PROTEROZOIC–PHANEROZOIC

PALEOZOIC

CARBONIFEROUS–PERMIAN

318–270 Ma — CPpo-sepg — **PATERSON FORMATION:** conglomerate (including diamictite), sandstone, and siltstone; largely glacigene

EPBN-od — **Beenong Dyke Suite:** mafic dykes; northwesterly trending; interpreted from aeromagnetic data
EPNB-od — **Nindibillup Dyke Suite:** mafic dykes; west-northwesterly trending, variably magnetic; some exceeding 400 km long; mostly interpreted from aeromagnetic data
EPNW-od — **Cosmo Newbery Dyke Suite:** northwest-trending mafic dykes; interpreted from aeromagnetic data; concealed where dashed

Eo — Mafic intrusive rock
Eod — Dolerite dyke, sill, or plug; fine- to medium-grained dolerite and gabbro; concealed where dashed

PROTEROZOIC

MESOPROTEROZOIC

Albany–Fraser Orogeny Stage II (1215–1140 Ma)

1200–1140 Ma — Esperance Supersuite — EEP-g, EEP-gm
EEP-g — Granitic rock; undeformed to moderately deformed
EEP-gm — Monzogranite; undeformed to moderately deformed; includes magnetite-rich varieties

c. 1210 Ma — Giovenangrup–Fraser Dyke Suite — EGF-od — Dolerite and gabbro dykes; east-northeast- to northeast-trending; mostly interpreted from aeromagnetic data; concealed where dashed

1321–1150 Ma — Erg-mh — **MOUNT RAGGED FORMATION:** psammitic schist and quartzite interbedded with thin layers of pelitic rocks

Albany–Fraser Orogeny Stage I (1345–1260 Ma)

1330–1280 Ma — Recherche Supersuite — ERE-mg, ERE-mgm
ERE-mg — Metagranite; heterogeneous; even grained or porphyritic; moderately to strongly deformed; may include intrusions of **Esperance Supersuite**
ERE-mgm — Monzogranitic gneiss; may contain remnants of **Biranup Zone** rocks

PALEOPROTEROZOIC–MESOPROTEROZOIC

1480–1345 Ma — Egk-xmtn-mo, Emm-xmh-mws
Egk-xmtn-mo — **GWYNNE CREEK GNEISS:** psammitic gneiss with minor semipelitic layers; includes minor metagranitic, metamafic, and meta-ultramafic rocks
Emm-xmh-mws — **MALCOLM METAMORPHICS:** interbedded psammitic and pelitic schist; mafic amphibolitic schist; minor calc-silicate rocks; may include granitic dykes and intrusions

Exmg-mwMD — Metagranitic and metamafic rocks, undivided; may include metasedimentary rocks

Biranup Orogeny (1710–1620 Ma)

1700–1620 Ma — EmgBR, Exmg-mogBR, Exmgn-mogBR, Exmgn-mdnBR, Exmgni-mhnBR
EmgBR — Metagranite
Exmg-mogBR — K-feldspar megacrystic metagranite and metasyenogranite, mingled with metagabbroic rocks; hybrid rocks; may include remnants of Archean rocks
Exmgn-mogBR — Granitic gneiss intruded by coarse pegmatite; undivided; may include interleaved Fraser Zone rocks
Exmgn-mdnBR — Granitic and metasedimentary gneisses dominant; includes intrusions of **Recherche** and **Esperance Supersuites**; may include remnants of Archean rocks
Exmgni-mhnBR — Migmatitic, monzogranitic to syenogranitic gneisses dominant; commonly garnet-bearing; may include remnants of Archean rocks

c. 1708 Ma — Ebt-mgr — **BOBBIE POINT METASYENOGRANITE:** metasyenogranite; weakly foliated to mylonitic; includes minor mingled mafic rocks and minor banded iron-formation rafts

c. 1760 Ma — Ekc-xmgr-mgi — **McKAY CREEK METASYENOGRANITE:** metasyenogranite, mingled with metagabbro; localized hybrids of metagranodiorite and metadiorite; may include intrusions of **BOBBIE POINT METASYENOGRANITE** and remnants of Archean rocks

c. 2410 Ma — Widgiemooltha Dyke Suite — EWl-o — Dolerite and gabbro; includes cumulate and granophyric differentiates; concealed where dashed

