

The new Queensland Geology map and volume

Ian Withnall

Geological Survey of Queensland

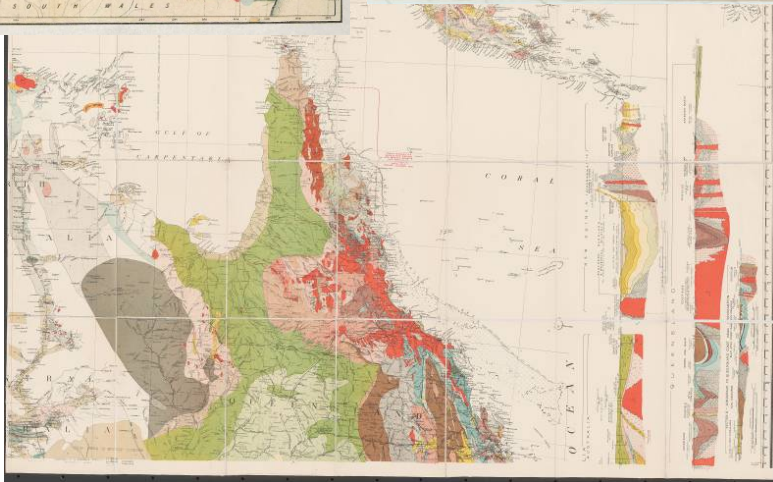
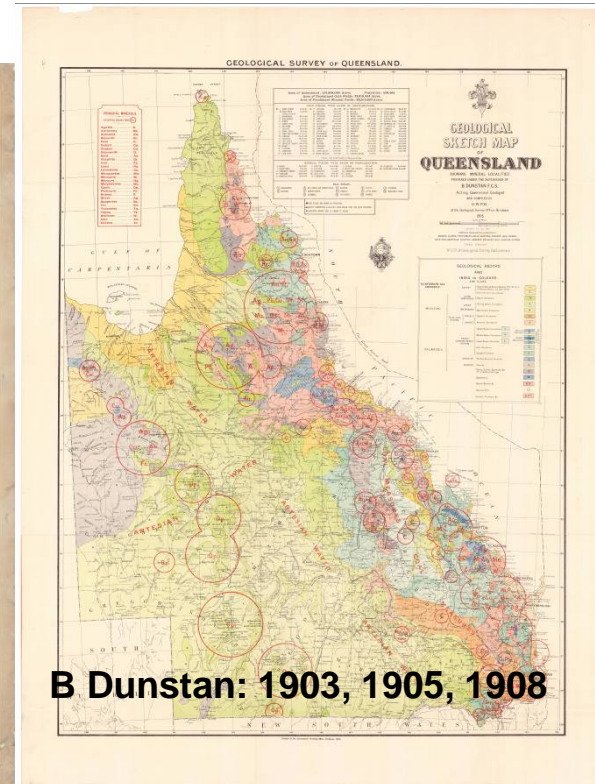
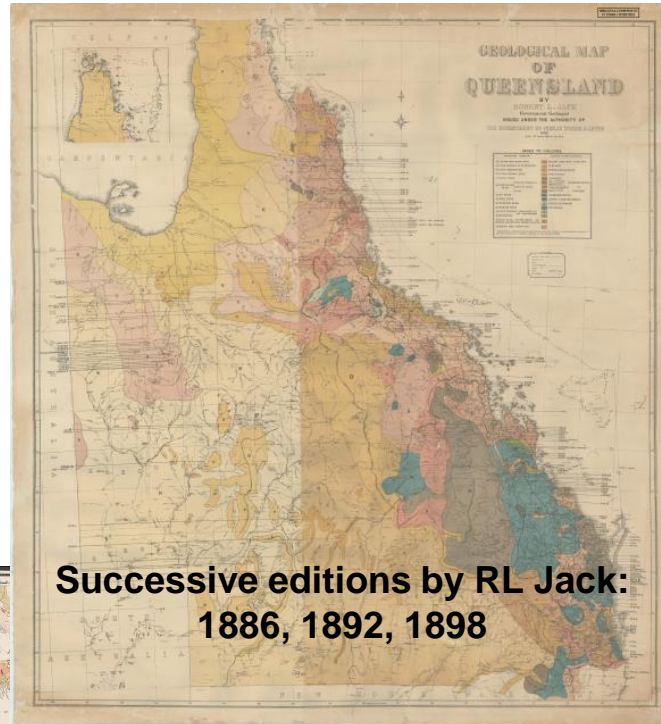
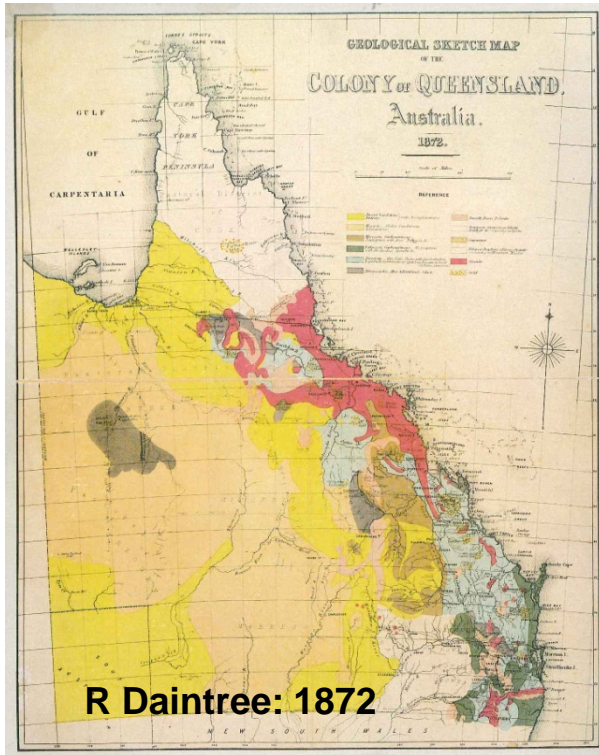
Digging Deeper 10

Emmanuel College, University of Queensland

Wednesday 5 December 2012

First some history:

Attempts to represent the geology of Queensland go back to the early days of Queensland:

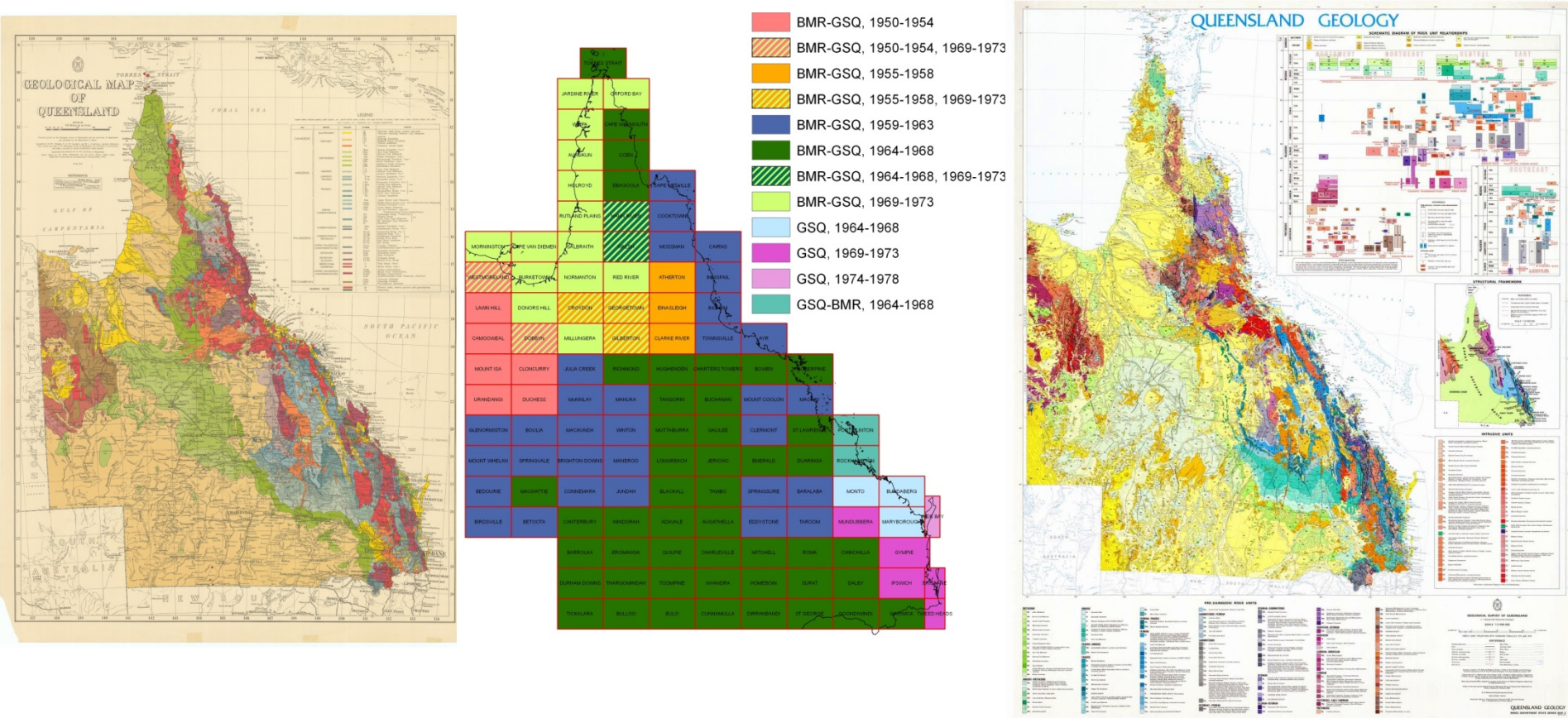


Hiatus in map revision (due to world wars and Depression) was filled by TWE David's map of the Commonwealth of Australia (1931) at 1:3M

