A revision of the tectonic units of Western Australia

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Abstract

A digital 1:2 500 000-scale tectonic units map of Western Australia has been compiled using boundaries modified from the 1:2 500 000 Geological map of Western Australia (13th edition) and the Basin Subdivisions of Western Australia map. Tectonic units are grouped into basins, cratons or orogens. Most Archaean and Proterozoic basins are parts of cratons or orogens, and have been defined according to tectonic style, age, and type of basin fill. Phanerozoic basins are defined largely on their presently expressed structural elements and boundaries. The cratons are Archaean to earliest Palaeoproterozoic in age, and the orogens range from Proterozoic to early Phanerozoic. The cratons are subdivided into terranes and basins, which can be deformed and metamorphosed within tectonic zones. Orogens are divided into igneous and metamorphic complexes and related basins. Complexes may be subdivided into terranes or zones. Orogenic forelands are reworked areas of adjacent craton and basin margins.

KEYWORDS: Tectonic units, Western Australia, basins, cratons, orogens.

Introduction

Part of the role of the Geological Survey of Western Australia (GSWA) is to reveal the potential for mineral and petroleum resources by providing spatially related geoscientific information, and regional geological, geophysical, and geochemical map products and reports. The basis for the presentation of these data is an up-to-date geological framework for Western Australia that uses consistent geological and tectonic unit hierarchies, nomenclature, and boundaries.

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The nomenclature and boundaries of, and the conceptual framework behind, the tectonic units of Western Australia have evolved considerably since the publication of GSWA Memoir 3 (Geological Survey of Western Australia, 1990) because of new geological mapping, combined with more detailed and more comprehensive geophysical, geochemical, isotopic, and geochronological datasets. In particular, the widespread application of SHRIMP (sensitive high-resolution ion microprobe) U–Pb zircon dating has revolutionized our understanding of the tectonic history of the Precambrian rocks in Western Australia. In addition, it is desirable to standardize the boundaries of the tectonic units with the geological unit boundaries shown on the latest regional map of Western Australian geology, the 1:2 500 000 Geological map of Western Australia (13th edition; Myers and Hocking, 1998), and with the basin subdivisions defined by Hocking (1994). The new map (Figs 1 and 2; Tyler and Hocking, 2001) retains the basic grouping of tectonic units into basins, cratons, and orogens adopted in GSWA Memoir 3, although modifications to their definitions have been necessary to accommodate our better understanding of their tectonic evolution.

The map is available as a plotted hard copy product or can be viewed as a searchable GIS dataset on the Western Australian Department of Mineral and Petroleum Resources website (www.mpr.wa.gov.au). Basic information is provided on the age (Archaean, Palaeoproterozoic, Mesoproterozoic, Neoproterozoic, Phanerozoic) and dominant lithological associations (granite–greenstone, igneous and metamorphic, sedimentary and volcanic) of each tectonic unit. This paper describes the most significant revisions, and identifies areas where further revision may be required.

Basins

Basins were defined in GSWA Memoir 3 as areas 'underlain by a substantial thickness of sedimentary rocks which possess unifying characteristics of stratigraphy and structure, due to their deposition during a regionally restricted episode of crustal depression or a related sequence of such episodes' (Trendall, 1990a, p. 4). The term

