

GSWA MAPPING OF OUTCROP AND BEDROCK GEOLOGY

P Bruce Groenewald

Geological Survey of Western Australia

bruce.groenewald@doir.wa.gov.au

Introduction

The geological mapping of Western Australia is a principal function of the Geological Survey, with coverage of the State at 1:250 000 completed in the early 1980s and some 20% of the State mapped at 1:100 000 scale to date. Until recently, maps were published as high quality lithographic products, providing a valuable foundation to mineral exploration and the general development of the State. A principle adhered to in this mapping has been the recording of outcrop geology and regolith in accurate detail to provide quality maps of the surface geology and, consequently, allow accurate **interpretation** of the basement geology — a vital aspect given the limited bedrock exposure in much of the State.

Recent advances in information technology have led to enormous changes in map production and vast improvements in the use of spatial information. These advances allow more efficient collection and interpretation of geological map information, the release of maps in digital format, and the production of maps on demand from a corporate database. New products such as the 1:100 000 Geological Information Series (GIS) that provide seamless digital geology, geophysical and satellite imagery, and associated structural and petrographic data over large areas are proving to be invaluable in mineral exploration targeting.

Procedure

Mapping projects are undertaken by GSWA in regions that are economically important or are considered to have high potential for new discoveries— such as the Eastern Goldfields, the Capricorn Orogen or the west Musgrave Complex. Initial work on new mapping areas now routinely involves the collation of legacy data generated during earlier mapping by GSWA and by external academic and commercial organisations, and acquisition of regional aeromagnetic, radiometric and high resolution orthophotographic coverage. Legacy data from existing maps, notebooks, petrographic studies, and exploration reports requires transformation into digital format, with verification of spatial accuracy an essential.

Accurately rectified digital aerial photography is studied stereoscopically at 1:25 000 to allow 3-D visualisation of the area and identification of outcrop and regolith distribution, allowing the entire area to be mapped provisionally before fieldwork is undertaken. A pre-mapping compilation of all the available geological information, together with an interpretation of bedrock geology based on this in combination with geophysical and sub-surface data (exploration drilling), is now planned for release as an Exploration Data Package as soon as possible, typically a year or more before the new geological map becomes available.

GSWA fieldwork is conducted using fly-camping on traverses that allow confirmation of the outcrop distribution and rock type characteristics, collection of structural measurements, and petrological samples for further work. The amount of fieldwork required for each mapsheet, typically equivalent to a quarter degree rectangle (~45x55 km), depends largely upon the ease of access, extent and distribution of outcrop, and the complexity of the geology. For Western Australia this can vary from about 2 to 20 weeks.

The new mapping process currently being rolled out in GSWA incorporates digital data capture in the field using hand-held iPAQ palm top computers, with progressive compilation of the map to identify and solve any problems early. These data are then incorporated into the project GIS database, from which the required maps may be extracted.

Digital map packages

Digital compilation of maps involves data in diverse formats, linked by spatial attributes, and this requires the subdivision of data into different information themes or layers. Much of the power of GIS stems from this subdivision in that it enhances selective access to data for detailed analysis. The layers used in GSWA digital map packages include the following:

Geology

- Distribution and nature of outcrop and regolith units are recorded as polygons, each with a rocktype code for which standardized definitions are provided in look-up tables;
- Outcropping faults or shears, lineaments, and joints are provided as a line data layer.
- Point records represent sample sites or field observation sites.
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Field observations – WAROX

All field observations are recorded in GSWA's corporate database, WAROX, from which appropriate records are extracted for inclusion in digital map products. The observations include rock type identification, structural measurements, petrographic description and photomicrographs (if a thin section has been made), and photographs of outcrops.

Geochronology and geochemistry

All available geochronology data are provided as points with links to records of the original analyses and interpretation. Similarly, geochemical analyses of rocks and regolith are also provided in point datasets — including the results of GSWA regolith geochemical mapping projects.

Sub-surface observations

Sub-surface records of rock types from drillholes and costeans are provided in a point dataset. Exploration drilling data is extracted from the statutory reports in the Department of Industry and Resources (DOIR) Western Australian mineral exploration database (WAMEX).

Regional interpreted bedrock geology

The bedrock geology layer provided in the databases is a map of the interpreted distribution of Precambrian rock types beneath younger cover. This is based on interpretation of detailed airborne magnetic surveys integrated with the observed outcrop geology. Polygon and line data are in separate layers.

WAMIN

The Western Australian mineral occurrence database (WAMIN) comprises the localities and commodity groups of currently operating and abandoned mines, all mineral deposits for which there is an established resource estimate, and prospects that have reported mineralization but from which there is no recorded production.