Two subsequent maps stand out as milestones:

Geological Map of Queensland (1 inch to 40 miles) published in 1953 represents the state of knowledge immediately prior to the joint BMR–GSQ systematic mapping.

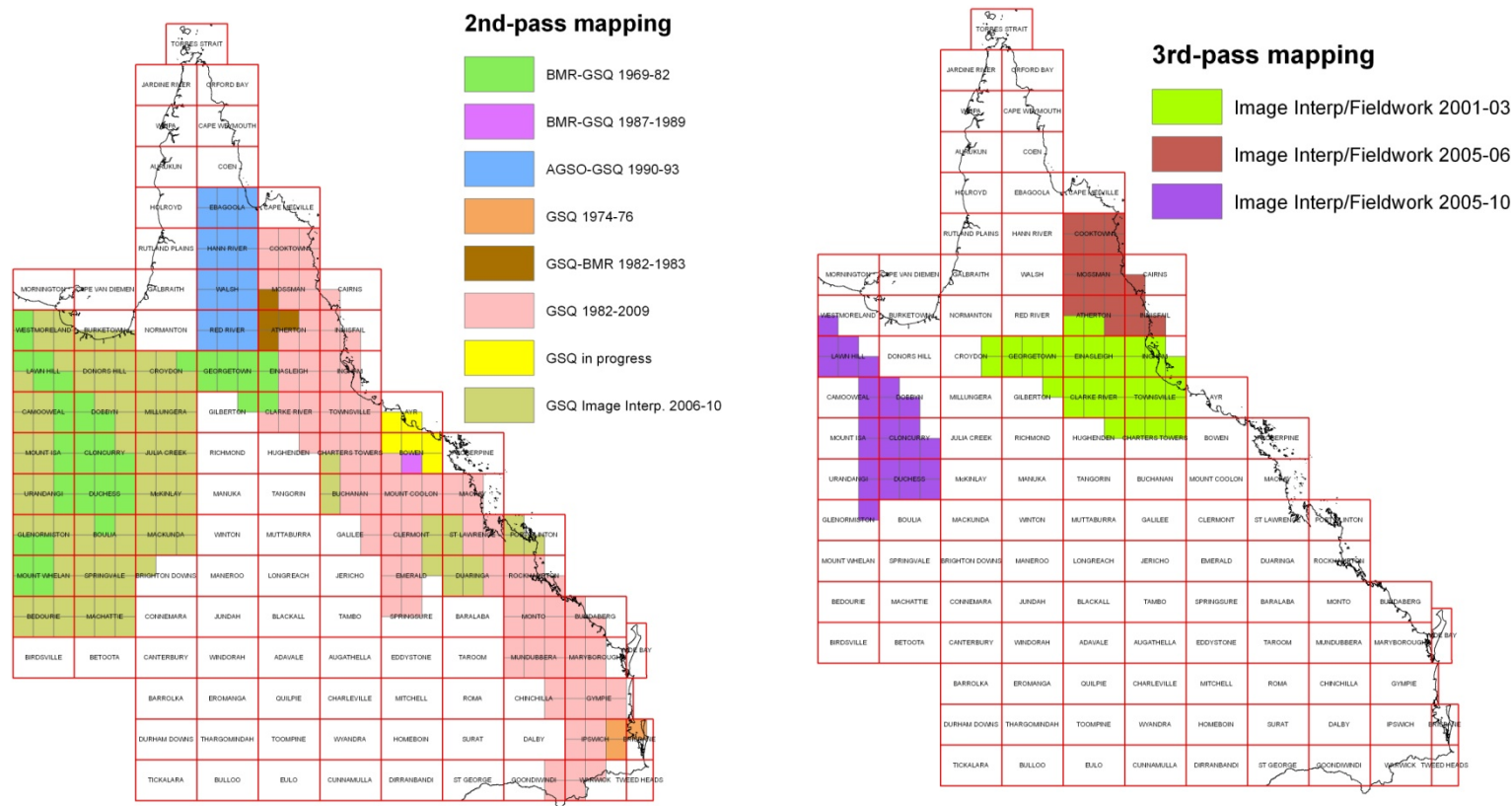
Its successor *Queensland Geology* (1:2 500 000) produced in 1975 for the 25th IGC in Sydney coincided with the completion of this remarkable mapping programme



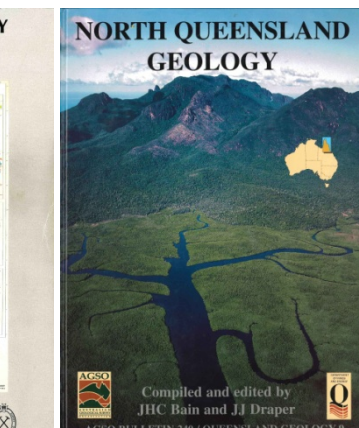
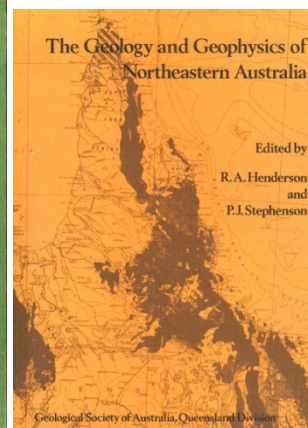
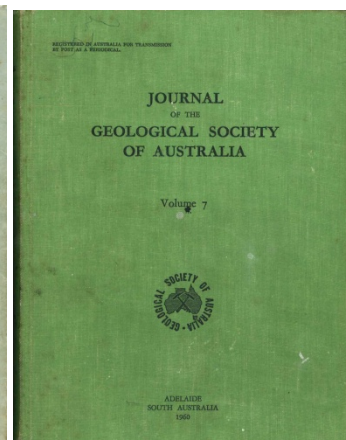
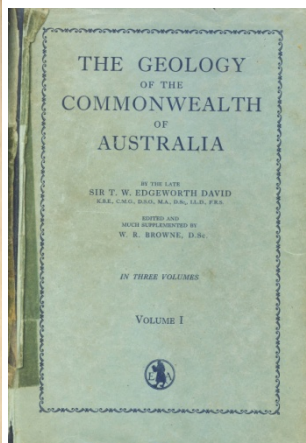
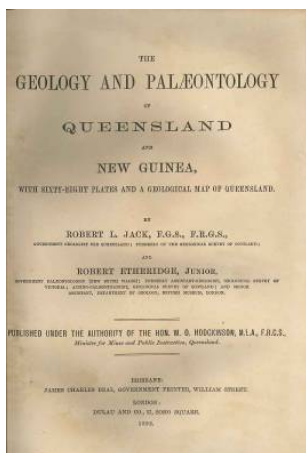
From 1968, GSQ (partly in conjunction with BMR/AGSO/GA) has had an ongoing programme of second-pass mapping of Queensland, mostly with the aim of producing maps at 1:100K scale.

Since 2000, GSQ has also gone back to areas that were remapped prior to the availability of airborne geophysics, revising those maps as a 3rd pass.

In addition, there have been extensive research by universities and other bodies including AMIRA, CRCs, CSIRO, as well as industry.



