

AUSTRALIAN CRUSTAL ELEMENTS

based on the distribution of geophysical domains

November 1995

Scale 1:5 000 000
Simple Conic Projection with two standard parallels at 18° S and 36° S

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Produced by AGSO Cartographic Services Unit

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Topographic base information © AUSLIS 1995

It is recommended that this map be referred to as: Shaw, R.D. et al.
1995 Australian Crustal Elements (1:5 000 000 scale map),
based on the distribution of geophysical domains.
Australian Geological Survey Organisation, Canberra

Copies of this map may be obtained from:
AGSO Sales Centre,
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Limitations of the current map

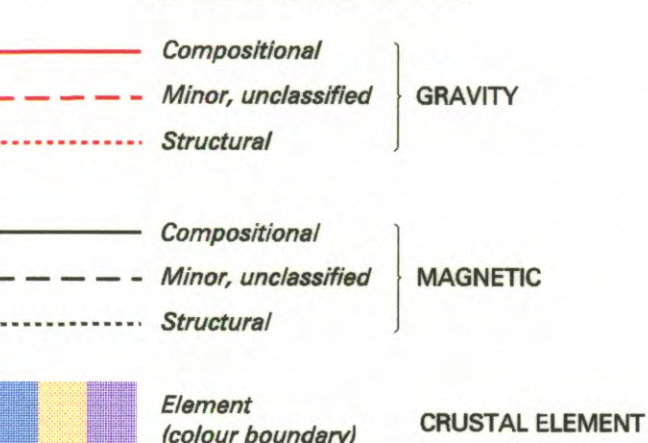
- The map is only a two-dimensional interpretation of magnetic, gravity and crustal element boundaries.
- Whereas the boundaries are intended to approximate their mean position in the upper crust, the accuracy of their position is considerably reduced in regions of thick sedimentary cover and sparse data.

The map presents a model for the crustal framework of the continent, which requires ongoing testing as further information on crustal structure derived from geology and geophysical data sets, such as heat flow and compressional seismic velocity, become available.

Further reading

Shaw R.D., Wellman P., Gum P., Whitaker A.J., Tarlowski C., and Morse M.P., 1995.
Australian Crustal Elements map. AGSO Research Newsletter 23, pages 1-3
Wellman, P., 1978. Gravity evidence for abrupt changes in mean crustal density
at the junction of Australian blocks. BMR Journal of Geology & Geophysics 3, pages 153-162

CRUSTAL BOUNDARY TYPE



GUIDE TO THE MAP

- The coloured crustal elements are generalised geophysical domains that are considered to represent individual pieces of upper crust.
- The element colour and relative age (sequence of numbers 1-30) gives an indication of when the dominant geophysical character may have been imprinted on the region (see below for further explanation).
- The different types of domain and their geological significance are explained in the legend.
- Symbols for the crustal elements are shown on the map sheet and for mega-elements on the inset map.
- Capital letters shown on the main map-face provide an informal reference mechanism for individual crustal elements.
- Symbols (groups of letters) commonly reflect the name of the corresponding geological province (e.g., MI, for Mount Isa).
- It is anticipated that these symbols will require constant refinement with the incoming of new data and fresh interpretations.

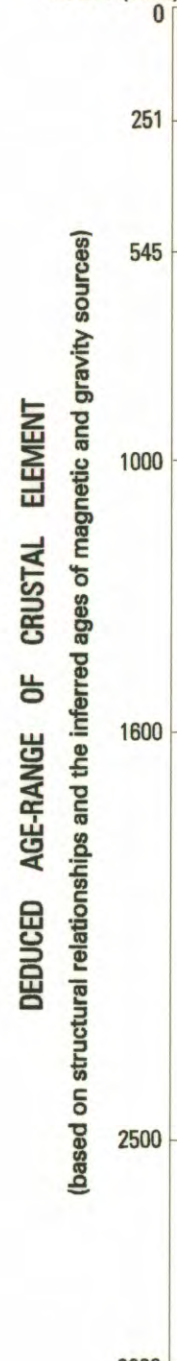
SUGGESTED USES OF THE MAP

- The map is designed to be used in conjunction with other types of geological and geophysical maps. It can be used:
 - to interpret the distribution of basement geological provinces underneath sedimentary cover;
 - to provide an initial model of the framework for the Australian crust;
 - to provide regional setting for more detailed geophysical interpretations;
 - to provide a framework for many types of geological interpretation, such as solid geology maps, structural syntheses, diagrams of basin development, and reconstructions of plate-tectonic settings and paleogeographic evolution;
 - as a framework for studying crustal processes such as earthquake distribution, geodynamics, crustal heat flow, the formation of metal deposits, and the generation and entrapment of oil.