2700–1650 Ma — ÆmgBR, ÆmgnBR, ÆmgnBR, ÆxmgssBR, ÆxmwoBR
ÆmgBR — Metagranitic rocks dominant; may include remnants of Archean rocks
ÆmgnBR — Metagranitic and gneissic rocks dominant, locally with mafic amphibolite lenses; may include remnants of Archean rocks
ÆmgnBR — Migmatitic, monzogranitic to syenogranitic granitic gneisses dominant; most are garnet-bearing; may include remnants of Archean rocks
ÆxmgssBR — Foliated metagranitic rocks with lenses of mafic amphibolite; may include remnants of Archean rocks
ÆxmwoBR — Mafic amphibolite dominant; intruded by foliated metagranitic rocks; may include remnants of Archean rocks

2800–1330 Ma — ÆxmnAFON, ÆxmgnAFON, ÆxmgAFON
ÆxmnAFON — Meta banded iron-formation, metagabbro, and metaleucogabbro; may include metagranite and **Biranup Zone** intrusions
ÆxmgnAFON — Granitic gneiss; quartzofeldspathic gneiss, locally with garnet; amphibolite; metagranite; minor meta banded iron-formation; may include **Biranup Zone** intrusions
ÆxmgAFON — Metagranitic and metamafic rocks; Archean granite and greenstone and Proterozoic granitic and mafic rocks deformed and metamorphosed during the **Albany–Fraser Orogeny**

2900–2660 Ma — AxmiAFON, AxmogAFON, AmoAFON, AxmbAFON, AmbAFON, AxmuAFON
AxmiAFON — Meta banded iron-formation, metachert, metasedimentary rocks, and amphibolite
AxmogAFON — Metagabbro and meta-ultramafic rocks; intruded by metagranite
AmoAFON — Meta-igneous mafic intrusive rock, undivided
AxmbAFON — Greenstones, undivided; may include iron formation
AmbAFON — Metamafic volcanic rocks, undivided
AxmuAFON — Meta-ultramafic rocks, quartzite, metaconglomerate, and metasandstone

AmgmY, AmgnY, AmgssY, AgY, AgmY

AmgmY — Biotite metamonzogranite; medium to coarse grained
AmgnY — Granitic gneiss, locally migmatitic; includes local mafic bands and enclaves
AmgssY — Foliated metagranite, locally gneissic; may include amphibolite lenses; includes deeply weathered rock
AgY — Granitic rock, undivided; metamorphosed
AgmY — Monzogranite; common biotite and rare local hornblende; minor granodiorite and syenogranite; fine to coarse grained; equigranular to porphyritic; massive to weakly foliated; metamorphosed

AmnYKA — Gneiss; protolith unknown

AsYKA — Siliciclastic sedimentary rock, undivided; includes sandstone, siltstone, shale, and chert; metamorphosed

2686–2666 Ma [1,4] — AmfYKA, AfYKA
AmfYKA — Felsic metavolcaniclastic rock
AfYKA — Felsic volcanic and volcaniclastic rock; metamorphosed; commonly deeply weathered and kaolinized

AmwoYKA — Amphibolite

2696 Ma [3] — AoYKA — Mafic intrusive rock, undivided; metamorphosed; includes deeply weathered rocks

2715–2692 Ma [4] — AbYKA — Fine to very fine grained mafic rock, minor ultramafic rock, undivided; metamorphosed; commonly deeply weathered

AoYKA — Ultramafic rock; may include pyroxenite and serpentinite; metamorphosed

AuYKA — Ultramafic volcanic rock; metamorphosed

AmtYKU — Quartzofeldspathic gneiss

AsYKU — Sedimentary rock, undivided; includes sandstone, siltstone, shale, and chert; metamorphosed; commonly deeply weathered

AcYKU — Chert and banded iron-formation; undivided; metamorphosed

2714–2704 Ma [4] — AfYKU — Felsic volcanic and volcaniclastic rock; metamorphosed; commonly deeply weathered and kaolinized

AoYKU — Mafic intrusive rock, undivided; metamorphosed; includes deeply weathered rocks

AbYKU, AbsYKU

AbYKU — Fine to very fine grained mafic rock, minor ultramafic rock, undivided; metamorphosed; commonly deeply weathered
AbsYKU — Pyroxene spinifex-textured basalt; locally variolitic and/or pillowed; metamorphosed

ARCHEAN

AuYKU — Ultramafic volcanic rock; metamorphosed

Abtoxs — **TOBIN FORMATION:** wacke, lithic sandstone, siltstone, abundant chert and banded iron-formation, and minor felsic volcaniclastic rocks; metamorphosed

2699–2682 Ma [4,7] — Abp-xf-v — **TOPPIN HILL FORMATION:** felsic volcanic and volcaniclastic rocks, with minor siliciclastic sedimentary rocks; metamorphosed

