

2006-07

Year in review



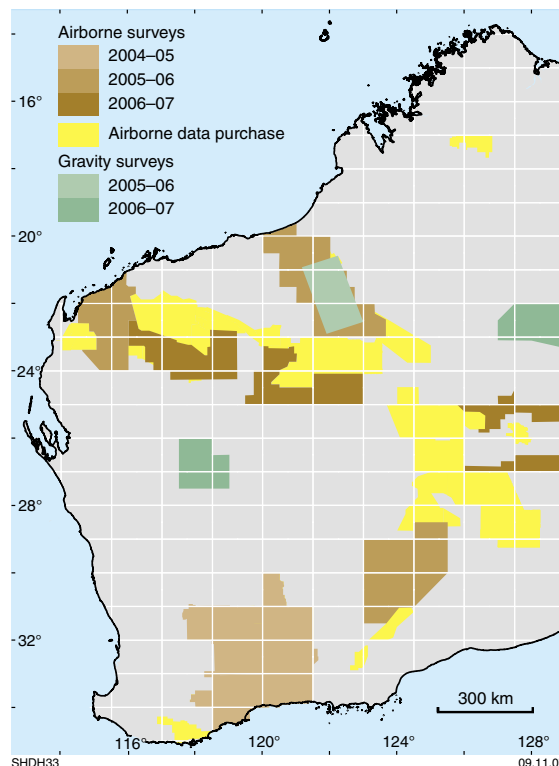
The resources industry continued its growth during 2006–07 as shown by the increase in capital expenditure on mining investment in Australia, up 19% on the previous year to \$22.1 billion. Western Australia accounted for 61% of this expenditure, and the State's total of \$13.5 billion in new capital expenditure on mining was up 26% on 2005–06. Commodity prices continued to rise on the back of strong demand, particularly for nickel (prices up more than 132% on 2005–06), zinc (up 65%), copper (up 33%), iron ore (up 11%), and gold (up more than 15%).

These higher prices have translated into an increase in mineral exploration activity in Western Australia, where there was a 39% increase in expenditure — very positive when compared with an increase of 35% for Australia as a whole. Petroleum exploration expenditure in Western Australia increased by a phenomenal 142% to \$1481 million, compared with the country's increase of 71% to \$2226 million. In 2006–07 Western Australia attracted 67% of the national petroleum exploration budget. These figures reflect a much healthier situation than last year. Nevertheless, further growth is required in mineral and onshore petroleum exploration if the current levels of return to the State are to be maintained from the petroleum sector and the higher levels of production from commodities such as iron ore and nickel are to be sustained. Gold exploration remains flat, but still just leads iron ore in attracting the highest level of exploration expenditure.

Pre-competitive geoscience funding for geophysics

In 2006–07, the \$3 million per annum additional funding provided to GSWA by the State Government in 2004 for acquisition of new pre-competitive geoscience information was once again used to increase the State's airborne magnetic and radiometric coverage and to acquire more regional gravity data (see adjacent map of airborne magnetics/radiometrics and gravity coverage).

Approximately 295 000 line-km of new airborne magnetic and radiometric surveys were flown in collaboration with Geoscience Australia in the Ashburton, the southern Officer Basin, and in the Musgrave region. These were complemented by the release of 390 000 line-km of company data purchased adjacent to the new surveys. Helicopter-assisted, ground gravity surveys at a nominal 2.5 km spacing in the Webb and Murchison areas added 7647 new data points to the State's gravity database.



Data from new surveys were made available as preliminary grids and images downloadable from the Geological Survey's website and, when finalized, as point-located and gridded data from the Geophysical Archive Data Delivery System (GADDS) on Geoscience Australia's website.

GSWA publications

During 2006–07 GSWA published:

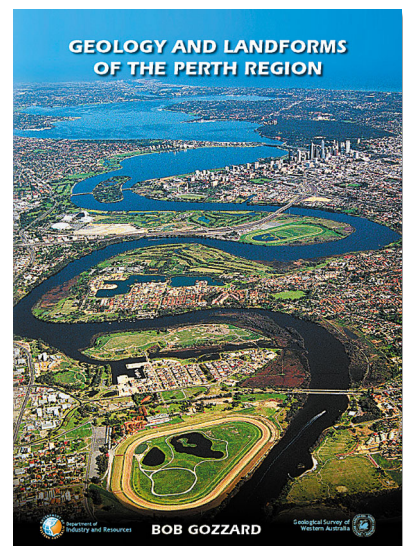
- 27 geoscience maps including ten geological maps at 1:100 000 scale
- 28 records, reports, and other publications
- 25 digital information products.