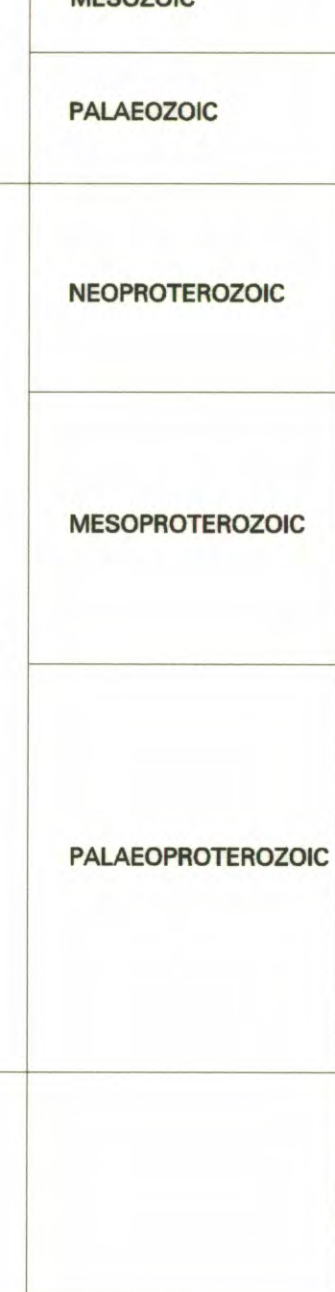
UNDERSTANDING THE DEDUCED TIMEFRAME

In many cases, the possible age-range of the magnetic and gravity sources within the domains can be deduced using gravity and magnetic trend relationships and other overprinting criteria, together with the available geological evidence. Each crustal element is coloured according to its deduced age, which is taken to be the time when the main geophysical features, normally the magnetic patterns, were imposed. In many, but not all, cases, this corresponds to the relative age of crystallisation or orogenesis. In several cases, the age for imposition of the magnetic pattern is poorly constrained, especially when the elements cannot be related to exposed and well-dated basement provinces. Other complications arise where a region has been subjected to periods of multiple tectonic reactivation. It is for these reasons that the map emphasises the possible age-range of the magnetic and gravity sources within the elements, rather than the age of orogenic events derived from geological and geochronological evidence.

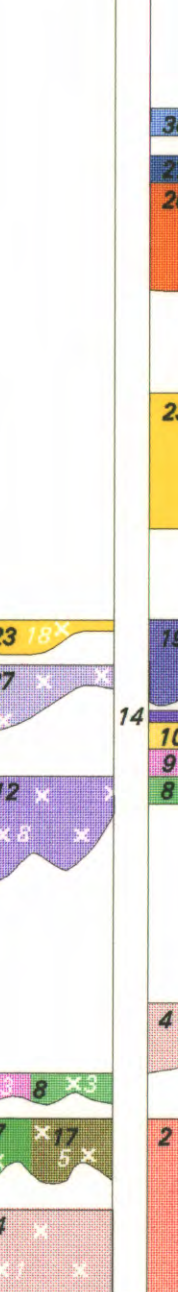
AGE (Ma)