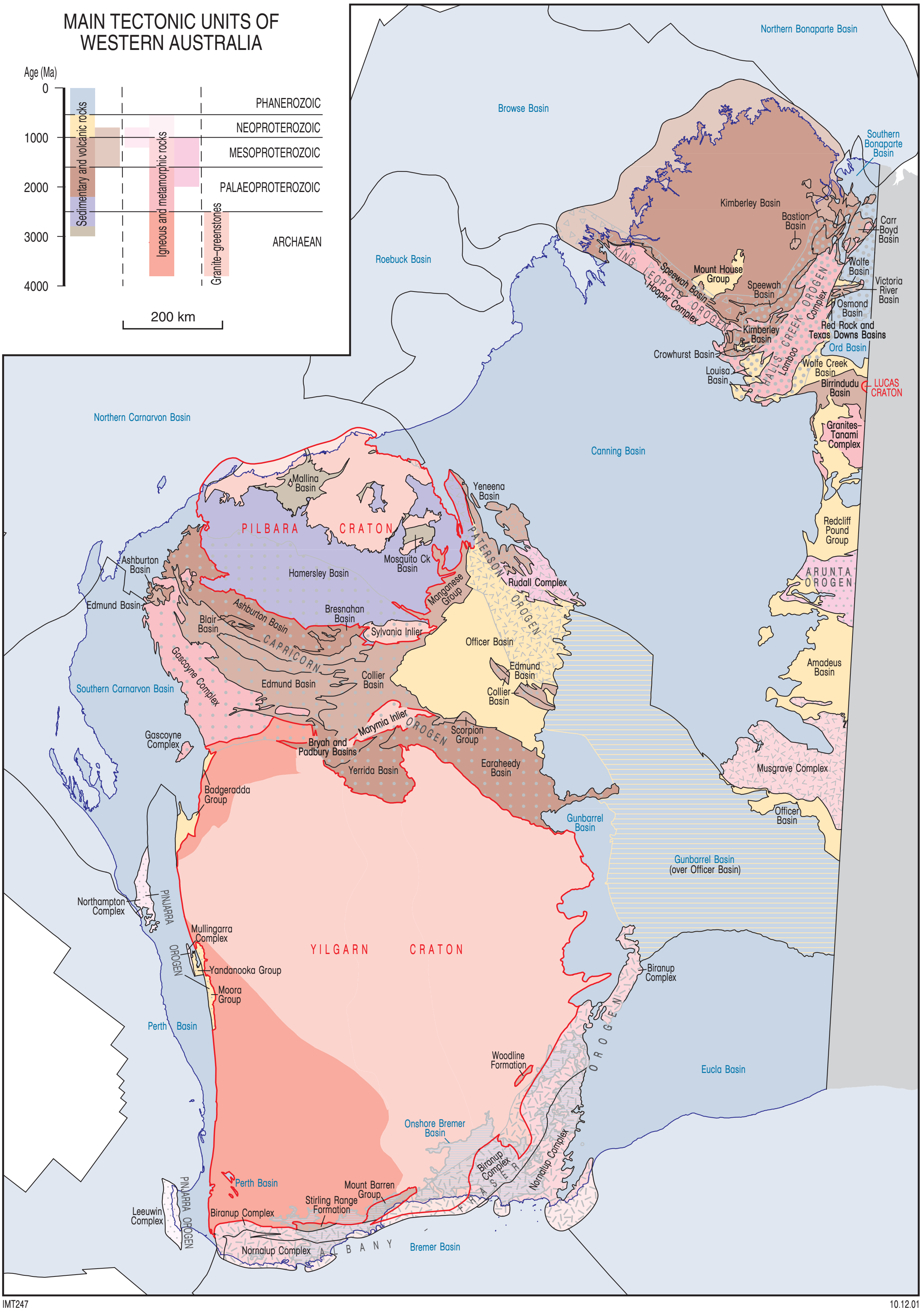

Figure 1. Main tectonic units of Western Australia

basin can be applied to the deposited rocks, their areal extent after erosion, and the crustal depression in which they accumulated.

Within GSWA, usage has differed between groups working in Precambrian and Phanerozoic basins. Most Precambrian basins are considered to be parts of Archaean to earliest Palaeoproterozoic cratons or Proterozoic orogens, and have been defined according to tectonic style, and the age and type of basin fill. These basins equate to discrete major depositional episodes, are tectono-stratigraphic, and commonly not polycyclic. They are discussed under **Cratons** and **Orogens** below. The Phanerozoic basins have been defined largely on their presently expressed structural elements and boundaries, rather than the nature and age of the contained succession, so that the basin is the container in which all of the succession sits. The contained succession may be a single depositional phase or several variably related phases (polycyclic). This usage has largely continued up today (as in, for example, the onshore Canning Basin), although two stacked basins were recognized by Hocking (1994): the Phanerozoic Gunbarrel Basin, which rests on the Neoproterozoic to earliest Phanerozoic Officer Basin, and the Westralian Superbasin, which onlaps and overlies (at depth) older Phanerozoic basins.

A comprehensive, consistent, structurally based set of subdivisions of the Neoproterozoic and Phanerozoic basins within Western Australia was proposed by Hocking (1994; see also Hocking et al., 1994, and Hocking and Preston, 1998) and is largely followed here. Two superbasins are recognized: the Neoproterozoic Centralian Superbasin and the Phanerozoic Westralian Superbasin, which are discussed below. Each superbasin groups a set of basins showing common age, tectonic style, and fill. Several Proterozoic sedimentary units have been identified as equivalent to basins or sub-basins, but have not yet been formally described as such because of uncertainty about their stratigraphic affinities. They are referred to here and on the map by their formal stratigraphic names.

Proterozoic basins not within orogens

A few Proterozoic basins cannot be related to the development of orogens. The Palaeoproterozoic Kimberley Basin (Fig. 2b) extended across the earlier Palaeoproterozoic Hooper Complex (Griffin and Tyler, 1995). The Palaeoproterozoic Texas Downs and Revolver Creek Basins, although contained and deformed entirely within the Halls Creek Orogen, may be equivalent to the Kimberley Basin (Tyler, 2000). Similarly, the Mesoproterozoic Bastion and Birrindudu Basins may be equivalent to the Crowhurst Basin within the Halls Creek Orogen (Tyler, 2000), and may originally have extended across the Palaeoproterozoic Lamboo and Granites–Tanami Complexes (Fig. 2b).

The tectonic settings of the Mesoproterozoic Woodline Formation (Fig. 2d) and the Neoproterozoic Badgeradda Group (Fig. 2c) , both of which overlie the Yilgarn Craton, are not known.

Centralian Superbasin

The Centralian Superbasin consists of Neoproterozoic to earliest Phanerozoic basins within central and northern Australia (Walter et al., 1995; Tyler, 2000) that are related by age, common tectonic styles, and closely comparable sedimentary successions. The basins included are the Officer, Wolfe Creek, Louisa, and Amadeus Basins, the Redcliffe Pound Group (previously included with the Mesoproterozoic Birrindudu Group in the Birrindudu Basin), the upper part of the Victoria River Basin, the Mount House Group, and the Oscar Range Group exposed within the Oscar Range Inlier (Fig. 2b,d).

The 'Savory Basin' of Williams (1992) is now considered to be a northwestern extension of the Officer Basin, as is the former 'Karara Basin', and what was the southwestern part of the Yeneena Basin (Bagas et al., 1999). Hocking (1994) divided the Neoproterozoic and Phanerozoic sedimentary rocks that were previously all included within the Officer Basin into an underlying Officer Basin and an overlying Gunbarrel Basin (Fig. 2d), with the boundary taken as the base of widespread early Palaeozoic flood basalts. This is consistent with the relationship between other Neoproterozoic basins and overlying Phanerozoic basins in Western Australia, where a widespread unconformity reflects major orogenic events during the latest Neoproterozoic to earliest Phanerozoic (Myers et al., 1996; Tyler et al., 1998). Apak and Moors (2000, 2001) suggested that the subdivisions within the Officer Basin shown by Hocking (1994), who followed Iasky (1990), cannot be recognized in seismic and well data. However, they were considering subdivisions in terms of depocentres rather than presently expressed structural elements. The subdivisions of Hocking (1994) are on the latter basis, so they are retained here and linked to the exposed northwest Officer Basin. Some subdivisions will alter as the status of a possibly underlying basin or basins is resolved.

Phanerozoic basins

The nomenclature and boundaries for Phanerozoic basins and sub-basins largely follows that of Hocking (1994), although changes have been made to the units recognized and to the boundaries between and within the Canning, Northern Carnarvon, Southern Carnarvon, and Perth Basins.

In the Canning Basin, the Tabletop Shelf is underlain by the Paterson Orogen (Fig. 2b,d), and is differentiated from the southern part of the Anketell Shelf. The boundary between the Canning and Gunbarrel Basins is arbitrary, and reflects the underlying front of the Paterson Orogen, linking the Rudall Complex and the Musgrave Complex. It is not marked by a surface structure or change in sedimentary succession, although earlier Palaeozoic sedimentary rocks may be absent along this zone, and may differ in character in the Canning and Gunbarrel Basins on either side. The late Palaeozoic and Mesozoic succession of the Gunbarrel Basin could be considered a southward extension of the Canning Basin.