Our current mapping and publication policy is to first compile all available data for a new project area (prior to new mapping being undertaken) and release these on DVD as a 'Geological Exploration Package' (GEP). As the results of our new mapping become available, a new version is released as a '1:100 000 Geological Information Series' (GIS) set of geoscience maps and multi-layer datasets that include geology, geophysics, satellite imagery, and associated sample and observational data that can include field photographs, petrographic descriptions and photomicrographs, and geochemical and geochronological data. All information can be accessed in the GIS software packages or with GSWA's GeoVIEWER.WA software that is also included with the information package. The 'Geological Information Series' package for an area is updated further as mapping progresses and new data are captured.

Although our emphasis is now very much on digital products — and almost all books and reports are now released as digital files in Acrobat pdf format for viewing and download from our website — we still make available conventional plotted maps on paper at 1:100 000 scale for geology, as well as other special geological and related information at a range of scales. These may be ordered online or from the Information Centre at Mineral House, Perth.

One exception to our publishing in digital format was the release of a popular and entertaining geology guidebook on the 'Geology and landforms of the Perth Region' that was launched by the Minister for Energy; Resources; Industry and Enterprise, the Hon. Francis Logan. The book — illustrated with diagrams, sketch maps, and detailed and panorama photos of many of the classic geological localities near Perth — describes the local landscapes and rocks, and provides explanations on how they formed.

In 2006–07, GSWA had mapping projects in the Pilbara — now being wrapped up after a 10-year program, the Murchison, eastern and central Yilgarn, the Gascoyne Complex and the Edmund and Collier Basins, western Tanami, and the western Musgrave Complex.



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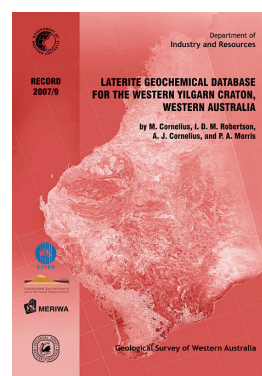
Geochemistry

The availability online of data from GSWA's lithogeochemical database WACHEM has drawn closer with the development of a prototype for web delivery of these data. The system, which includes data extraction tools for the viewing and download of data according to location and the displaying of analytical metadata, is being trialled internally for eventual deployment on the department's website.

The Yilgarn Laterite Geochemical project, GSWA's collaborative venture with CRC LEME and CSIRO (with financial support from the Minerals and Energy Research Institute of Western Australia, MERIWA) to compile a regional laterite chemistry map of the Yilgarn Craton south of 30°S and west of 120°E, was completed. The complete dataset of more than 3000 analyses plus metadata was released in early June 2007.

Release of these data had an immediate impact on exploration activity in the State's southwest. In the four weeks immediately preceding data release, tenements covering about 3000 km² were pegged in the southwest Yilgarn, compared to tenements covering more than 15 100 km² in the four-week period after data release.

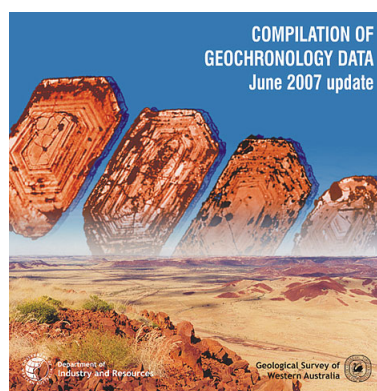
Preliminary work and access negotiations were completed with the Ngaanyatjarra Council and Kiwikurra Community for a regional regolith geochemistry survey in the Webb area in early 2007–08.



Geochronology

Geochronology continues to be an important aspect of GSWA's regional mapping programs. A total of 44 new geochronology data reports — all U–Pb zircon ages determined via sensitive high-resolution ion microprobe (SHRIMP) — from the various project areas were completed in 2006–07.

The geochronology coverage of the State is summarized in annual 'Compilation of Geochronology' updates; the latest such update in June 2007 has data for 729 GSWA samples as well as 1162 samples from Geoscience Australia's Ozchron database. The accompanying GeoVIEWER.WA software allows queries on many aspects including rock type, stratigraphic unit, and age range, with results plotted on a background of the State 1:500 000- or 1:2 500 000-scale geology. Improved graphs help in visualizing results and interpretation of these complex data.



Mineral systems studies

The year 2006–07 also saw the introduction of a program of mineral systems studies to stimulate exploration in greenfields areas by attempting to determine vectors to mineralization through investigation of the various geological and geodynamic factors — at all scales — that control the inception, evolution, and preservation of ore deposits.