- In addition to the maps, various treatises covering the geology of Queensland have been produced
 - Jack & Etheridge, 1892: *The Geology and Palaeontology of Queensland and New Guinea*.
 - David & Browne, 1950: *The Geology of the Commonwealth of Australia* (started by TWE David)
 - Hill & Denmead (editors), 1960: *Geology of Queensland*. (J. Geol Soc. Aust, vol 6)
 - Stephenson & Henderson, 1980 (editors): *Geology and Geophysics of Northeastern Australia*. GSA Qld Div
 - Day et al, 1983: *Queensland Geology — a companion to the 1:2 500 000 geological map (1975)*. GSQ Publication 383
 - Bain & Draper, 1997 (editors) *North Queensland Geology*. AGSO Bulletin, 240.



However

- **No modern comprehensive geological treatise covering all of Queensland**
- **Current State map more than 30 years out-of-date**
- With the approach of the 34th IGC in Brisbane in 2012, the time was therefore considered opportune for a new map and treatise covering geology for the whole of Queensland
- GSQ has almost completed second-pass mapping of most of the Qld hard-rock areas and has revised mapping of NW Qld
- Another factor was that many experts who have contributed to the advances in knowledge of Queensland geology are/were fast approaching retirement
- A new volume would draw on this expertise both within GSQ and externally (GA, universities, museums)
- Funding was available, initially from Smart Mining and then Greenfields 2020

2009 Election Commitment to QRC

“Utilising the data from our Smart Mining, Smart Exploration, and Q2 Resources initiatives, GSQ will produce:

- a new *Geological Map of Queensland*, and
- *Geology of Queensland* book

in time for the 34th International Geological Congress, in Brisbane 2012”

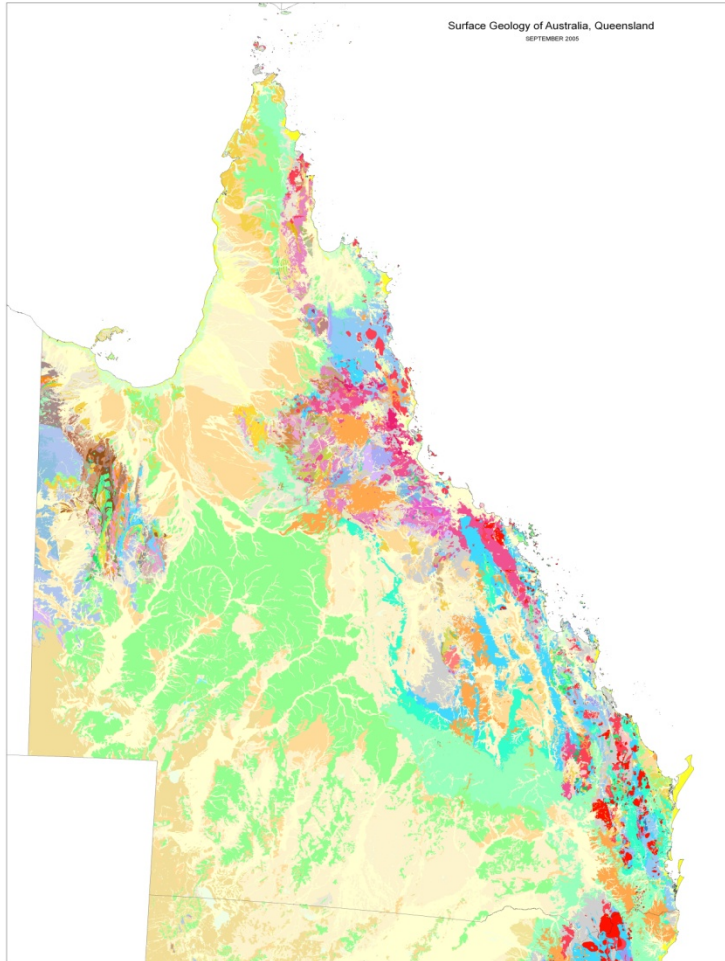
Achieving these two commitments were included in the Greenfields 2020 Program under the *Resourceful Queensland Initiative*

- Aims:
 - Collation of geological knowledge of Queensland, particularly new data achieved in the last 30 years, as a high quality publication and wall map
 - Clear, comprehensive and concise expression of that knowledge in text, maps and photographs
 - Resulting in the most up to date and comprehensive reference work on the geology of Queensland, for use by geologists worldwide, especially those in the mining industry and research institutions.

Queensland Geology map

In compiling a new map, we were given a head start.

GA released a 1:1M-scale digital geological map of Australia in 2008, incorporating most of new data for Queensland up to about 2005.



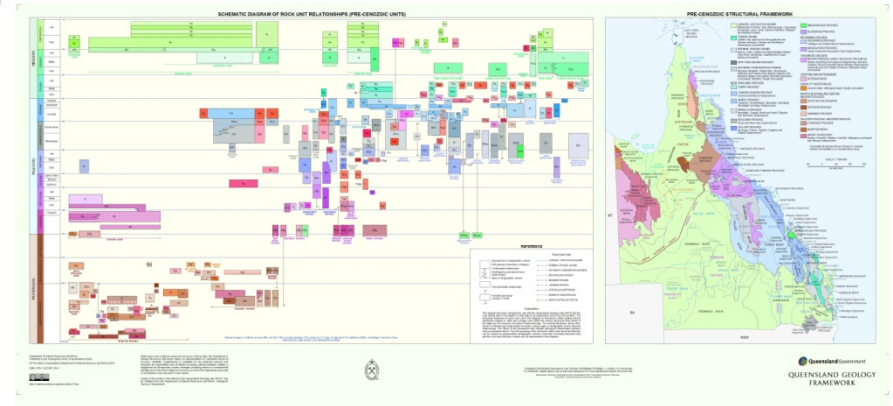
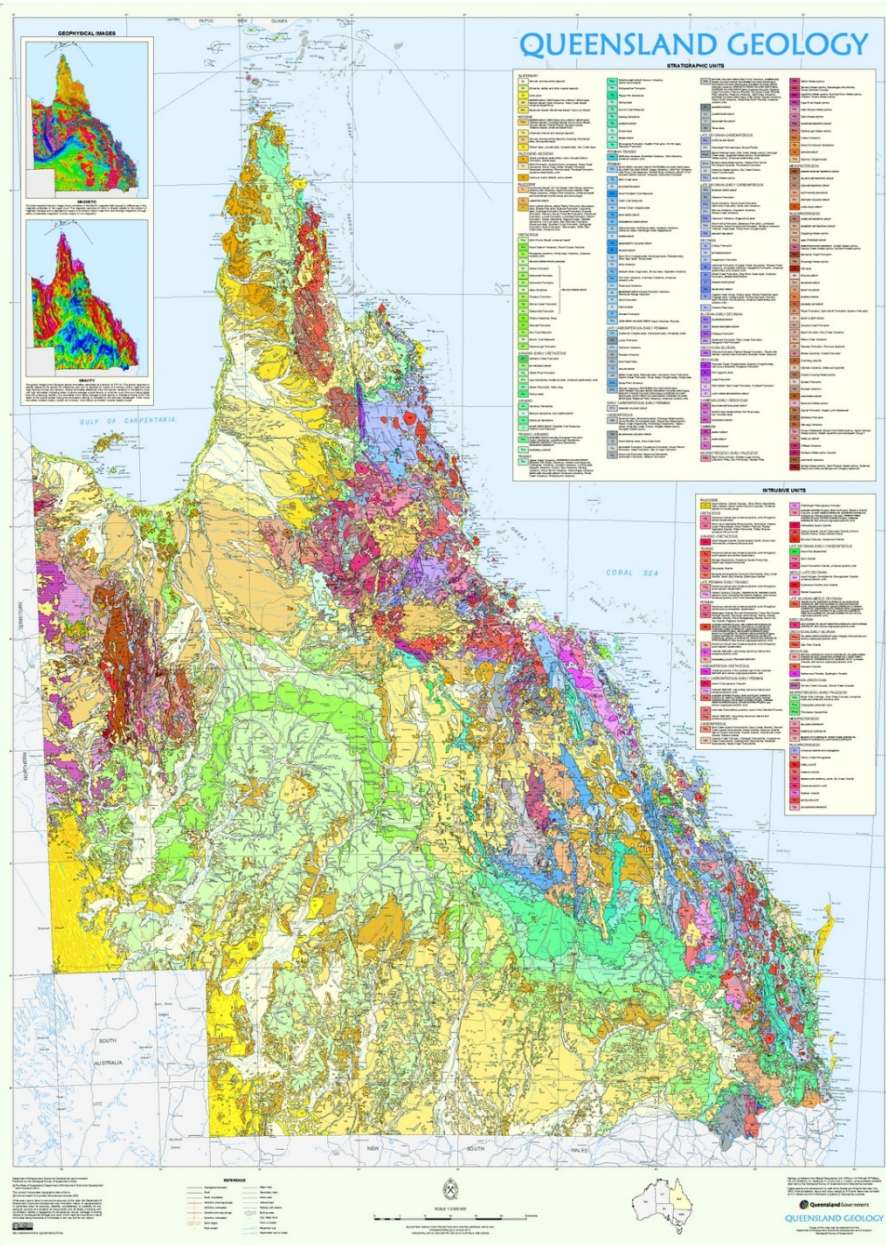
Several problems with this data:

- GA map data compiled for nominal presentation at 1:1M scale — too detailed for hard-copy map at 1:2.5M
- About 1900 rock units recognised and tagged in the data
- This number of units OK for a digital map, but could not be displayed on a 1:2.5M hard copy map due to limitations of space for a legend and symbology – a realistic maximum of 300.
- Already out-of-date — more recent work by GSQ in some key areas (e.g. Drummond Basin and NW Qld)

Queensland Geology map

- Project commenced September 2010
- Formalised nomenclature used by geologists for many of the rock units provided a hierarchy which was utilised to group them. Others were grouped on an informal basis, such as age, rock type and association.
- Using such criteria, resulted in reducing the 1900 units to a final list of just 250 units
- The units in the GA data were merged on this basis and common boundaries dissolved, resulting in a much simpler map, but still too many intricate boundaries and small polygons for 1:2M scale
- Boundaries of generalised units were therefore plotted at 1:500K and traced and generalised by geologists and then re-digitised, polygonised and tagged by cartographers and joined into a seamless map (compilation phase completed March, 2011).
- Geology in areas of new detailed mapping (NW Qld and Drummond Basin) were also grouped and generalised as above

Queensland Geology map



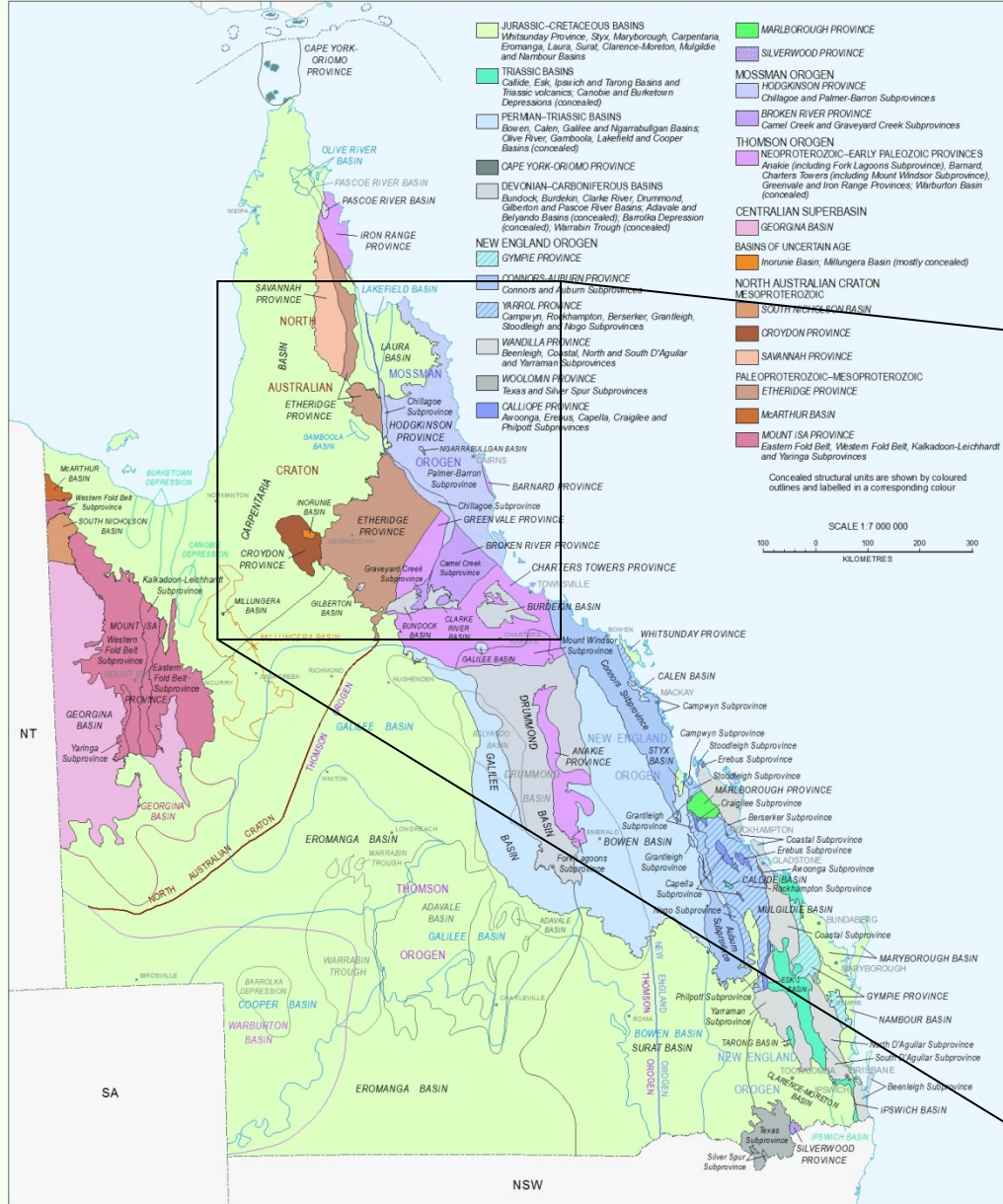
- The final phase was the design of the map itself, using ArcGIS
- Stratigraphic units coloured using standard age colours with pattern overprints, and intrusive units (shown separately on the legend) coloured using standard lithological colours (mainly reds and purples)
- Unique letter symbols assigned to each unit
- The scale of 1:2M (chosen to allow more detail to be represented) necessitated having the structural elements map and schematic reference printed on a separate sheet
- The map was printed in June 2012 and released at the 34th IGC