AmqtYYA — Quartzofeldspathic gneiss, locally strongly foliated

AmwYYA — Meta-igneous mafic rock; undivided

AoYYA — Igneous mafic intrusive rock, undivided; metamorphosed

AmbYYA, Axb-ogIYA, AbYYA
AmbYYA — Metamafic volcanic rock, undivided
Axb-ogIYA — Mafic volcanic rock with minor gabbro; metamorphosed
AbYYA — Mafic volcanic rock; metamorphosed

Mingliwel Suite

2769–2765 Ma [4] — AMN-mgn — Granitic gneiss

AmqYBU — Quartzofeldspathic gneiss derived from felsic volcanic and/or sedimentary rock

c. 2774 Ma — Ahj-fdvd — **HANNS JASPER FORMATION:** dacitic volcaniclastic sandstone; crystal and lithic rich; metamorphosed

AmdYBU, AsYBU
AmdYBU — Metasedimentary rock, undivided; includes metamorphosed sandstone, siltstone, shale, and chert
AsYBU — Siliciclastic rocks, undivided; metamorphosed

AmcYBU, AcYBU
AmcYBU — Metachert
AcYBU — Chemical sedimentary rock, undivided; metamorphosed

AmfdYBU — Meta-andesite

AmwYBU — Meta-igneous mafic rock; undivided

AmoYBU, AoYBU
AmoYBU — Metamafic intrusive rock
AoYBU — Igneous mafic intrusive rock, undivided; metamorphosed

AmbYBU, AbYBU
AmbYBU — Metamafic volcanic rock, undivided
AbYBU — Mafic volcanic rock, undivided; metamorphosed

AmoYBU — Meta-igneous ultramafic intrusive rock, undivided

AmuYBU — Meta-ultramafic rock, undivided; includes talc–chlorite(–carbonate) and tremolite–chlorite schist

c. 1620 Ma — Efd-mhng — **FLY DAM FORMATION:** interbedded psammitic to pelitic gneiss with leucosomes; pelitic layers garnet- and biotite-rich

Edgy Suite — c. 1665 Ma — EEY-xmgg-mog — Metagranodiorite, metadiorite and metagabbro, granitic gneiss, lenses of metasedimentary rocks, and pegmatite; may include remnants of other **Biranup Zone units**

c. 1750 Ma — Ewo-mt — **WOODLINE FORMATION:** quartz metasandstone, quartz metaconglomerate, and metasiltstone

c. 1305–1290 Ma — EmogFR, Exmog-mgnFR
EmogFR — Metagabbroic rocks; may include felsic granulite, metagranitic and metasedimentary rocks; undivided
Exmog-mgnFR — Metagabbroic and metamafic rocks; may include metagranite and metasedimentary rocks, mafic and felsic granulite

1305–1290 Ma — EFM-xmog-mgn — **FRASER RANGE METAMORPHICS:** sheeted and mostly strongly deformed metagabbro, metagranite, and minor metasedimentary rocks; includes hybrid rocks and mafic and felsic granulite

1335–1290 Ma — EFM-xmdn-mhn, EFM-xmhn-mno

FRASER RANGE METAMORPHICS
EFM-xmdn-mhn — Sedimentary gneiss; psammitic, semipelitic, and locally calc-silicate layers; commonly interlayered with bands of amphibolite, or mafic and felsic granulite
EFM-xmhn-mno — Sedimentary gneiss; interlayered psammitic to pelitic, amphibolite- to granulite- facies gneiss, commonly interlayered with bands of amphibolite, or mafic and felsic granulite

Exmt-mqAFOB — Quartzite and metasandstone, interbedded with metasiltstone; locally interbedded with metaconglomerate and pebbly metasandstone

2700–2630 Ma — AmgmBR, AmgrBR
AmgmBR — Metamonzogranite; foliated
AmgrBR — Metasyenogranite; mostly homogeneous; weakly to strongly foliated; local folded mafic amphibolite lenses; sparse leucosomes

2710–1330 Ma — ÆmuxmgnMO — **MUNGLINUP GNEISS:** granitic gneiss, heterogeneous, and minor metamafic rocks; Archean granite and greenstone and Proterozoic granitic and mafic rock deformed and metamorphosed during the **Albany–Fraser Orogeny**