In the Southern Carnarvon Basin (Fig. 2c), Iasky and Mory (1999) changed the boundaries between the Merlinleigh Sub-basin, Gascoyne Platform, and Byro Sub-basin, after recognizing that the Wandagee

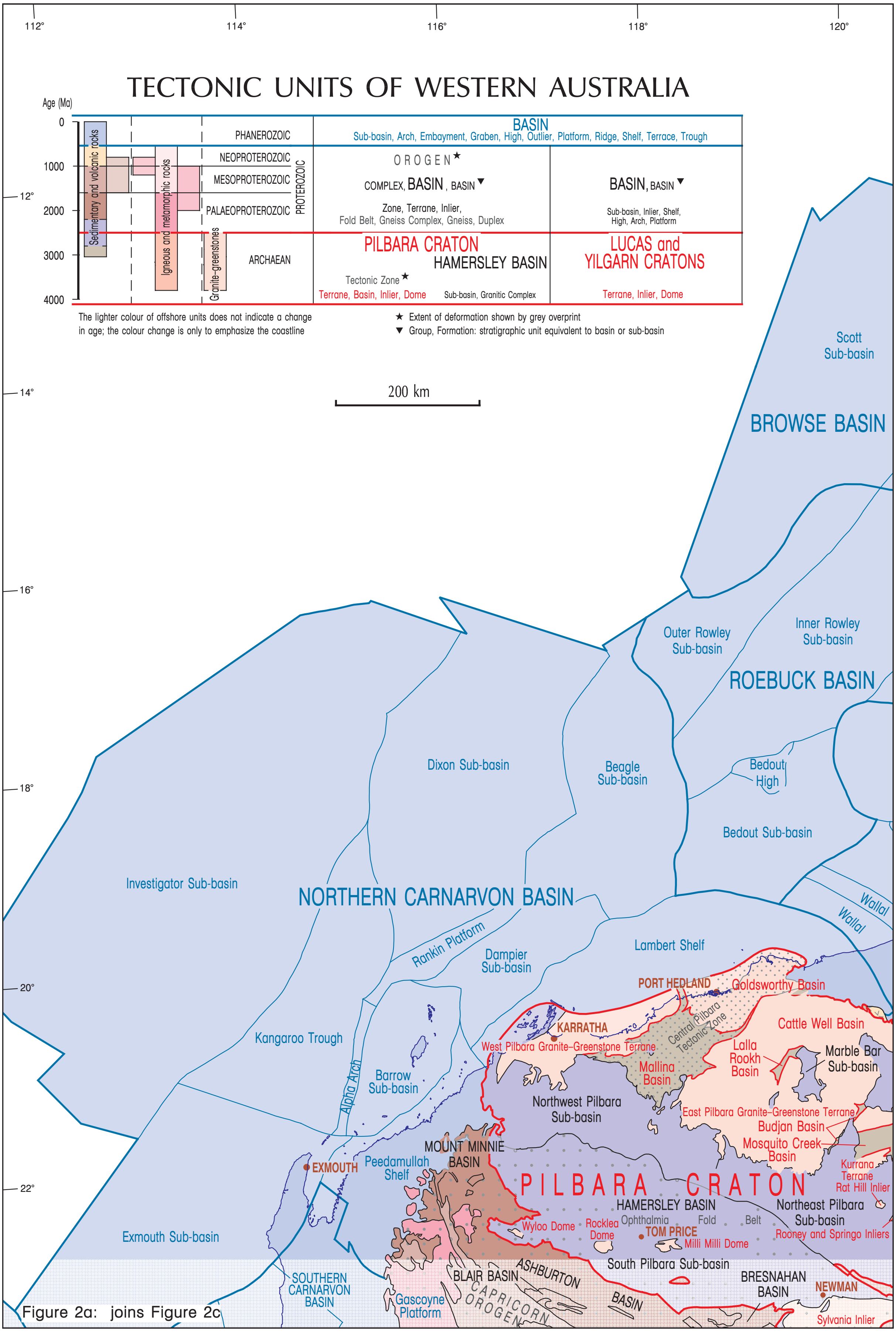

Figure 2a: joins Figure 2c

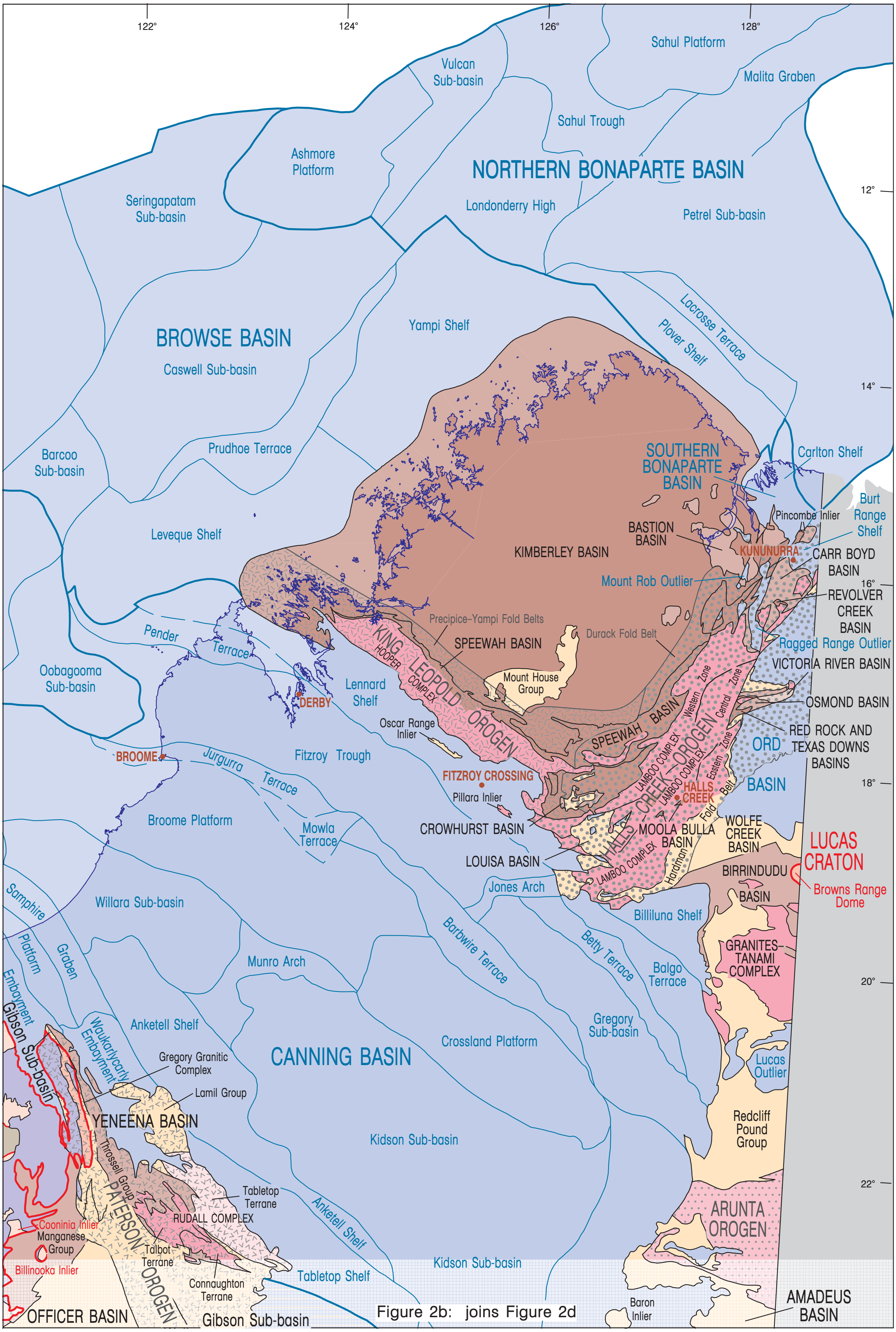

Figure 2b: joins Figure 2d

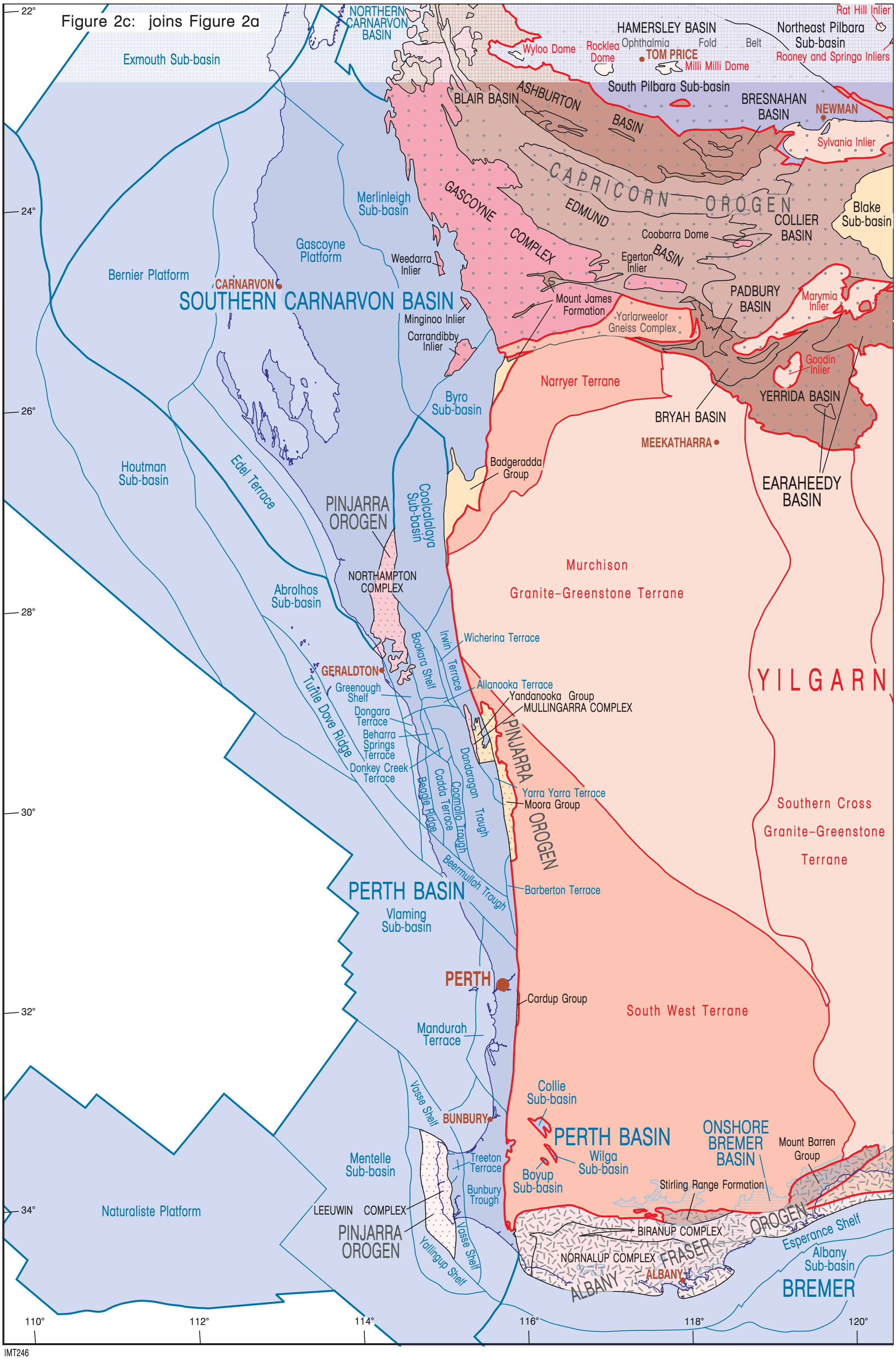
Figure 2c: joins Figure 2a
Exmouth Sub-basin
NORTHERN CARNARVON BASIN
HAMERSLEY BASIN
Northeast Pilbara Sub-basin
Rat Hill Inlier
Wyloo Dome
Rocklea Dome
Ophthalmia Fold Belt
TOM PRICE
Milli Milli Dome
Rooney and Springo Inliers
South Pilbara Sub-basin
BLAIR BASIN
ASHBURTON BASIN
BRESNAHAN BASIN
NEWMAN
Sylvania Inlier
CAPRICORN OROGEN
EDMUND BASIN
GASCOYNE COMPLEX
Merlinleigh Sub-basin
Gascoyne Platform
Weedarra Inlier
Coobarra Dome
Egerton Inlier
COLLIER BASIN
Blake Sub-basin
Bernier Platform
CARNARVON
SOUTHERN CARNARVON BASIN
Minginoo Inlier
Carrandibby Inlier
Mount James Formation
Yarlarweelor Gneiss Complex
PADBURY BASIN
Marymia Inlier
Goodin Inlier
Narryer Terrane
Byro Sub-basin
BRYAH BASIN
YERRIDA BASIN
MEEKATHARRA
EARAHEEDY BASIN
Houtman Sub-basin
Edel Terrace
Badgeradda Group
