

Geological and energy implications of the Paterson Province airborne electromagnetic survey

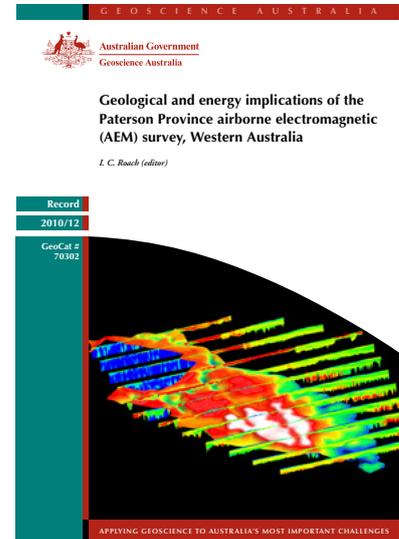
The Paterson airborne electromagnetic (AEM) survey was the first regional AEM survey flown in Australia. It was conducted between September 2007 and October 2008 over the Paterson region of northwestern Western Australia as part of Geoscience Australia's Onshore Energy Security Program. The survey was flown by Fugro Airborne Surveys Pty. Ltd. using the Fugro TEMPEST™ time-domain AEM system. The survey included a total of 28 200 line kilometres flown at various line spacings (six kilometres, two kilometres, one kilometre, and 200 metres) and covered an area of approximately 47 600 square kilometres.

The Paterson AEM survey was designed to deliver reliable, pre-competitive AEM data to promote exploration for uranium, uranium-copper, copper-gold, base metals and manganese minerals in the under-explored Paterson region. The survey area includes the working mines of Woodie Woodie (manganese), Nifty (copper) and Telfer (gold-copper) and the deposits at Kintyre (uranium) and Magnum (copper). All of the known deposits or prospects occur in Archean or Proterozoic rocks that outcrop within the surrounding Permian, Mesozoic and Quaternary cover; the cover comprises about 84 per cent of the survey area.

Airborne electromagnetic data were subjected to quality assurance and quality control procedures before being inverted using sample-by-sample Geoscience Australia layered earth inversion (GA-LEI) software. The GA-LEI data were validated using confidential and public-domain drill hole conductivity data collected during field trips to the region, and public-domain drill hole lithological data compiled during the data processing phase of the survey.

Interpretation of the GA-LEI data reveals new information for uranium prospectivity in potential unconformity-related, sandstone (roll-front and tabular) and valley calcrete uranium systems. The AEM data imaged the important Coolbro Sandstone-Rudall Complex unconformity near the Kintyre uranium deposit. The data also highlighted other areas where this unconformity, or others assessed as having moderate to high potential for uranium mineralisation, may occur. The AEM data are particularly effective for mapping carbonaceous and pyritic metasedimentary rocks at depth. These may be important reductants for reacting with uranium-bearing hydrothermal fluids.

The AEM data also provided new interpretations for the extent of Permian palaeovalley systems, the extent of and inter-relationships between Archean and Proterozoic bedrocks and Permian and Mesozoic cover in the Canning Basin and the extent of potential



redox fronts near salt lakes and playas associated with valley calcretes occupying palaeodrainage channels within the survey area.

The potential for gold and base metal mineralisation within the survey area has been reassessed in light of collated knowledge regarding the Miles mineral system, and the O'Callaghans mineral system. The Miles mineral system is the most prevalent and formed during the inversion of the Yeneena Basin. This mineral system dissolved uranium and copper and deposited them at redox boundaries near major faults. The O'Callaghans mineral system operated during and after intrusion of the O'Callaghans granite suite.

The AEM data have greatly improved understanding of the basement-cover relationships

in the area, particularly between Proterozoic rocks of the Yeneena Basin and Rudall Complex and the overlying Paleozoic-Mesozoic rocks of the Canning Basin. A number of the units within the Permian and Mesozoic cover are weakly to moderately conductive, due to contained clays, saline groundwater, or a combination of both and are well imaged within the data. The AEM data and the drill hole data base have also allowed the 3D stratigraphy of the Canning Basin to be interpreted over a broad area, revealing a number of large-scale sedimentary structures that were previously unknown. The data also reveal new information regarding the 3D structure of Permian palaeovalley systems around the Rudall Complex, especially those near the Kintyre uranium deposit.

For more information

email ausgeo@ga.gov.au

Related websites/articles

Geological and energy implications of the Paterson Province airborne electromagnetic (AEM) survey, Western Australia (Geoscience Australia Record 2010/12)

https://www.ga.gov.au/products/servlet/controller?event=GEOCAT_DETAILS&catno=70302

A drill hole database for the Paterson airborne electromagnetic (AEM) survey, western Australia. (Geoscience Australia Record 2009/31)

https://www.ga.gov.au/products/servlet/controller?event=GEOCAT_DETAILS&catno=69505

New geophysical datasets released

Airborne electromagnetic datasets covering the Pine Creek region of the Northern Territory and the Paterson region in Western Australia have been acquired by Geoscience Australia. These areas

are considered to have potential for uranium or thorium mineralisation and the surveys were conducted as part of the Onshore Energy Security Program.