Queensland Geology map



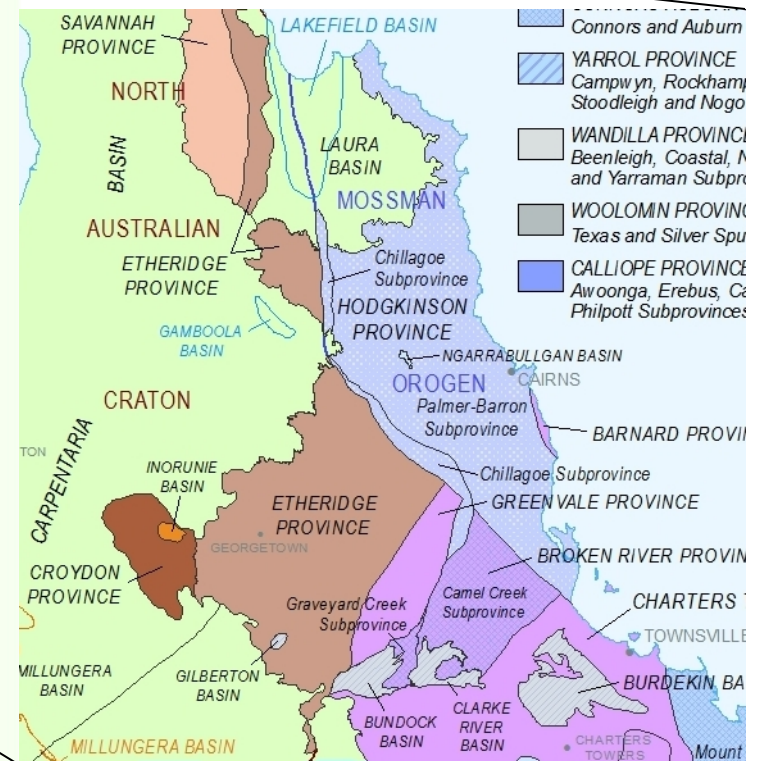
Queensland Geology map

PRE-CENOZOIC STRUCTURAL FRAMEWORK

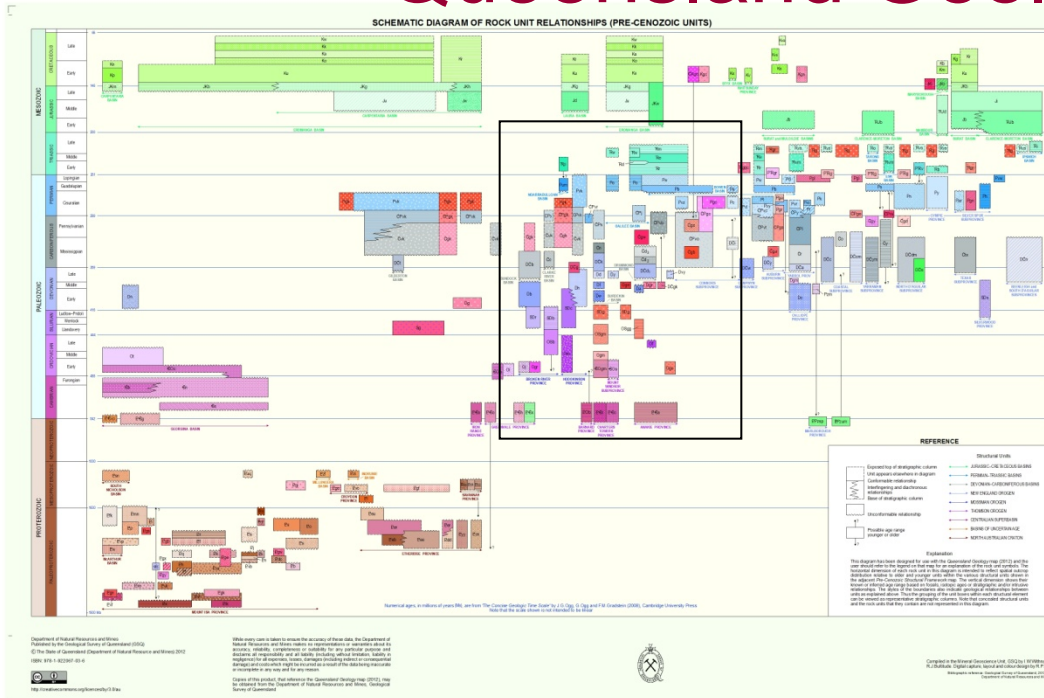


Structural Framework map completely revised using latest province and basin nomenclature

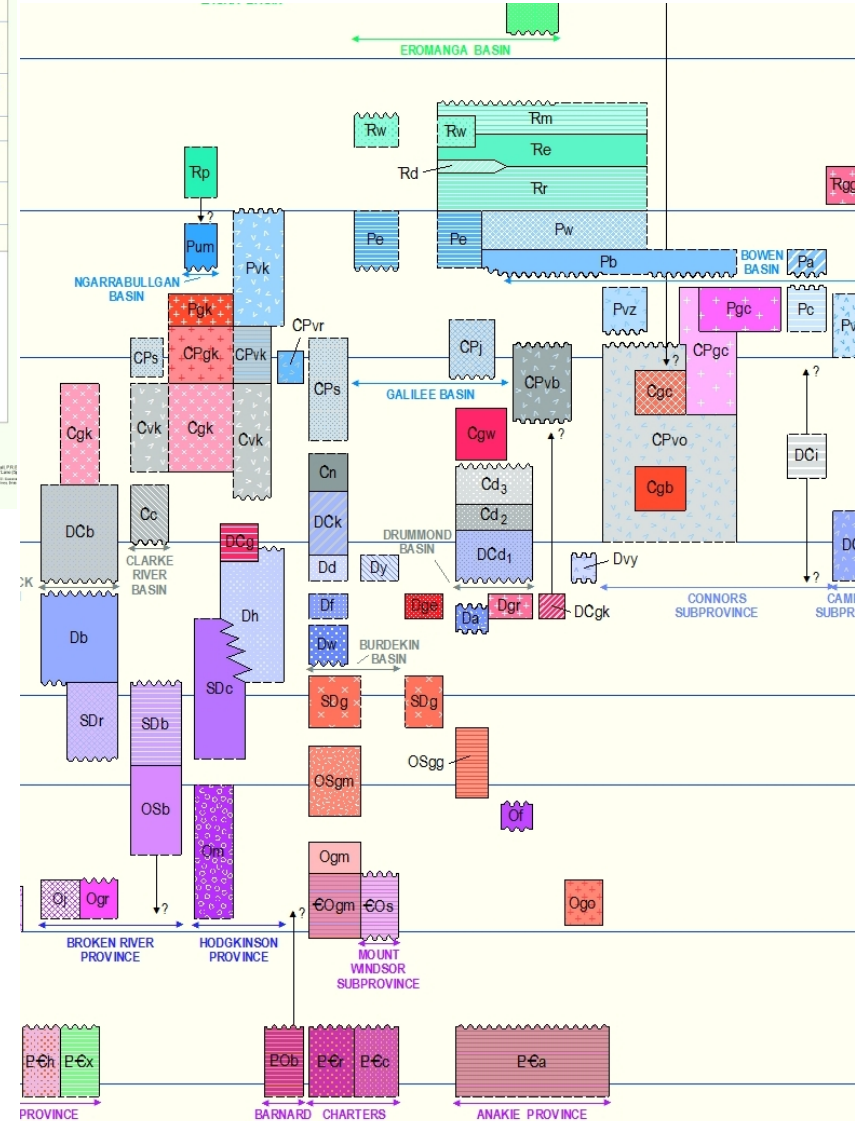
Outlines of subsurface basins also shown



Queensland Geology map

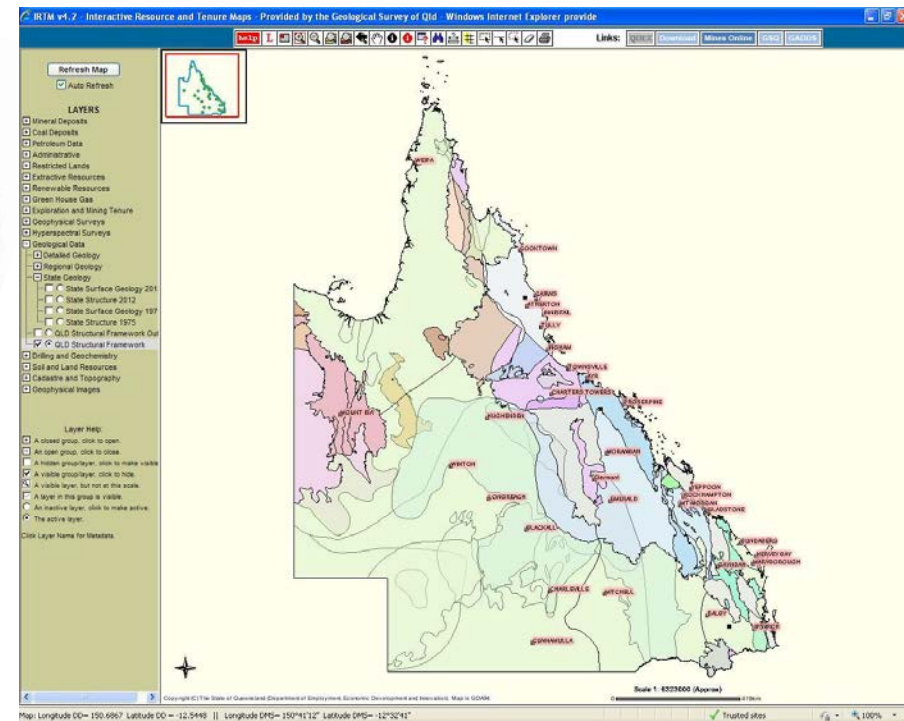
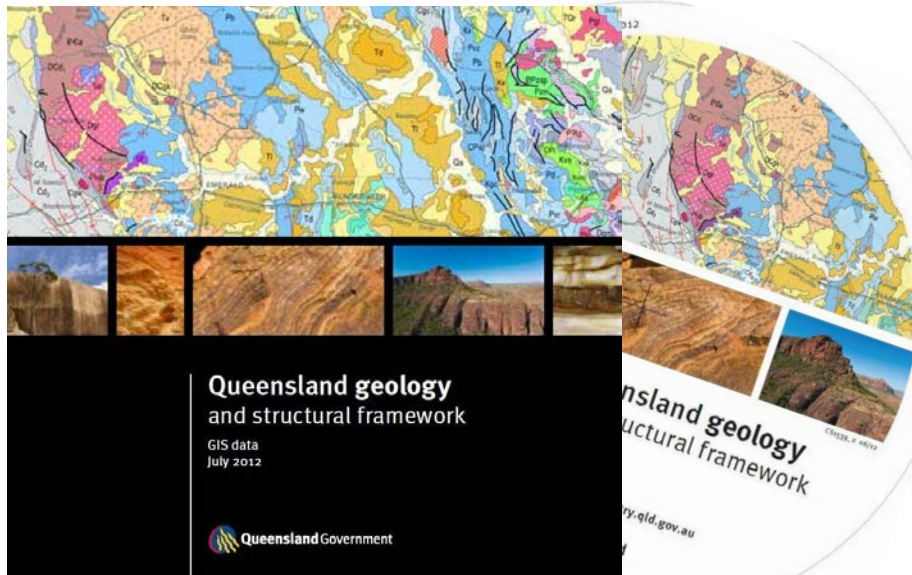


- Schematic Diagram (or time-space plot) shows units from main map and legend
- Horizontal dimension reflects spatial outcrop distribution relative to older and younger units and the various units in the Structural Framework map
- Vertical dimension shows their known or inferred time range
- Styles of boundaries also indicate geological relationships



Queensland Geology GIS

- The digital data used in the production of the hardcopy map has been incorporated into the Queensland Geology GIS product, available on DVD
- The datasets are also incorporated into the Interactive Resource and Tenure Maps (IRTM) online GIS application making the information freely available for query, analysis, print and download.