Studies have begun on systems in the Musgrave and Gascoyne Complexes, with the information to be published as a series of 'live' documents that can be regularly updated, as new ideas and information become available. These will be incorporated into WA Geology Online, GSWA's web-based compilation of the geology and mineral resources of Western Australia that is presently under development.

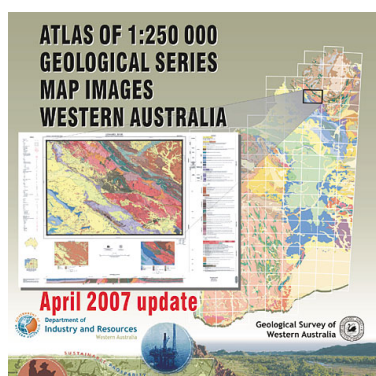
New digital atlas

The release of all 163 of the 1:250 000 Geological Series maps of Western Australia on a single CD in January 2003 proved so popular that it was re-released with improvements only five months later in June 2003. A third release on DVD in January 2005 included the NATMAP mosaic of 1:250 000 topographic map images. The latest update in April 2007 incorporated new data and new viewing facilities.

As before, individual 1:250 000 Geological Series map sheets are supplied as ECW images of the latest edition maps (to 31 December 2006), complete with reference, cross section and marginalia; as well as the topographic coverage. However, in addition, the atlas now includes the magnetic anomaly image of WA (based on best-available public-domain aeromagnetic coverage); a Landsat TM image covering the entire

State; and a Statewide mosaic of the individual geological maps.

Users can toggle between the geology, topography, magnetic anomaly, and satellite images, and the images are linked as a user zooms-in to any selected area so that the same area is seen on each dataset.



All maps are georeferenced to GDA94 enabling accurate MGA coordinates (legacy Imperial maps have a blue MGA grid overlay added to them) to be read in real time on screen with GIS software or ER VIEWER freeware. The datasets can also be viewed with the included self-loading Atlas Viewer software and are suitable for printing to at least 1:250 000 scale.

Web delivery of products and reports

GeoVIEW.WA, GSWA's interactive map and data viewing facility on the Internet, was upgraded in 2006–07 with a new 'engine' and integration of more data that can be accessed online.

A heavily revised and extended 1:500 000-scale geological dataset replaces the pre-existing 2001 geological map, with greater spatial accuracy, improved geological interpretations, and more detail added for several regions. Most importantly, a lot of data have been added behind the scenes in the form of attribute tables giving detailed, consistent information about the map units, including lithology, lithostratigraphy, relationships, age, tectonic units, and deformation.

The new 1:500 000-scale dataset will become the foundation for most other GSWA products. It will not be a static product — the map and the data layers behind it will be refined incrementally as new mapping and information are added and new interpretations are made.

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For documents, GSWA's implementation of DigitalPaper XE provides the ability to view online, print, or download without charge almost all GSWA products released since 1895, including maps, Reports and Bulletins. The same facility enables viewing and downloading of open-file company mineral exploration (WAMEX) reports and at the end of 2006–07 more than 40 000 reports were available for viewing.

Access to Aboriginal lands

GSWA continues to work with traditional owners and Land Councils to develop agreements and close working relations that enable field-mapping programs to proceed while meeting the interests and cultural sensitivities of the local Aboriginal people.

During 2006–07, through agreements with the Ngaanyatjarra Council and traditional owners, field mapping progressed in the west Musgrave region at Blackstone–Wingellina (Papulankutja–Irrunytju) and in the Cosmo Newbery area in the northeastern Goldfields. In addition, a helicopter-based gravity survey took place around the Kiwikurra Community in the Webb area and plans were finalized for a helicopter-based soil-sampling and field-mapping survey in early 2007–08. The Ngaanyatjarra Council and Kiwikurra Community have been working closely with GSWA to ensure that any culturally sensitive locations are excised from the survey areas.

Petroleum systems studies

Work in the Canning Basin by members of the Petroleum Systems Studies team is gaining momentum with the release of a pre-interpretive merged well-log data DVD package for the Canning Basin and an interpretation project for the eastern Canning Basin. The Canning Basin is the largest onshore basin in Western Australia, but is under-explored for a basin that contains economic oilfields (albeit small) and scattered shows at several levels in the succession, with a very low density of wells overall.