PINJARRA OROGEN
Coolcalalaya Sub-basin
NORTHAMPTON COMPLEX
Murchison Granite–Greenstone Terrane
Abrolhos Sub-basin
Wicherina Terrace
Irwin Terrace
Bookara Shelf
GERALDTON
Greenough Shelf
Turtle Dove Ridge
Allanooka Terrace
Yandanooka Group
MULLINGARRA COMPLEX
YILGARN
Dongara Terrace
Beharra Springs Terrace
Donkey Creek Terrace
Dandaragan Trough
PINJARRA OROGEN
Beagle Ridge
Cadda Terrace
Coomallo Trough
Yarra Yarra Terrace
Moora Group
Southern Cross Granite–Greenstone Terrane
Beermullah Trough
PERTH BASIN
Barberton Terrace
Vlaming Sub-basin
PERTH
Cardup Group
South West Terrane
Mandurah Terrace
Collie Sub-basin
Vasse Shelf
BUNBURY
PERTH BASIN
ONSHORE BREMER BASIN
Mount Barren Group
Mentelle Sub-basin
Treeton Terrace
Wilga Sub-basin
Boyup Sub-basin
Stirling Range Formation
Bunbury Trough
Naturaliste Platform
LEEUWIN COMPLEX
PINJARRA OROGEN
Yallingup Shelf
Vasse Shelf
BIRANUP COMPLEX
NORNALUP COMPLEX
ALBANY FRASER OROGEN
ALBANY
Esperance Shelf
Albany Sub-basin
BREMER
22°
24°
26°
28°
30°
32°
34°
110°
112°
114°
116°
118°
120°
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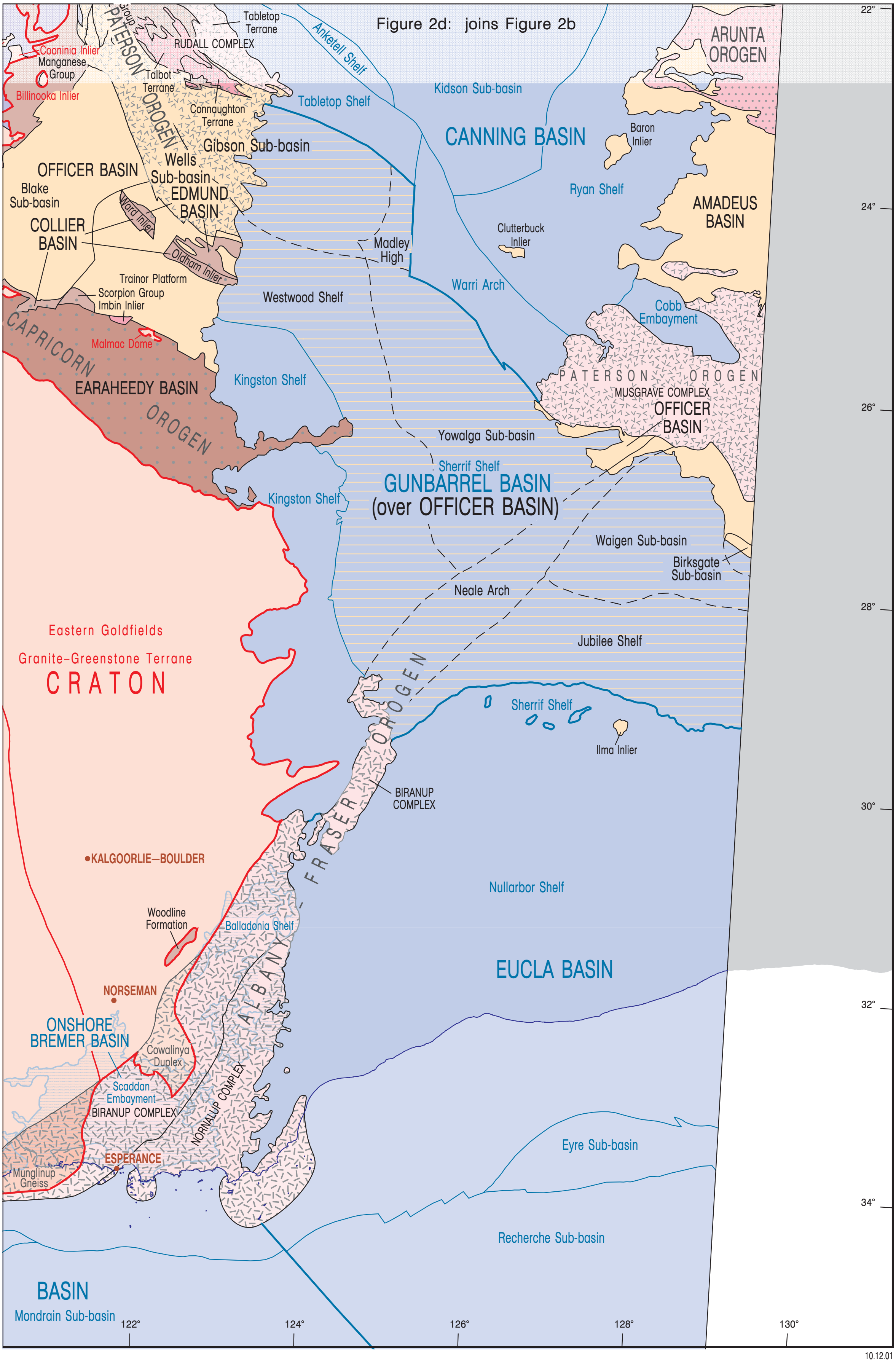
Figure 2d: joins Figure 2b
Tabletop Terrane
