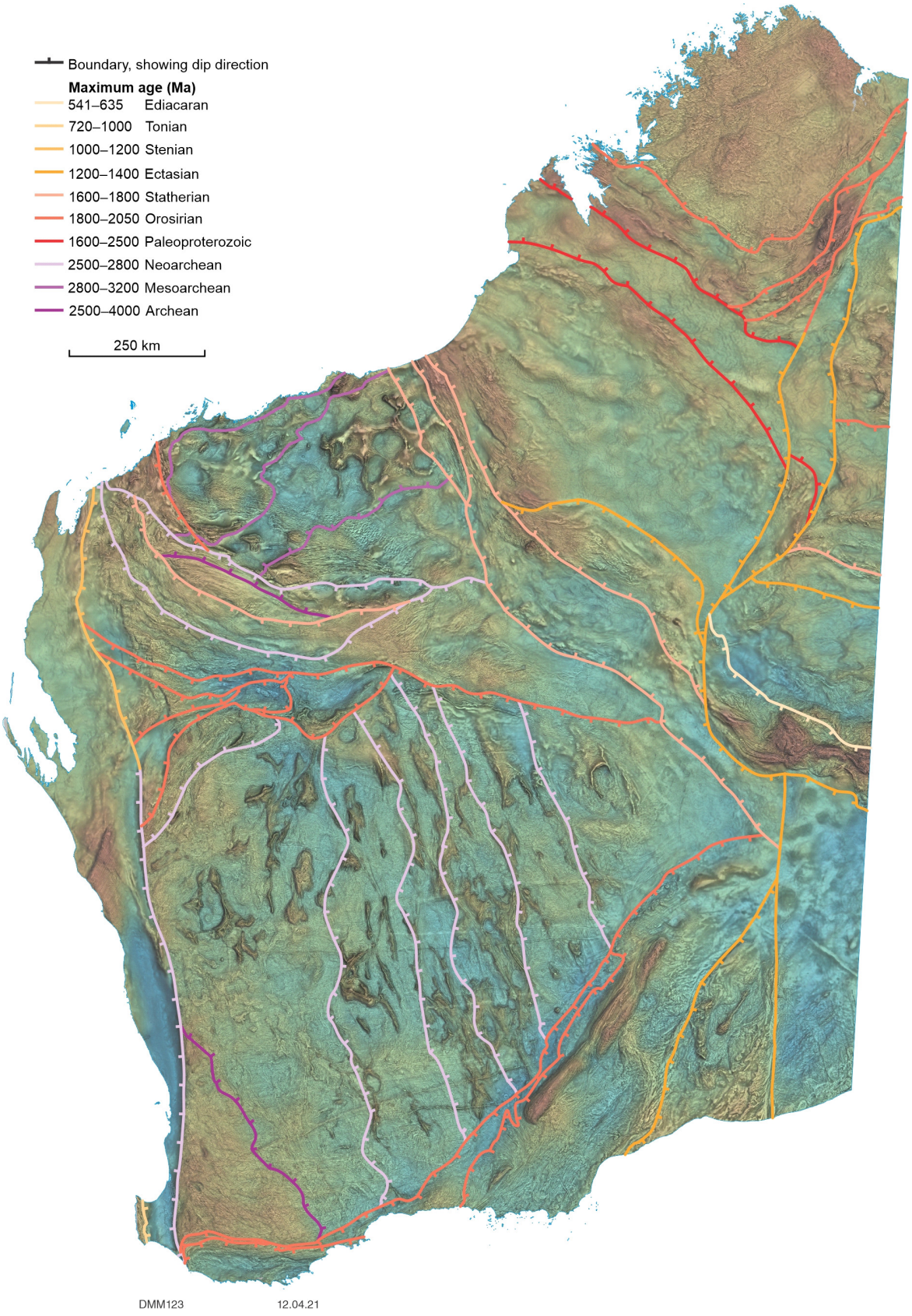

Figure 1. Major crustal boundaries of Western Australia overlain on composite potential field data consisting of isostatic residual gravity (colour) and first vertical derivative, reduced to pole aeromagnetics (texture). Boundaries are symbolized and coloured according to dip direction and maximum age, respectively

How to access

The 1:2 500 000 major crustal boundaries dataset is best accessed using GeoVIEW.WA. This online interactive mapping system allows data to be viewed and searched together with other datasets, including GSWA and Geoscience Australia geochronology data, geological maps and mineral exploration datasets. The 1:2 500 000 major crustal boundaries map is also available for download from the Data and Software Centre in various formats. This digital product will be subject to ongoing updates as new data are acquired and tectonic interpretations are revised.

References

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Recommended reference

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EXPLORATION INCENTIVE SCHEME