The new 1:2 500 000-scale State geological map of Western Australia

by

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A new 1:2 500 000-scale geological map of Western Australia was compiled and printed during 1998 (Myers and Hocking, 1998). The map provides a new interpretation of the geology of Western Australia based on field mapping and geochronology by the Geological Survey of Western Australia (GSWA), regional aeromagnetic and gravity data, and recent publications from various sources. The map incorporates many new features on the map face and provides much more information than its 1988 predecessor. The main features are listed below. The 1998 printed map is also available digitally, in Microstation DGN format and ArcInfo format, and can be provided as Map Info export files on request. The digital formats enable the geology to be interrogated and integrated with data on mineral deposits, mineral exploration, and mining tenements. The 1998 map has already been simplified and combined with information on mineral deposits, and has been published as an atlas and gazetteer in which deposits can easily be located by type, name or area (GSWA, 1999). The 1998 map will form the basis for future GSWA index maps.

Large areas of the 1998 geological map are based on new detailed mapping by the GSWA. Since 1988, new concepts and revised geology have arisen out of the Eastern Goldfields, Glengarry, Southern Gascoyne, Rudall, Pilbara, Kimberley, Earaheedy, Western Margin, and Interior Basins projects. The map also contains a substantial amount of new structural and tectonic interpretation, gained through the integration of geological mapping with aeromagnetic and gravity data. Many observations and interpretations appear for the first time on this map — new information was added, and the map updated, until early November 1998.

The geology is subdivided and portrayed in a similar manner to the 1988 map, with largely the same colour scheme and style of legend. Precambrian geology is displayed as either lithostratigraphic packages of formations and groups that are generally relatively little deformed or metamorphosed, or by lithology in belts of generally more highly deformed and metamorphosed rocks. New geochronological results obtained during the past ten years have enabled the ages of Precambrian geological units to be defined with greater precision, and this information has been used to place most Precambrian rock units into time slots of 100 million years. Phanerozoic geology is presented as major depositional rock packages, but like the Precambrian is more finely subdivided on this map than the 1988 edition. Interestingly, where recent work has cast doubts on the assumed age of some successions, the age of some Phanerozoic rocks is shown with more latitude than in 1988.

The main new features of the 1998 State geological map are:

- Completely new compilation of the geology of the eastern part of the Yilgarn Craton, the southern part of the Capricorn Orogen, the Pilbara granite–greenstone terrane, the Rudall portion of the Paterson Orogen, and the west and east Kimberley, all largely based on new mapping for 1:100 000-scale map sheets. The Perth and Carnarvon Basins have been revised substantially after reassessments by the Petroleum Initiatives Group within GSWA and limited remapping.
- Geological structure of Western Australia substantially reinterpreted, based on integration of geological mapping with aeromagnetic and gravity data.
- Interpretation of the gross geological structure of crystalline basement beneath the the Canning, Officer and Eucla Basins.
- Dynamics of major fault movements indicated, and fault systems linked at both near-surface and subsurface levels. The major offshore structural fabric around Western Australia has been interpreted and compiled from both published and unpublished sources including GeoSat and ERS-1 satellite data, and linked to onshore structures.
- Reinterpretation of the eastern part of the Albany–Fraser Orogen based on new geological reconnaissance mapping, geochronology, and geophysics.
- Major lithostratigraphic revisions in the southern Capricorn Orogen and the Centralian Superbasin.

- Dolerite dykes interpreted from aeromagnetic data as well as from mapped exposures.
- Contours showing the thickness of Neoproterozoic sedimentary rocks in the Officer Basin, and the thickness of Phanerozoic sedimentary rocks offshore and in most onshore basins.
- Location of the pre-Miocene palaeodrainage systems.
- Elimination of the term Tertiary, following IUGS recommendations, and using Cainozoic series (Miocene etc.) directly.

The geology of Western Australia reveals a long dynamic history of repeated generation, aggregation and dispersal of crustal fragments. The boundaries between these crustal fragments remained zones of crustal weakness in which the rocks were intermittently folded, fractured and overlain by sedimentary rocks. These zones (orogenic belts) provided important environments for the development of mineral deposits, and the location and structure of many mineral deposits are related to the tectonic evolution of these belts.

The oldest crustal fragments (Pilbara and Yilgarn Cratons) were themselves formed by the amalgamation of a number of older pieces of crust, and the location of mineral deposits such as gold are related to the older boundaries and associated fracture zones within these cratons. The Pilbara and Yilgarn Cratons were joined along the Capricorn Orogen at c. 1800 Ma to form the West Australian Craton, and this was joined at c. 1300 Ma with the North Australian Craton, along the Paterson Orogen, and a combined south Australian–East Antarctic continent called the Mawson Craton, along the Albany–Fraser Orogen.

An overlay of current mineral exploration and mining tenements on the geological map shows that, while there is substantial interest in the geology of Western Australia, some geological units that could have significant mineral potential are currently underexplored. Most of the greenstones of the Archaean Pilbara and Yilgarn Cratons are currently being explored, and there is widespread exploration along the margins of the Capricorn Orogen, and within the Halls Creek and Paterson Orogens. Exploration in especially intense in the Albany–Fraser Orogen, a region that until recently was relatively little explored. Areas currently receiving little attention include: the Archaean Fortescue flood basalts of the Pilbara Craton and Palaeozoic Antrim Plateau flood basalts in the east Kimberley (potential hosts to Noril'sk-type nickel deposits), the Gascoyne Complex of the Capricorn Orogen and overlying Bangemall Basin (potential gold and base metals), part of the Paterson Orogen, and the eastern and southern parts of the Albany–Fraser Orogen.

References

GEOLOGICAL SURVEY OF WESTERN AUSTRALIA, 1999, Western Australia atlas of mineral deposits and petroleum fields 1999: Western Australia Geological Survey, 33p.

MYERS, J. S., and HOCKING, R. M., 1998, Geological map of Western Australia, 1:250 000 (13th edition): Western Australia Geological Survey.