Queensland Geology GIS

QUEENSLAND_GEOLOGY_2012.MXD - ArcMap - ArcInfo

File Edit View Bookmarks Insert Selection Tools Window Help

1:1,301,618

Georeferencing Layer: Qld_Magnetic.jpg

Legend Limiter OFF

Layers

- QLD_STRUCTURAL_FRAMEWORK_O
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- QLD_STRUCTURAL_FRAMEWORK
- QLD_GEOLOGY_2012_EDN_ROCK_U
- <all other values>
- 01 QUATERNARY (STRATIGRAPH
- Qa, 3588
- Qe, 10704
- Qd, 10551
- Qbn, 16024
- Qbs, 16095
- 02 NEOGENE
- TQbn, 16034
- TQr, 2559
- TQ, 3589
- Tu, 3592
- 03 PALEOGENE - NEOGENE
- Ts, 2567
- Tm, 3593
- Td, 2564
- 04 PALEOGENE
- Tv, 3597
- Tvl, 774
- Tl, 3594
- 05 CRETACEOUS
- Kva, 16109
- Kvs, 16110
- Kv, 16646
- Kr, 1244
- Kw, 1528
- Kk, 841
- Kn, 1079
- Ka, 18
- Ko, 1436
- Kg, 620
- Ku, 1477
- Kp, 1165
- Ks, 1331
- Kx, 1354
- Kb, 225
- Km, 880
- 06 JURASSIC - EARLY CRETACE
- JKr, 609
- Jkb, 3618
- Jkg, 572
- Jkm, 16008
- Jk, 2521

Identify

Identify from: <Top-most layer>

QLD_GEOLOGY_2012_ED

Anakie Metamorphic Gr

Location: 147.461589 -22.823041 Decimal Degrees

Field	Value
FID	4509
Shape	Polygon
KEY	28
NAME	Anakie Metamorphic Group
MAP_SYMBOL	PLEa
LITH_SUMM	Siltstone, fine sandstone, phyllite, schist, commonly cleaved and multiply deformed
AGE_NAME	NEOPROTEROZOIC - CAMBRIAN?
DOM_ROCK	PELITE
UNIT_TYPE	STRATIFIED UNIT (INCLUDING VOLCANIC AND METAMORPHIC)

Identified 1 feature

- Polygons have a range of attributes including unit name, type of unit, age, lithological description, dominant rock type, and an abbreviated symbol for use in labelling the polygons.
- Lines comprise the boundaries of geological units and other linear features such as faults and folds.
- In the ESRI version, a layer file is provided which presents the units in the colours and patterns used on the printed hard copy map.
- For MapInfo users, a simplified colour palette is provided without patterns.

Display Source Selection

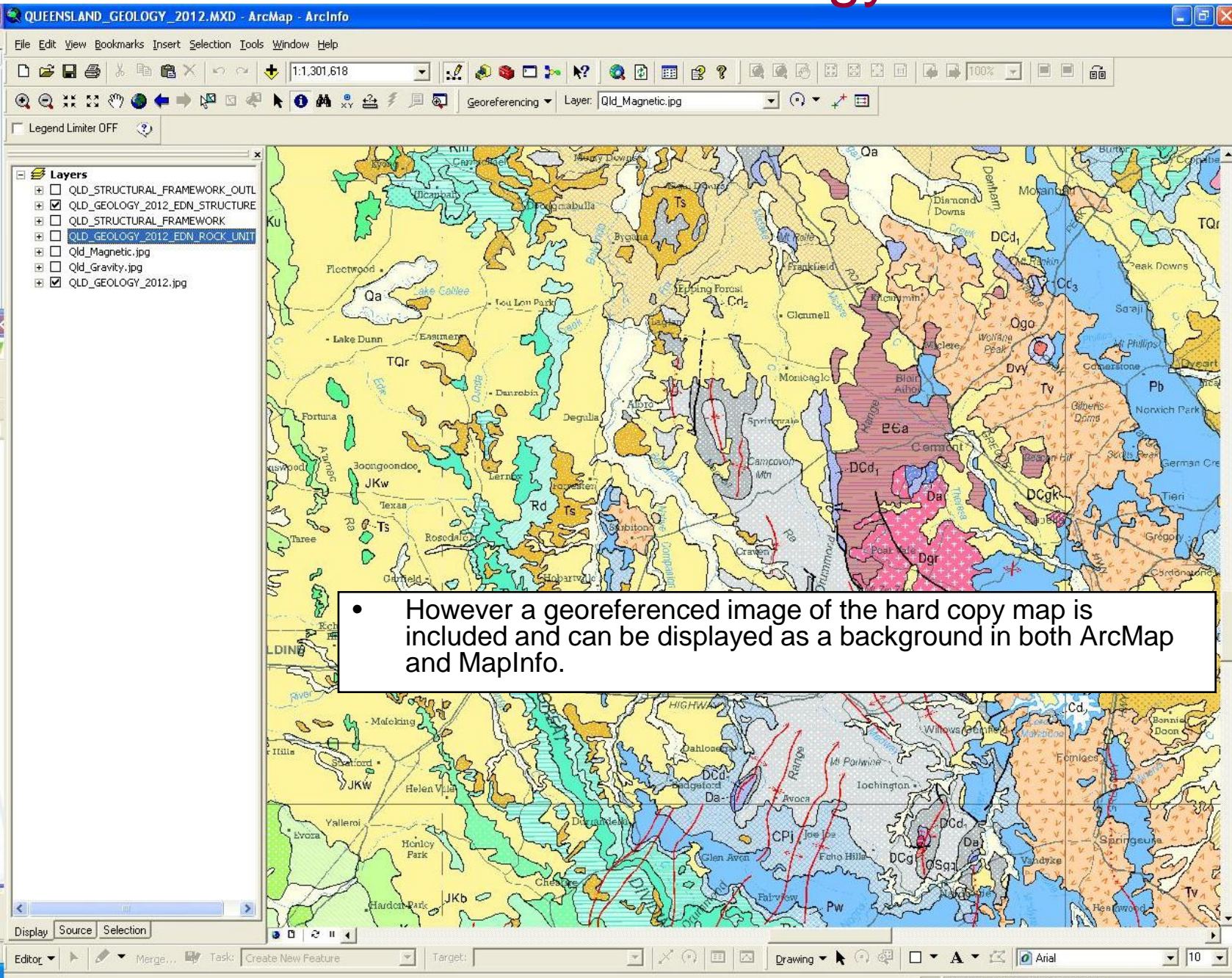
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Drawing