To support the interpretation of these datasets Geoscience Australia also collected downhole conductivity logs for a number of drillholes in each area. Data from these logs are now available through the Geoscience Australia website.

Conductivity logs were acquired from twenty four boreholes during two field campaigns in April and October 2008 in support of the Pine Creek AEM survey. The Pine Creek AEM survey comprises three areas: Kombolgie to the east of Kakadu National Park; Woolner Granite near Darwin; and Rum Jungle to the west of Kakadu National Park (figure 1). In the Paterson region conductivity logs were

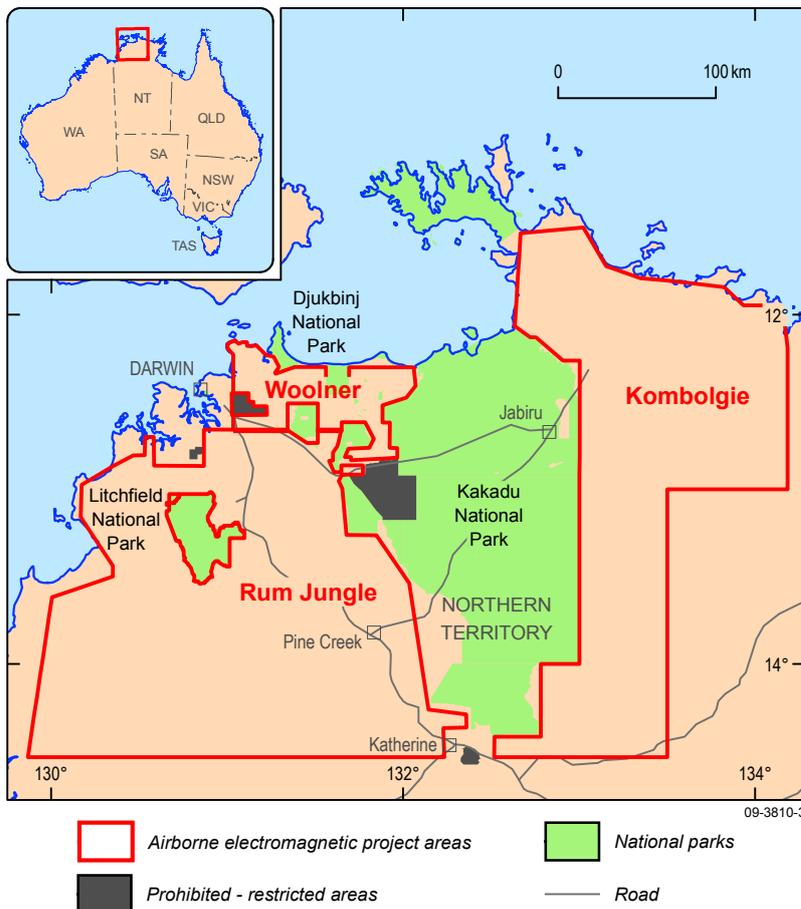


Figure 1. The Pine Creek airborne electromagnetic survey boundary locations showing the Kombolgie, Woolner and Rum Jungle areas.



acquired from nineteen boreholes during September 2008. The survey covers a total area of 49 000 square kilometres. These products are available for free download through the Geoscience Australia website.

Two areas of previously confidential infill AEM data and inversion products from the Rum Jungle TEMPEST™ survey in the Pine Creek area have also been released. The first is Phase-2 data, that is, Geoscience Australia layered earth inversion data and derived products, for the Woolner Granite and Rum Jungle surveys. Final data including Infill areas K1, K2 and K3 for the Pine Creek–Kombolgie AEM survey, that is, the area east of Kakadu National Park are also available. The data for the Rum Jungle survey are available for download through the Geoscience Australia website whilst the Pine Creek products are only available on DVD through the Geoscience Australia Sales Centre.

Table 1. Details of the airborne electromagnetic survey data.

Survey	Completed	Area	AEM system	Line kilometres	Contractor
Rum Jungle NT	24 May 2009	34 900 square kilometres	TEMPEST	14 200	Fugro Airborne Surveys Pty Ltd
Kombolgie NT	27 April 2009	30 500 square kilometres	VTEM	8800	Geotech Airborne Pty Ltd

For more information

email ausgeo@ga.gov.au

Related websites

Free Data Downloads facility (Geoscience Australia)

https://www.ga.gov.au/products/servlet/controller?event=DEFINE_PRODUCTS

Pine Creek–Kombolgie AEM survey final data (DVD only)

https://www.ga.gov.au/products/servlet/controller?event=GEOCAT_DETAILS&catno=71372

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