GSWA's petroleum exploration information database (WAPIMS) continued to improve access to exploration data, with a total of 480 Gb of data now available online. The transcription of valuable historic seismic data to modern media continued, and some 75% of the archive is complete. There is now an annual program for release of discrete data packages with the most recent release in June 2007.

GSWA also participated in Geoscience Australia's survey along the offshore margin of southeastern Western Australia and western South Australia, using the CSIRO research vessel *Southern Surveyor*. The survey collected new data to improve our knowledge of the geological history and petroleum prospectivity of the poorly explored Bight Basin.

Geothermal studies

This past year also saw geothermal energy gain some prominence in GSWA with the release of a report on the first phase of geothermal studies for the State together with a temperature log package (see also a Technical Paper later in this Review: KAR Ghorri's 'The search for Western Australia's geothermal resources'). The WAPIMS database is in the process of being modified for use by geothermal exploration companies to gain easier access to the wealth of well log data it contains.

Geological field excursions

Field excursions, to complement the publication of maps and reports from our field mapping, continue to be popular with our customers.

In August 2006–07, GSWA and GA geologists led fifty participants in two geological field excursions to the northern Pilbara Craton to showcase results from the recently completed 10-year program of 1:100 000-scale mapping and mineralization studies jointly conducted by GSWA and GA as part of the National Geoscience Agreement. Fourteen geoscientists from GSWA and GA have worked on the project, which has established the northern Pilbara Craton as arguably the world's best area to study Archean crustal evolution and early life between 3520 and 2900 million years ago.

In September 2006, GSWA geologists led a field excursion that examined the geology of the northwestern Capricorn Orogen, where GSWA's recent field mapping and associated geochronological studies have sparked a major revision of the geological framework of the region — now almost completely covered by mineral tenements and tenement applications.



(Top) An extraordinary sight on a remote road in the Pilbara, as participants on the Pilbara excursion visit a field locality; (bottom) field work continues into the evening with a presentation under the stars on the Capricorn field excursion

Promotional events

GSWA continued to target major national and international mineral and petroleum exploration promotional events as part of its role to promote the prospectivity of Western Australia and attract exploration investment to the State.

In 2006–07, GSWA participated with 'Team Australia' at the Prospectors and Developers Association of Canada (PDAC) in Canada and China Mining, and had a presence at other international promotional events at NAPE (North American Prospect Expo) in Houston, PETEX (Petroleum Experts), and 'Australia Day' in London.

Within Australia, besides the annual GSWA and Petroleum Open Days presented by the Department in Perth, GSWA was present at Mining 2006, the AAPG International Symposium and the RIU Explorers Conference in Perth, Diggers and Dealers in Kalgoorlie, and the APPEA Conference in Adelaide as well as various commodity conferences in Perth.

Year in review

The future

GSWA's primary mandate remains unchanged: to attract mineral and petroleum — and now geothermal — exploration investment to the State; and make Western Australia the preferred destination for explorers, be they local, interstate, or international. However, there is also a growing demand from land use and planning groups in WA for geoscience information and advice regarding the impact of land use changes on opportunities for future resource extraction.

GSWA's approach to achieving these objectives is still to conduct regional geoscience surveys, including extensive field-based geological mapping, and making regional syntheses of these data. These interpretive compilations include maps and reports, and mineral system and commodity summaries. For these to be most useful, there is an increasing need to portray and analyse the information in three dimensions as well as with time-varying models.

The volumes of data being acquired — directly, through GSWA programs, and indirectly, through exploration activity reports that companies submit to GSWA — are such that more efficient mechanisms are required to make the data immediately accessible and more readily usable and visualized. To this end, a strong emphasis is being placed on information distribution by creating multiple-format datasets, developing and populating databases, providing visualization and reporting tools; and integrating online delivery systems. Smart systems are required that combine and synthesize various datasets and display the results in a usable form to aid both mineral and energy explorers, and also land use decision makers. Significantly more work is required to secure our future in the resources industry.

The recently completed, independent review of GSWA has confirmed that the present level of GSWA funding is low relative to other States and that substantial additional funding will be required if the necessary coverage of geological, geophysical, geochronological, and geochemical data is to be obtained to sustain the WA community.

In this buoyant time in the resources sector, it is all too easy for community and other stakeholders to become complacent in terms of the work that is done by GSWA. The Department of Industry and Resources and particularly the staff of GSWA should be very proud of the level and quality of material released each year. Ironically, the large number of data and information products that GSWA releases disguises the fact that it is actually very small in relation to the size of the State, the size of the resources sector in the State, and the variety of uses to which it is put.



TJ Griffin
Executive Director