Arial 10

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Queensland Geology GIS



Queensland Geology GIS

FRAMEWORK_2012.MXD - ArcMap - ArcInfo

File Edit View Bookmarks Insert Selection Tools Window Help

1:10,791,955

Georeferencing Layer: Qld_Magnetic.jpg

Legend Limiter OFF

QLD_STRUCTURAL_FRAMEWORK

- 01 JURASSIC - CRETACEOUS BASINS
 - Carpentaria Basin, JURASSIC - CRETACEOUS, 14231
 - Clarence-Moreton Basin, TRIASSIC - JURASSIC, 16551
 - Eromanga Basin, JURASSIC - CRETACEOUS, 13822
 - Laura Basin, JURASSIC - CRETACEOUS, 16592
 - Maryborough Basin, JURASSIC - CRETACEOUS, 16576
 - Mulgildie Basin, JURASSIC, 16548
 - Nambour Basin, JURASSIC, 16577
 - Styx Basin, CRETACEOUS, 16585
 - Surat Basin, JURASSIC - CRETACEOUS, 16547
 - Whitsunday Province, CRETACEOUS, 16564
- 02 TRIASSIC BASINS
 - Callide Basin, TRIASSIC, 16650
 - Esk Basin, TRIASSIC, 16578
 - Ipswich Basin, TRIASSIC, 16549
 - Tarong Basin, TRIASSIC, 16550
 - Undivided Triassic volcanics, TRIASSIC, 16663
 - Burketown Depression, TRIASSIC, 14231
 - Canobie Depression, TRIASSIC, 14231
- 03 PERMIAN - TRIASSIC BASINS
 - Bowen Basin, PERMIAN - TRIASSIC, 16586
 - Calen Basin, PERMIAN, 16553
 - Galilee Basin, CARBONIFEROUS - TRIASSIC, 16587
 - Ngarrabullgan Basin, PERMIAN - TRIASSIC, 16649
 - Cooper Basin, PERMIAN - TRIASSIC, 13822
 - Gamboola Basin, PERMIAN, 14231
 - Lakefield Basin, PERMIAN - TRIASSIC, 16592
 - Olive River Basin, PERMIAN, 14231
- 04 CAPE YORK - OROIMO PROVINCE
 - Cape York-Oriomo Province, CARBONIFEROUS - PERMIAN
- 04a DEVONIAN - CARBONIFEROUS BASINS
 - Bundock Basin, LATE DEVONIAN - EARLY CARBONIFEROUS
 - Burdekin Basin, DEVONIAN - CARBONIFEROUS, 16552
 - Clarke River Basin, LATE DEVONIAN - EARLY CARBONIFEROUS
 - Drummond Basin, DEVONIAN - CARBONIFEROUS, 1656
 - Gilberton Basin, LATE DEVONIAN - EARLY CARBONIFEROUS
 - Pascoe River Basin, LATE DEVONIAN - EARLY CARBONIFEROUS
 - Adavale Basin, DEVONIAN, 13822
 - Barrolka Depression, DEVONIAN, 13822
 - Belyando Basin, DEVONIAN, 16587
 - Warrabin Trough, DEVONIAN, 13822
- 05 NEW ENGLAND OROGEN, GYMPIE PROVINCE
 - Gympie Province, PERMIAN - TRIASSIC, 16582
 - Marlborough Province, NEOPROTEROZOIC - PALAEOZOIC
 - Silverwood Province, SILURIAN - DEVONIAN, 16580
- 06 CONNORS - AUBURN PROVINCE
 - Connors Subprovince, CARBONIFEROUS - PERMIAN

Identify

Identify from: <Top-most layer>

QLD_STRUCTURAL_FRAMEWORK

JURASSIC - CRETACEOUS

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Field	Value
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Shape	Polygon
KEY	13822
AGE	JURASSIC - CRETACEOUS
SURF_UNIT	Eromanga Basin
HIERARCHY	Eromanga Basin>Cooper Basin>Warrabin Trough>Thomson Orogen/Warburton Basin
RANK_CODE	PROVIN
OROGEN	Thomson Orogen

Identified 1 feature

- For the Structural Framework map, querying the data in one version shows the surface unit with the subsurface units embedded in a text string..

Display Source Selection

Editor Merge... Task: Create New Feature Target:

Drawing Drawing

Arial 10

136.169 -25.688 Decimal Degrees

Queensland Geology GIS

FRAMEWORK_2012.MXD - ArcMap - ArcInfo

File Edit View Bookmarks Insert Selection Tools Window Help

1:10,791,955

Georeferencing Layer: Qld_Magnetic.jpg

Legend Limiter OFF

Layers

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- ☐ QLD_STRUCTURAL_FRAMEWORK
- ☐ QLD_STRUCTURAL_FRAMEWORK_MULTI_POLYS (Surface)
- ☒ QLD_STRUCTURAL_FRAMEWORK_MULTI_POLYS (Orogens)
 - <all other values>
 - OROGEN
 - Post Orogenic Basins
 - New England Orogen
 - Mossman Orogen
 - Thomson Orogen
 - North Australian Craton
- ☐ Qld_Magnetic.jpg
- ☐ Qld_Gravity.jpg

Identify

Identify from: <Top-most layer>

QLD_STRUCTURAL_FRAMEWORK_

- CAMBRIAN
- DEVONIAN
- PERMIAN - TRIASSIC
- JURASSIC - CRETACEOUS

Location: 141.348586 -26.443467 Decimal

Field	Value
FID	14
Shape	Polygon
KEY	13822
AGE	CAMBRIAN
RANK_CODE	PROVIN
STRU_UNIT	Warburton Basin
PARENT	Warburton Basin
PROVINCE	Warburton Basin
OROGEN	Thomson Orogen
Sequence	14

Identified 4 features

- For the Structural Framework map, another version has the data structured into a series of overlapping, multi-part polygons, one for each structural unit, so that querying a point will retrieve each of the underlying structural units in order of superposition..

Display Source Selection

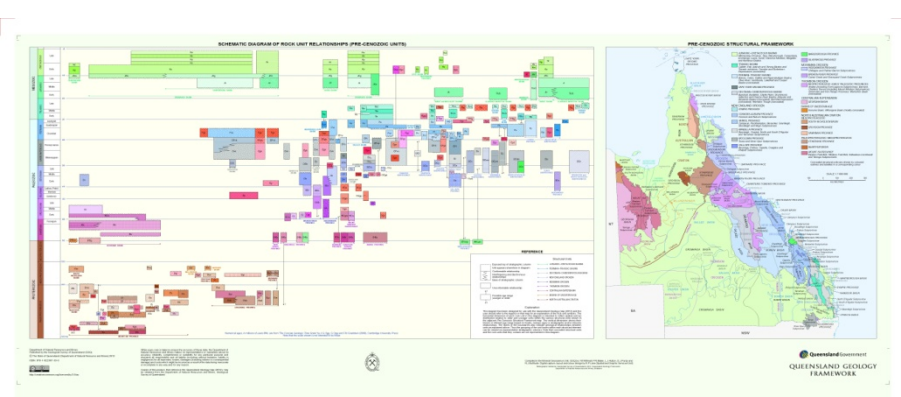
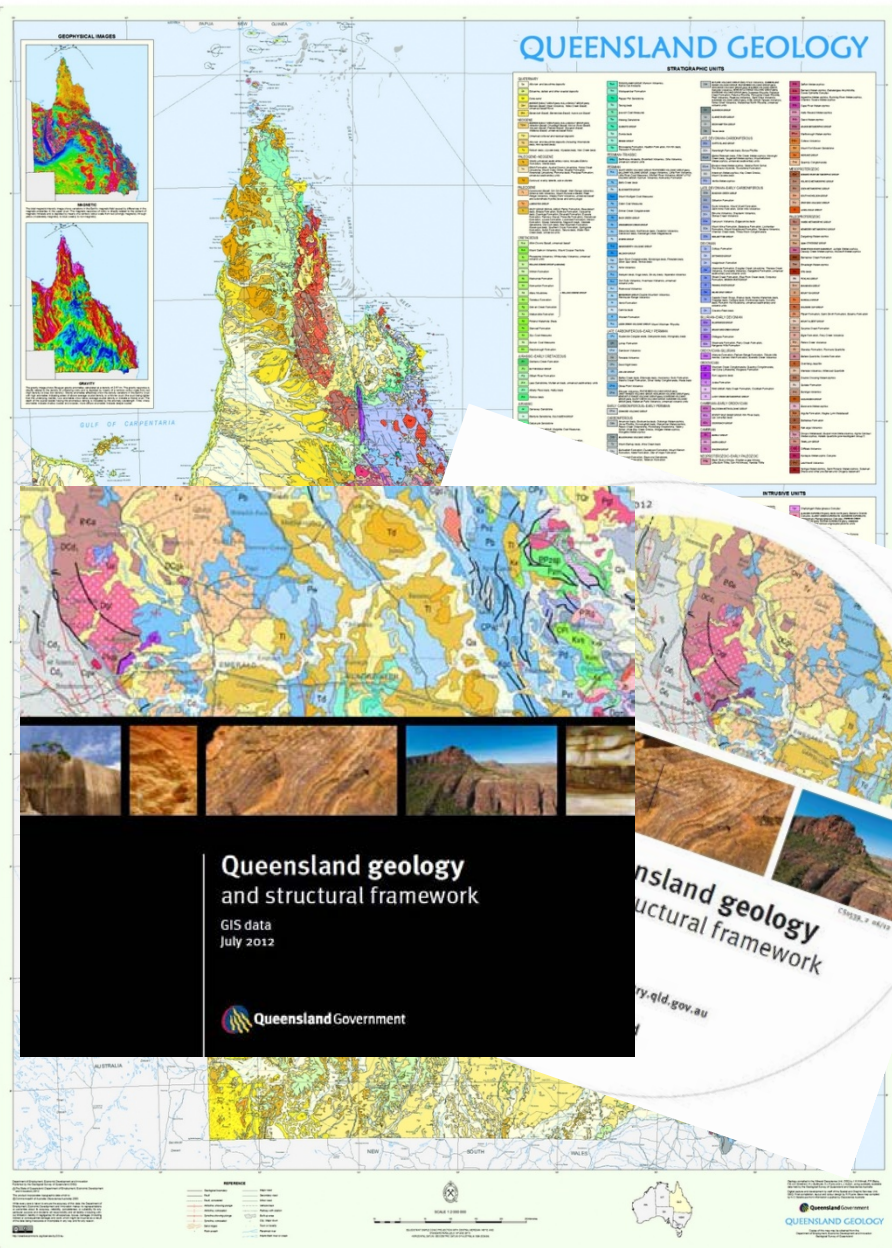
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Drawing