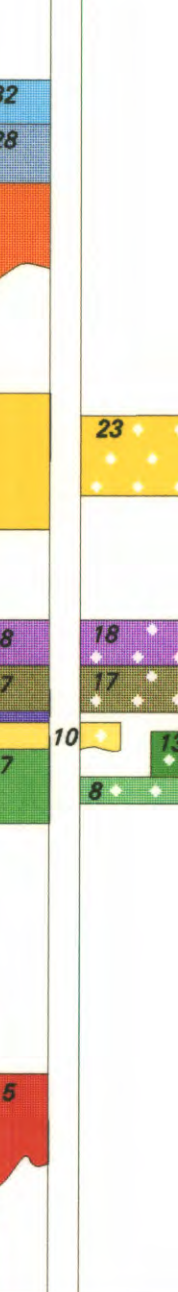
MEGAELEMENTS



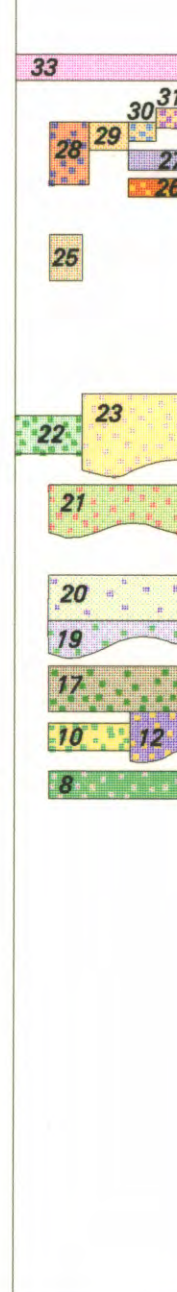
CRUSTAL ELEMENTS



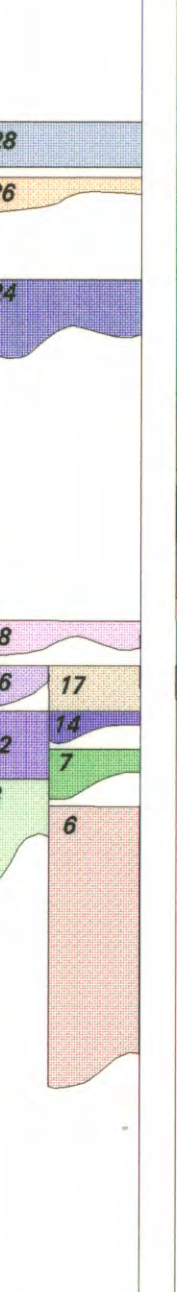
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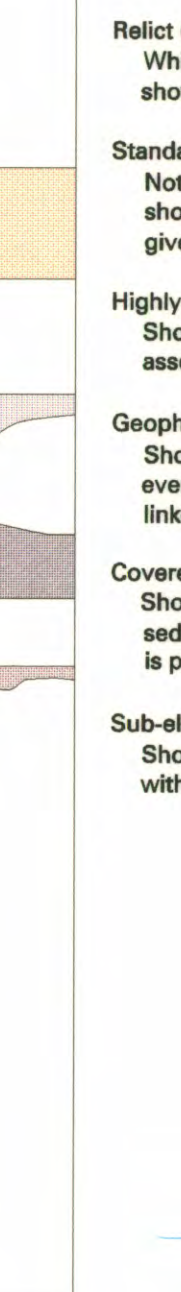
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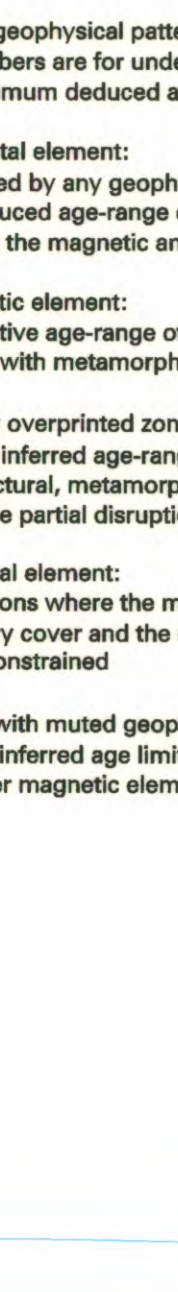
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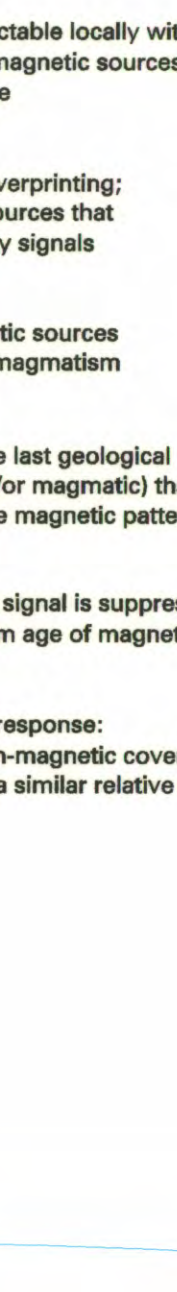
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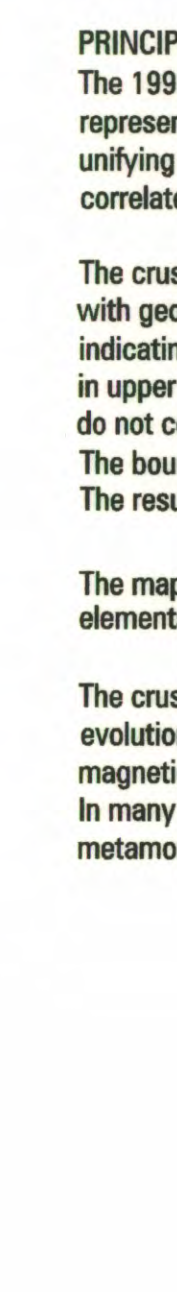
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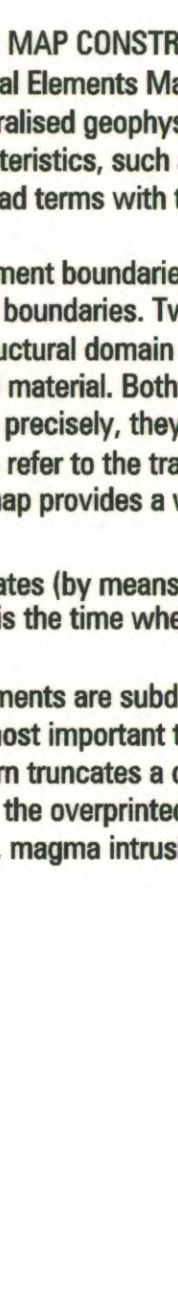