RUDALL COMPLEX
Anketell Shelf
ARUNTA OROGEN
Coonimia Inlier
Manganese Group
Billinooka Inlier
PATERSON OROGEN
Talbot Terrane
Connaughton Terrane
Tabletop Shelf
Kidson Sub-basin
CANNING BASIN
Baron Inlier
Gibson Sub-basin
Wells Sub-basin
OFFICER BASIN
Blake Sub-basin
EDMUND BASIN
COLLIER BASIN
Ward Inlier
Oldham Inlier
Ryan Shelf
AMADEUS BASIN
Clutterbuck Inlier
Madley High
Trainor Platform
Scorpion Group
Imbin Inlier
Westwood Shelf
Warri Arch
Cobb Embayment
Malmac Dome
CAPRICORN OROGEN
EARAHEEDY BASIN
Kingston Shelf
PATERSON OROGEN
MUSGRAVE COMPLEX
OFFICER BASIN
Yowalga Sub-basin
Sherrif Shelf
GUNBARREL BASIN
(over OFFICER BASIN)
Kingston Shelf
Waigen Sub-basin
Birksgate Sub-basin
Neale Arch
Eastern Goldfields
Granite–Greenstone Terrane
CRATON
Jubilee Shelf
Sherrif Shelf
Ilma Inlier
BIRANUP COMPLEX
FRASER OROGEN
•KALGOORLIE–BOULDER
Nullarbor Shelf
Woodline Formation
Balladonia Shelf
ALBANY
EUCLA BASIN
NORSEMAN
ONSHORE BREMER BASIN
Cowalinya Duplex
Scaddan Embayment
BIRANUP COMPLEX
NORNALUP COMPLEX
ESPERANCE
Munglinup Gneiss
Eyre Sub-basin
Recherche Sub-basin
BASIN
Mondrain Sub-basin
22°
24°
26°
28°
30°
32°
34°
122°
124°
126°
128°
130°
10.12.01