GUNBARREL BASIN

ALBANY–FRASER OROGEN

RAGGED BASIN

Fraser and Nornalup Zones

ALBANY–FRASER OROGEN

ARID BASIN

MADURA PROVINCE

Biranup Zone

ALBANY–FRASER OROGEN

BARREN BASIN

Biranup Zone

Biranup Zone

Northern Foreland

ALBANY–FRASER OROGEN

YILGARN CRATON

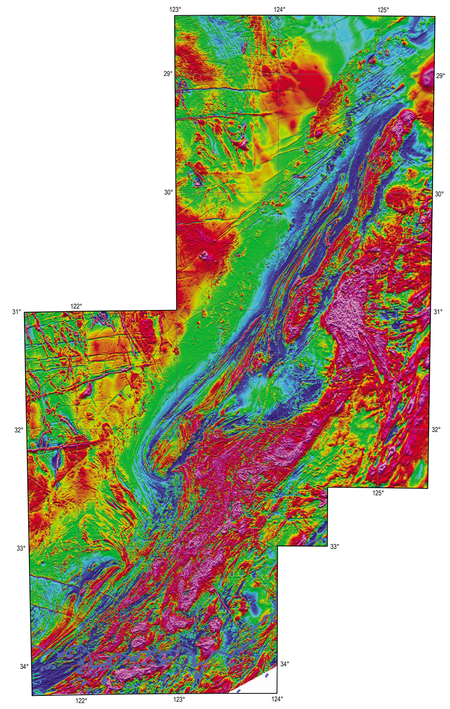
Kalgoorlie Terrane

Yilgarn Craton

Kurnalpi Terrane

Burtville Terrane

REDUCED-TO-POLE AEROMAGNETIC IMAGE



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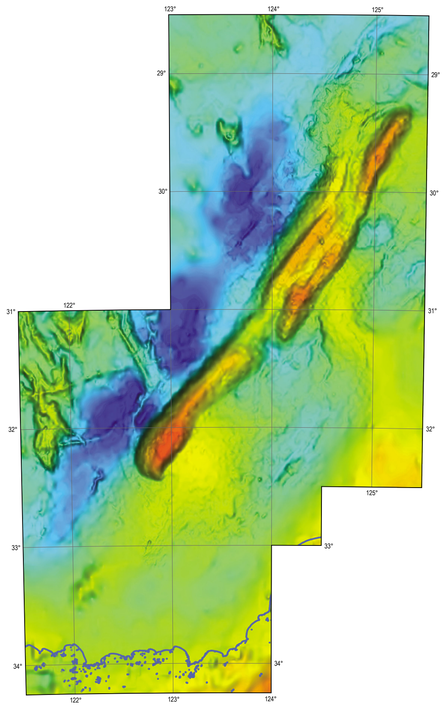
BOUGUER GRAVITY IMAGE



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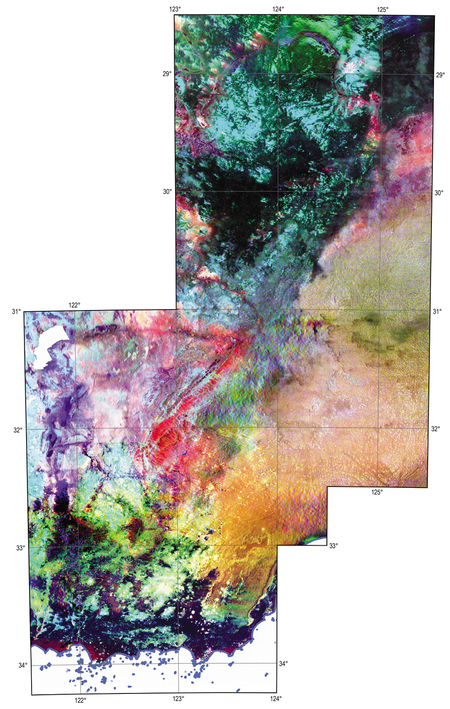

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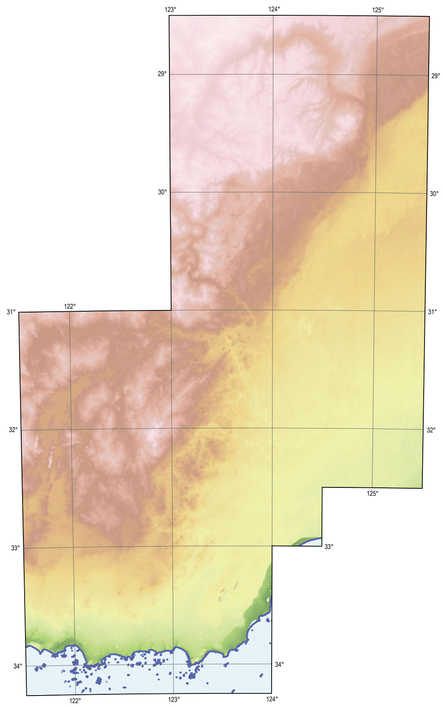