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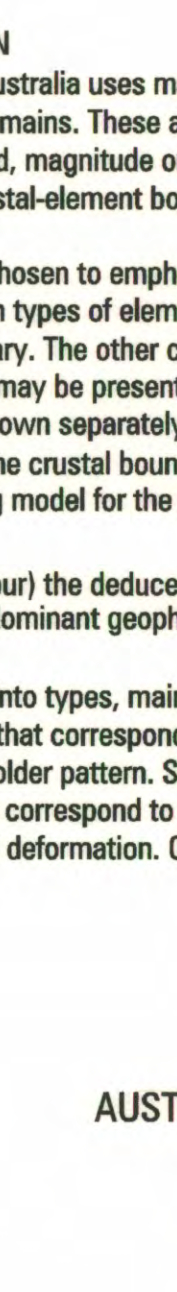
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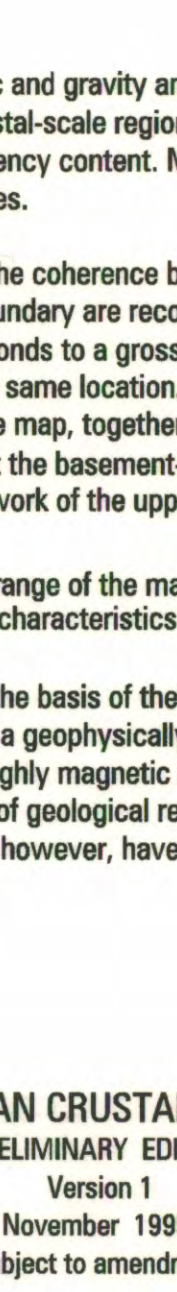
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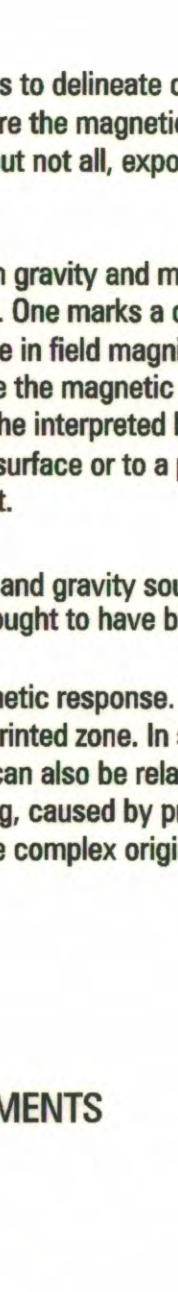
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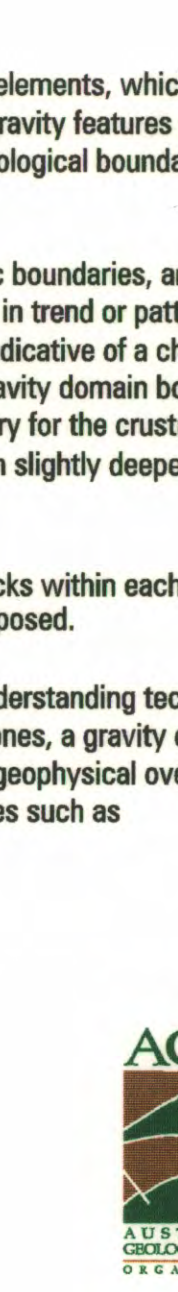
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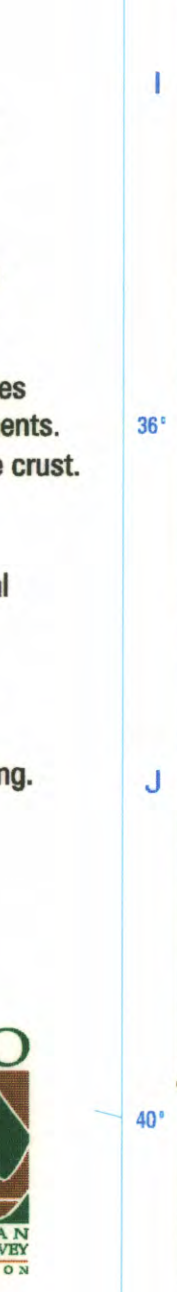
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PRINCIPLES OF MAP CONSTRUCTION