Ridge (along the eastern edge of the Gascoyne Platform) did not extend north to the Peedamullah Shelf (Fig. 2a). The former 'Bidgemia Sub-basin' is now assigned to the Merlinleigh Sub-basin. The boundaries of the Edel Terrace and Gascoyne Platform with the Abrolhos Sub-basin in the Perth Basin were modified by Crostella (2001; Fig. 2a,c). In the Northern Carnarvon Basin (Fig. 2a), Crostella et al. (2000) amended the boundaries between the Peedamullah Shelf and the Barrow Sub-basin.

Extensive changes have been made within the subdivisions of the Perth Basin (Mory and Iasky, 1996; Crostella and Backhouse, 2000; Fig. 2c). The Dandaragan Trough and the former 'Dongara Saddle' have been subdivided into the Bookara Shelf and Greenough Shelf, the Allanooka, Wicherina, Dongara, Beharra Springs, Donkey Creek, Yarra Yarra, Barberton, and Mandurah Terraces, and the Coomallo and Beermullah Troughs. The former 'Collie Basin', together with what were the 'Wilga and Boyup Outliers', are now regarded as sub-basins of the Perth Basin.

The Balladonia Shelf is at the western edge of the Nullabor Shelf of the Eucla Basin (Fig. 2d). This contains clastic material marginal to the Eucla Basin, similar in nature to the deposits of the Bremer Basin farther southwest. The onshore Bremer Basin is shown as an overprint (Fig. 2c,d) because it is at best a discontinuous veneer, and the boundaries are amended where drilling has provided better delineation of the extent of the sedimentary rocks.

Westralian Superbasin

The Westralian Superbasin is a grouping of related basins along the North West Shelf (Fig. 2a,b). The basins included are the Northern Bonaparte, Browse, Roebuck, and Northern Carnarvon Basins, all of which are mostly offshore and dominated by Mesozoic and lesser amounts of Cainozoic fill. The superbasin reflects the breakup and subsequent drift apart of Gondwana. The boundary between the Northern Carnarvon and the Roebuck and Canning Basins has been revised. The Lambert Shelf (Northern Carnarvon Basin) has been extended eastwards to a logical boundary against the Wallal Embayment (Canning Basin), rather than arbitrarily breaking the Lambert Shelf where no change is apparent.

Cratons

Cratons were defined in the Western Australian context in GSWA Memoir 3 as a part of the Earth's crust that attained stability by about 2.4 Ga, since which time they were regarded as being little-deformed in comparison with adjacent parts of the crust (Trendall, 1990a, p. 4). The essence of this definition is retained here, but may be reconsidered in a later revision in light of the recognition of the formation of younger, separate, North, West, and South Australian 'cratons' by Palaeoproterozoic orogenic processes at c. 1.8 Ga, and their amalgamation as a single 'Proterozoic Australian craton' by Mesoproterozoic orogenic processes at c. 1.3 Ga (Myers et al., 1996). The effects of these later orogenic events within the margins of the pre-2.4 Ga cratons were discussed in GSWA Memoir 3 (Trendall, 1990a, p. 5). However, in contrast to GSWA Memoir 3, the extent of overlap of orogenic deformation, metamorphism, and igneous intrusion into the pre-2.4 Ga cratons is shown on the new map (Figs 1 and 2). The rocks within these orogenic forelands can be regarded, in terms of their tectonic evolution, as part of both the earlier craton and the later orogen.

There are three areas of crust in Western Australia that stabilized prior to 2.4 Ga: the Pilbara and Yilgarn Cratons, which were defined in GSWA Memoir 3, and the Lucas Craton, which was recognized by Myers et al. (1996). The cratons have been divided into basins and terranes, which are defined here as fault-bounded bodies of rock of regional extent, characterized by a geological history different from those adjacent to them (Jackson, 1997).