Arial

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Queensland Geology map



- Queensland Geology 1:2 000 000 map and Framework 2012 — \$20.65
- Queensland Geology and Structural Framework GIS Data July 2012 (DVD) — \$15.25

Contact sales@deedi.qld.gov.au

or phone +61 7 3035 5306

or visit Level 10, 119 Charlotte Street

Geology of Queensland volume

- Editor appointed – Dr Peter Jell – former Director, Qld Museum (1 March 2010)
- Development of outline and selection of chapter coordinators (April 2010)
- 24 chapter coordinators and 34 other contributors from GSQ, GA, Australian universities and museums and consultants as well as cartographers and graphic designers
- Initial deadline for receipt of draft manuscripts (30 June 2011)
- Most (almost) final manuscripts to hand (December 2011)
- Desktop production and design put in hands of Customer Solutions (within DEEDI/DNRM) who also contracted an external style editor
- Final manuscript received June 2012 allowing mock-up to be prepared for display at IGC
- Indexing and checking/correcting proofs completed early December 2012
- Approximately 980 pages and 732 text figures
- Printing January 2013 and release February 2013



Geology of Queensland volume

Chapters & chapter coordinators

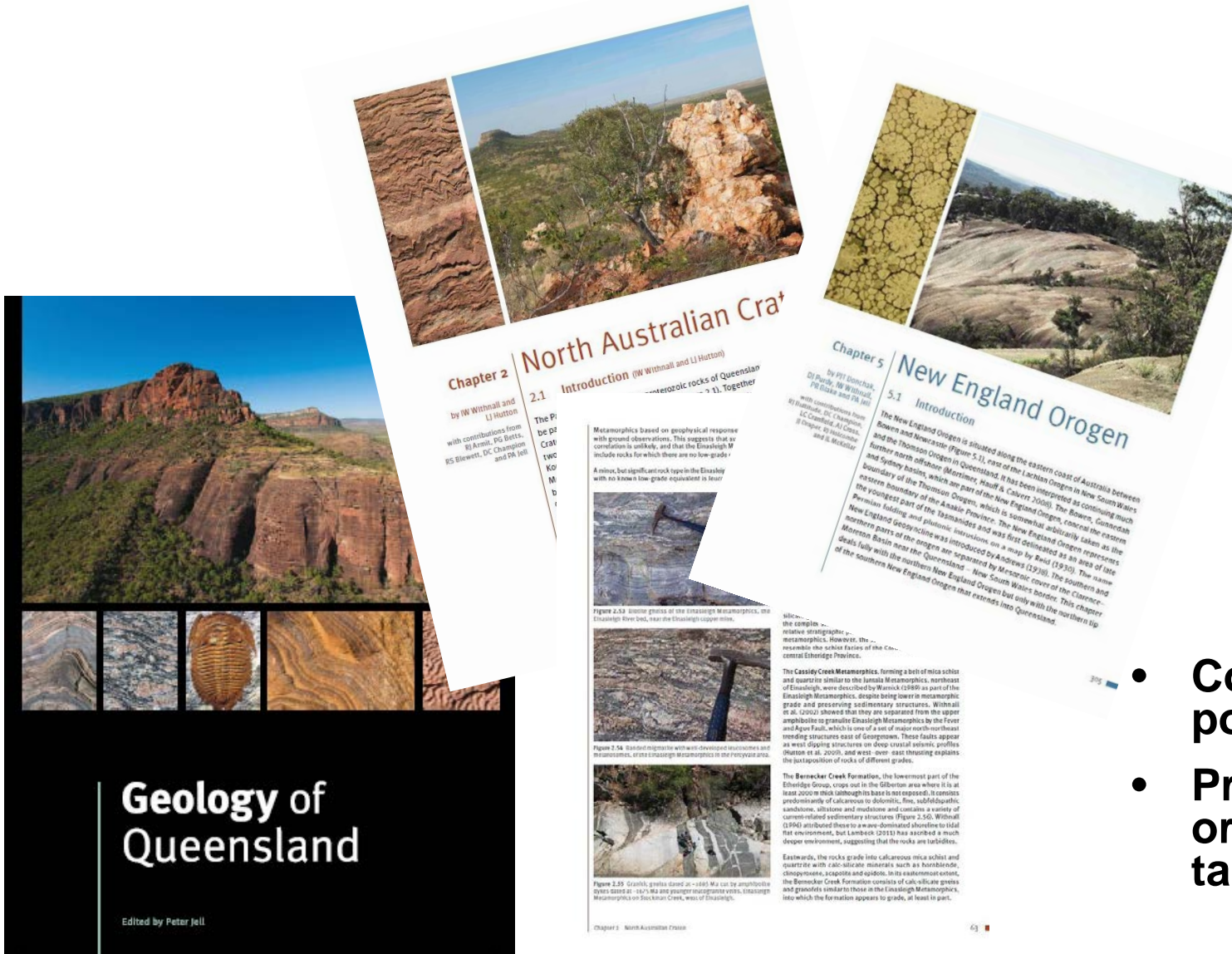
- | | |
|---------------|--|
| Ch 1 | INTRODUCTION IW Withnall, RA Henderson, DC Champion & PA Jell |
| Ch. 2 | NORTH AUSTRALIAN CRATON IW Withnall LJ Hutton |
| Ch. 3 | THOMSON OROGEN CL Fergusson, RA Henderson |
| Ch. 4 | MOSSMAN OROGEN RA Henderson, PJT Donchak, IW Withnall |
| Ch. 5 | NEW ENGLAND OROGEN , PJT Donchak, DJ Purdy, PR Blake, IW Withnall & PA Jell |
| Ch. 6 | KENNEDY IGNEOUS ASSOCIATION DC Champion & RJ Bultitude |
| Ch. 7 | POST-OROGENIC MESOZOIC BASINS & MAGMATISM AG Cook, SE Bryan, JJ Draper, |
| Ch 8 | PALEOGENE-NEOGENE AG Cook & JS Jell |
| Ch. 9 | QUATERNARY GJ Price |
| Ch. 10 | MINERAL & ENERGY RESOURCES T Denaro, R Randall & R Smith |
| Ch. 11 | SEISMICITY 1866-2009 JMW Rynn & D Weatherley |
| Ch. 12 | ENGINEERING GEOLOGY KJ Waye & MJ Irwin |
| Ch. 13 | GROUNDWATER RESOURCES LM Leach |
| Ch. 14 | IMPACT STRUCTURES & METEORITES AG Cook |
| Ch. 15 | GEOLOGICAL HERITAGE WF Willmott |

Geology of Queensland volume

- The Proterozoic North Australian Craton and the Thomson, Mossman and New England Orogens considered to be the major large-scale structural elements, so they have been treated in separate Chapters 2–5.
- Each of these chapters includes descriptions of overlying post-orogenic sedimentary basins and igneous intrusive and extrusive rocks within the particular structural element.
- This arrangement is not perfect and many issues remain, such as the separation of the Burdekin Basin that rests on the Thomson Orogen from the rocks in the Broken River area which are in the Mossman Orogen despite their marked similarities in fossil faunas and sedimentary environments.
- The Kennedy Igneous Association, which incorporates magmatic rocks emplaced into several of these structural elements, does not fit this framework and is treated in a separate Chapter 6
- The post-orogenic Mesozoic, Paleogene–Neogene and Quaternary history of the state is treated on a more conventional chronological basis in Chapters 7–9.
- Thematic chapters on resources, seismicity, engineering, groundwater, extra-terrestrial impact features and heritage are included to highlight major geological impacts on human society Chapters 10–15.

Geology of Queensland volume

Like its predecessors, *Geology of Queensland* will become a standard reference for future generations of geologists



- Cost \$75.00 plus postage
- Pre-publication orders being taken