The 1995 Crustal Elements Map of Australia uses magnetic and gravity anomalies to delineate crustal elements, which represent generalised geophysical domains. These are crustal-scale regions where the magnetic and gravity features show unifying characteristics, such as trend, magnitude or frequency content. Many, but not all, exposed geological boundaries correlate in broad terms with the crustal-element boundaries.

The crustal-element boundaries are chosen to emphasise the coherence between gravity and magnetic boundaries, and also with geological boundaries. Two main types of element boundary are recognised. One marks a change in trend or pattern indicating a structural domain boundary. The other corresponds to a gross change in field magnitude indicative of a change in upper crustal material. Both types may be present at the same location. Where the magnetic and gravity domain boundaries do not coincide precisely, they are shown separately on the map, together with the interpreted boundary for the crustal elements. The boundaries refer to the trace of the crustal boundary at the basement-cover surface or to a position slightly deeper in the crust. The resulting map provides a working model for the framework of the upper crust.

The map illustrates (by means of colour) the deduced age-range of the magnetic and gravity source rocks within each crustal element; that is the time when the dominant geophysical characteristics are thought to have been imposed.

The crustal elements are subdivided into types, mainly on the basis of their magnetic response. For understanding tectonic evolution the most important type is that corresponding to a geophysically overprinted zone. In such zones, a gravity or magnetic pattern truncates a clearly older pattern. Some highly magnetic zones can also be related to geophysical overprinting. In many cases, the overprinted zones correspond to zones of geological reworking, caused by processes such as metamorphism, magma intrusion and deformation. Others, however, have a more complex origin.

AUSTRALIAN CRUSTAL ELEMENTS
PRELIMINARY EDITION
Version 1
November 1995
Subject to amendment