Pilbara Craton

The Pilbara Craton is made up of Archaean granite–greenstones and basins that stabilized prior to 2.8 Ga and, given that a craton is defined here as stabilizing prior to 2.4 Ga, also includes the unconformably overlying latest Archaean to earliest Palaeoproterozoic Hamersley Basin (Fig. 2a,b). The northern part of the Pilbara Craton has been divided into the West Pilbara Granite–Greenstone Terrane, East Pilbara Granite–Greenstone Terrane, and the Kurrana Terrane, together with the Mallina, Lalla Rookh, Cattle Well, Goldsworthy, Budjan, and Mosquito Creek Basins (Hickman et al., 2000; Hickman, 2001). The Mallina Basin, together with part of the East Pilbara Granite–Greenstone Terrane, has been deformed, metamorphosed, and intruded by granite plutons within the Central Pilbara Tectonic Zone (Fig. 2a). The granite–greenstones extend to the south and southeast beneath the Hamersley Basin, and outcrop as a series of inliers and domes in both the Hamersley Basin and the overlying Mesoproterozoic Collier Basin (Fig. 2c). The Hamersley Basin has been subdivided into the Marble Bar, Northwest Pilbara, Northeast Pilbara, and South Pilbara Sub-basins (Thorne and Trendall, 2001). The Gregory Granitic Complex (Fig. 2b) is the intrusive equivalent of felsic volcanic rocks in the lower part of the Northeast Pilbara Sub-basin succession.

Yilgarn Craton

The Yilgarn Craton consists of extensive Archaean granite–greenstones, as well as areas of Archaean medium- to high-grade metamorphic rocks and intrusive igneous rocks. The subdivision of the Yilgarn Craton largely follows that of Myers (1997) and Witt et al. (1998). To be consistent with the nomenclature of the Pilbara Craton, the Eastern Goldfields, Southern Cross, and Murchison Granite–Greenstone Terranes are recognized, together with the igneous and higher grade metamorphic rocks of the Narryer and South West Terranes (Fig. 2c,d). Further subdivision into smaller terranes was suggested for the Southern Cross and Eastern Goldfields Granite–Greenstone Terranes by Myers (1997) and Witt et al. (1998), and for the South West Terrane by Wilde et al. (1996). This has not been attempted here as the boundaries are difficult to establish on the 1:2 500 000 Geological map of Western Australia, and the status of some of the 'terranes' is controversial (e.g. Groenewald et al., 2000). Along the northern margin of the Yilgarn Craton, granite–greenstones outcrop in a series of inliers within Proterozoic basins.

Lucas Craton

In the northeast of Western Australia, latest Archaean (c. 2.5 Ga) igneous and metamorphic rocks are exposed in the Browns Range Dome (Page et al., 1995), which is an inlier within the Mesoproterozoic Birrindudu Basin (Fig. 2b). Myers et al. (1996, fig. 4) suggested that this formed part of the Lucas Craton which, to the east in the Northern Territory, also outcrops as the Billabong complex. The craton formed a basement to the Palaeoproterozoic rocks now exposed within the Granites–Tanami Complex.

Orogens

Orogens were defined in GSWA Memoir 3 as tectonic belts characterized by regional metamorphism and abundant plutonic intrusion, which were established by a distinct tectonic pulse, but could be reactivated by later tectonic episodes, and remained permanent zones of weakness in the Earth's crust (Trendall, 1990a, p. 4). There are seven orogens within Western Australia (shown as a grey overprint on Figs 1 and 2), all of which are long-lived features that may have been reactivated a number of times by different orogenies (Myers et al., 1996; Tyler et al., 1998). They are predominantly Proterozoic in age, although there was significant reactivation of the Halls Creek Orogen (Fig. 2b) during the Palaeozoic Alice Springs Orogeny (Tyler, 2000). The boundaries of the orogens are defined here by the limits of orogenic deformation, metamorphism, and igneous activity that overlap as orogenic forelands, reworking adjacent craton and basin margins.

The orogens are divided into igneous and metamorphic complexes (as defined by Trendall, 1990b, p. 197), and related basins. The igneous and metamorphic complexes may be subdivided into terranes, as defined under **Cratons** above, or zones. The nature of the reworking in the orogenic forelands varies, forming fold belts or duplexes, gneisses, and gneiss complexes. In future revisions the areas within orogens that are affected by individual orogenies will be defined.

King Leopold and Halls Creek Orogens

The King Leopold Orogen (Fig. 2b) includes Palaeoproterozoic igneous and metamorphic rocks of the Hooper Complex along with the Precipice and Yampi Fold Belts, which form an orogenic foreland. This foreland consists of deformed rocks of the Palaeoproterozoic Speewah and Kimberley Basins and the Neoproterozoic Mount House and Oscar Range Groups (Tyler and Griffin, 1990; Griffin et al., 1993).

In the Halls Creek Orogen (Fig. 2b), Palaeoproterozoic igneous and metamorphic rocks of the Lamboo Complex have been divided into Western, Central, and Eastern Zones, each showing different geological histories prior to c. 1820 Ma (Tyler, 2000). The Western Zone is equivalent to the Hooper Complex (Tyler, 2000). A number of Proterozoic basins are present within the orogen, including the Palaeoproterozoic Moola Bulla, Red Rock, Texas Downs and Revolver Creek Basins, the Mesoproterozoic Osmond, Crowhurst, and Carr Boyd Basins, and the Neoproterozoic Louisa Basin (Tyler, 2000). Orogenic forelands are recognized on either side of the orogen: to the west the Durack Fold Belt affects the southeastern edge of the Speewah and Kimberley Basins, and the Phanerozoic Southern Bonaparte Basin; to the east the Hardman Fold Belt affects rocks of the Osmond Basin, the Mesoproterozoic to Neoproterozoic Victoria River Basin, Neoproterozoic Wolfe Creek Basin, and Phanerozoic Ord Basin. The extension of the Precipice Fold Belt affects the Louisa Basin in the southern part of the orogen.