MINEDEX

The extract from the mineral deposits database (MINEDEX) provides information, either directly as point attributes or in look-up tables, for commodity groups, projects, and sites, corporate ownership, site type and stage of development, site coordinates, and current (at date of compilation) mineral resource estimates.

MITIS

The tenement information within the database is extracted from DOIR's electronic tenement graphics system (MITIS). The information includes extent and location of tenements, with identity, status, and commencement and expiry date information.

Airborne magnetic survey

Total magnetic intensity and radiometric images are provided if such data are publicly available.

Landsat 7 TM

The Landsat 7 TM layers comprise images prepared using data collected in 2002. Data from several Landsat scenes have been merged using robust regression techniques, to provide a seamless image. Spatial accuracy better than 50 m, with a pixel size of 25 m, has been preserved.

Topocadastral data

Topocadastral data are provided as separate layers for rivers and creeks, roads and tracks, airfields, railways, homesteads, townsite locations, other localities (hilltops), and waterbodies.

Software and application

The mapping and associated data are collated using software such as ArcGIS and MSAccess, and provided in formats suitable for use with GIS software such as ArcView, ArcInfo and MapInfo. To allow direct visual access to the data, GSWA has developed GeoVIEWER.WA software that allows the user to select and customize layers for viewing (Fig. 1). This software is distributed free on Geological Information Series CDs or DVDs.

An example of GSWA digital data map products is the 1:100 000 East Yilgarn Geological Information Series which comprises fifty-seven map sheets that cover 150 000 km² in the Eastern Goldfields region. The collation of geoscience information in this database provides a cornerstone for mineral exploration targeting in the region.

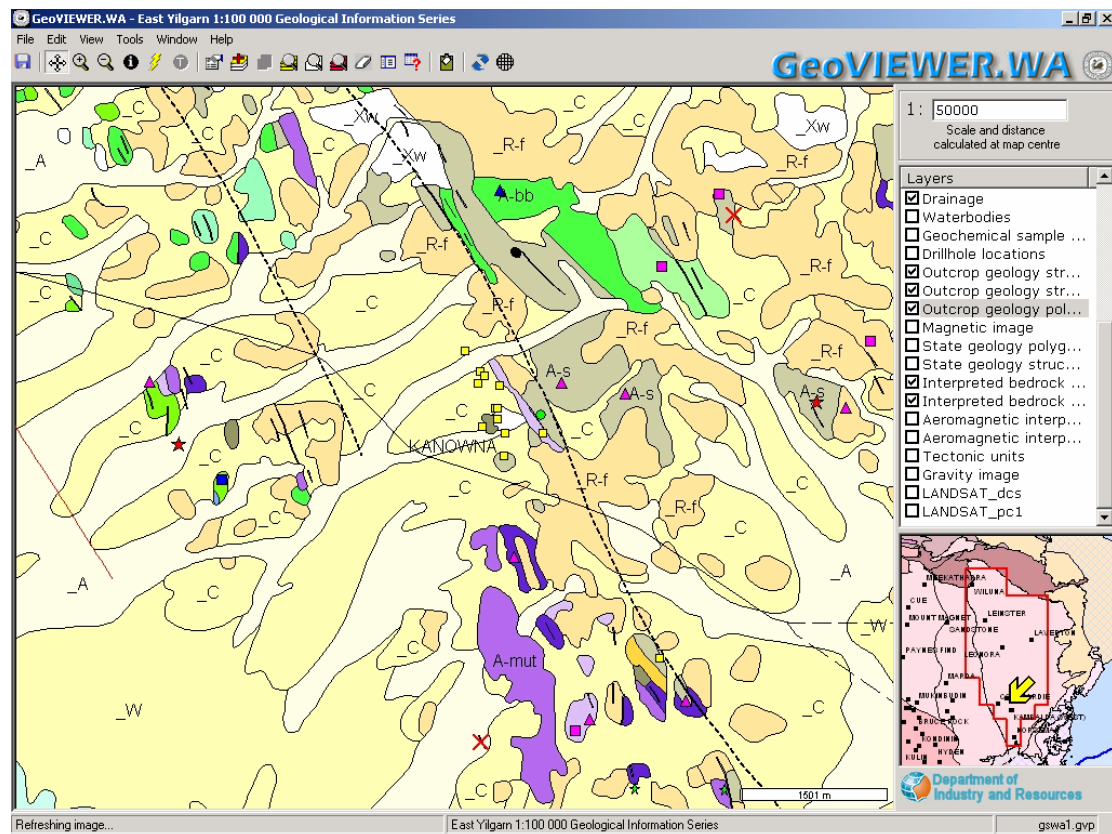


Figure 1. A typical screen view of GSWA geological map data in the Eastern Goldfields provided by GeoVIEWER.WA software.