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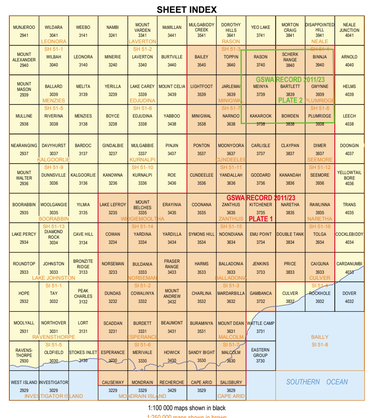
SHEET INDEX



1:100 000 maps shown in black
1:250 000 maps shown in brown

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GSWA RECORD 2011/23 PLATE 1
GSWA RECORD 2011/23 PLATE 2

DATA DICTIONARY

Theme	Data Currency	Organization
Geology *	2011	Geological Survey of Western Australia, Department of Mines and Petroleum
Mineral sites *	JAN 2012	Geological Survey of Western Australia, Department of Mines and Petroleum

* DMP data can be viewed interactively via GeoVIEW.WA <http://www.dmp.wa.gov.au/geoview>, and related datasets can be downloaded from the GSWA Data and Software Centre <http://www.dmp.wa.gov.au/datacentre>.

Compiled by CV Spaggiari 2009–11 (Albany–Fraser), MJ Pawley 2010–11 (east Yilgarn); southeast Yilgarn extracted from Geological Survey of Western Australia 2005 and 2008, 1:500 000 scale interpreted bedrock geology

Geology by CV Spaggiari 2006–11, CL Kirkland 2008–11, and MJ Pawley 2008 (Albany–Fraser); CM Doyle and S Jones 2005, MP Doublier, CE Hall, MJ Pawley, SS Romano, and S Wyche 1998–08 (east Yilgarn); TJ Griffin 1980–84, AH Hickman 1979–81, and P McGoldrick 1988–90 (southeast Yilgarn)

Geochronology from GSWA data (published and in preparation) and interpreted from external sources (listed below). Some GSWA geochronology may come from samples obtained on adjoining sheets. GSWA geochronology data are available online at <http://www.dmp.wa.gov.au/geochron>.

Geochronology by:

1) Cassidy, KF 2007, GA Sample 989670508: Geoscience Australia's geochronology database, July 2007 data release.
2) Durphy, JM et al. 2003, Geoscience Australia, Record 2003/15, p. 95–99.
3) Krapež, B et al. 2000, Tectonophysics v. 322, p. 89–133.
4) Kositcin, N et al. 2008, Precambrian Research v. 161, p. 5–33.
5) Fletcher, IR et al. 2001, Geoscience Australia, Record 2001/47, p. 44–47.
6) Sircombe, KN et al. 2007, Geoscience Australia, Record 2007/1, p. 169–174.
7) Sircombe, KN et al. 2007, Geoscience Australia, Record 2007/1, p. 175–180.
8) Fletcher, IR et al. 2001, Geoscience Australia, Record 2001/47, p. 27–30.

Cartography by AK Jones

Edited by K Greenberg and SK Martin

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The recommended reference for this plate is:
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Government of **Western Australia**
Department of **Mines and Petroleum**

HON. NORMAN MOORE, M.L.C.
MINISTER FOR MINES AND PETROLEUM

Geological Survey of Western Australia

RICK ROGERSON
EXECUTIVE DIRECTOR

SCALE 1:500 000
5 000 0 10 20 30 40 50
Metres Kilometres

UNIVERSAL TRANSVERSE MERCATOR PROJECTION
HORIZONTAL DATUM: GEOCENTRIC DATUM OF AUSTRALIA 1994
VERTICAL DATUM: AUSTRALIAN HEIGHT DATUM

Grid lines indicate 20 000 metre interval of the Map Grid Australia Zone 51

GDA

The Map Grip Australia (MGA) is based on the Geocentric Datum of Australia 1994 (GDA94)
GDA94 positions are compatible within one metre of the datum WGS84 positions

GEOLOGICAL SURVEY OF WESTERN AUSTRALIA
RECORD 2011/23 PLATE 1A

GEOPHYSICAL AND REMOTE SENSING IMAGERY AND REFERENCE FOR PLATE 1, EAST ALBANY–FRASER OROGEN AND SOUTHEAST YILGARN CRATON

June 2012

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