Granites–Tanami Complex and Arunta Orogen

There has been no re-evaluation of the igneous and metamorphic rocks of the Palaeoproterozoic Granites–Tanami Complex and the Palaeoproterozoic to Mesoproterozoic Arunta Orogen (Fig. 2b) in Western Australia since the publication of GSWA Memoir 3. Extrapolation from the Northern Territory suggests that subdivision into terranes or zones is possible, at least in the Arunta Orogen (Tyler et al., 1998)

Paterson Orogen

Igneous and metamorphic complexes within the Paterson Orogen (Fig. 2b,d) include the Mesoproterozoic Musgrave Complex and the Rudall Complex, which is divided into the Palaeoproterozoic Talbot and Connaughton Terranes and the Mesoproterozoic Tabletop Terrane (Bagas and Smithies, 1998). Subdivision of the Musgrave Complex into terranes may also be possible (Tyler et al., 1998). The Yeneena Basin overlies the Rudall Complex and contains rocks of the possibly Mesoproterozoic Throssell Group and the Neoproterozoic Lamil Group (Bagas et al., 2000). The deformed northeastern margin of the Officer Basin, including the Gibson and Wells Sub-basins (Fig. 2d), and the underlying Gregory Granitic Complex and eastern margin of the Hamersley Basin (Fig. 2b) at the edge of the Pilbara Craton, are also included within the Paterson Orogen.

Capricorn Orogen

The Capricorn Orogen (Fig. 2c) consists of the Palaeoproterozoic igneous and metamorphic rocks of the Gascoyne Complex, together with a number of Palaeoproterozoic and Mesoproterozoic basins. To the west, the Gascoyne Complex forms inliers within the Phanerozoic Southern Carnarvon Basin. To the east the complex underlies much of the Mesoproterozoic Edmund and Collier Basins, and outcrops in the Egerton Inlier and the Coobarra Dome (Fig. 2c). It also underlies the northern part of the Palaeoproterozoic Earaheedy Basin, outcropping in the Imbin Inlier (Fig. 2d). Recent remapping suggests that the Gascoyne Complex probably consists of a number of terranes (Occhipinti et al., 1999).

Along the northern margin of the Yilgarn Craton, the Palaeoproterozoic Yerrida, Bryah, Padbury, and Earaheedy Basins (Fig. 2c,d; Pirajno and Occhipinti, 2000;

Hocking et al., 2000) were previously all included in the 'Nabberu Basin'. Along the southern margin of the Pilbara Craton are the Palaeoproterozoic Ashburton, Blair, Mount Minnie, and Bresnahan Basins. The Palaeoproterozoic Mount James Formation overlies the Gascoyne Complex (Fig. 2c).

The Yarlarweelor Gneiss Complex (Fig. 2c), at the southern margin of the Capricorn Orogen, represents reworking of the northwestern margin of the Yilgarn Craton (Occhipinti et al., 1999). Yilgarn Craton granite–greenstones outcrop within the orogen in the Marymia and Goodin Inliers (Fig. 2c), and the Malmac Dome (Fig. 2d).

At the northern edge of the Capricorn Orogen, the South Pilbara Sub-basin of the Hamersley Basin and the underlying granite–greenstones of the southern Pilbara Craton are deformed by the Ophthalmia Fold Belt (Tyler and Thorne, 1990; Fig. 2a).

The overlying Mesoproterozoic rocks, previously placed within the 'Bangemall Basin', have been separated into the older Edmund Basin and the younger Collier Basin (Martin and Thorne, 2001; Fig. 2c,d). These rocks were not previously included within the Capricorn Orogen, but the Edmund Basin, the ?equivalent Scorpion Group, and much of the Collier Basin were deformed above reactivated structures in the underlying units during the late Mesoproterozoic to early Neoproterozoic Edmundian Orogeny (Martin and Thorne, 2001). Therefore, the deformed Edmund and Collier Basins are here included within the Capricorn Orogen. The Manganese Group (Fig. 2b,d) was deposited in a sub-basin of the Collier Basin over the southeast Pilbara Craton, but was little-deformed by the Edmundian Orogeny, and is not included in the Capricorn Orogen. Deformed sedimentary rocks outcropping in the Ward and Oldham Inliers within the Officer Basin (Fig. 2d) form part of the Capricorn Orogen, and may correlate with the Edmund and Collier Groups (Hocking et al., 2000).

Pinjarra Orogen

The Pinjarra Orogen (Fig. 2c) formed along the western margin of the Yilgarn Craton and is largely buried beneath the Phanerozoic Perth Basin. It outcrops as Mesoproterozoic igneous and metamorphic rocks of the Northampton and Mullingarra Complexes, and Mesoproterozoic to Neoproterozoic igneous and metamorphic rocks of the Leeuwin Complex (Fitzsimons, 2001; Wilde and Nelson, 2001). The Neoproterozoic sedimentary and volcanic rocks of the Moora and Cardup Groups overlie the Yilgarn Craton, and the Neoproterozoic Yandanooka Group overlies the Mullingarra Complex (Tyler et al., 1998; Fig. 2c). The Badgeradda Group may be part of this orogen.

Albany–Fraser Orogen

The Albany–Fraser Orogen (Fig. 2c,d) consists of the Mesoproterozoic igneous and metamorphic rocks of the Biranup and Nornalup Complexes, and Mesoproterozoic metasedimentary rocks of the Stirling Range Formation and Mount Barren Group (Myers et al., 1995a,b). Archaean rocks are reworked within the orogen, with the Munglinup Gneiss representing Archaean igneous and metamorphic rocks reworked within the Biranup Complex (Nelson et al., 1995). The Cowalinya Duplex (Fig. 2d) consists of reworked rocks of the Eastern Goldfields Granite–Greenstone Terrane of the Yilgarn Craton (Myers, 1995b).

Future revisions

Continuing remapping and re-evaluation at various scales, combined with new geophysical, geochemical, isotopic, and geochronological data, will continue to highlight geological complexity and inconsistency, with the need for further changes to nomenclature, modification to boundaries of tectonic units, and subdivision of these units. Revision of the map and database will be ongoing as new results and reinterpretations covering major tectonic units become accepted, with periodic releases incorporating major revisions.

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