Australian Government
Geoscience Australia

Pine Creek Airborne Electromagnetic Survey Results

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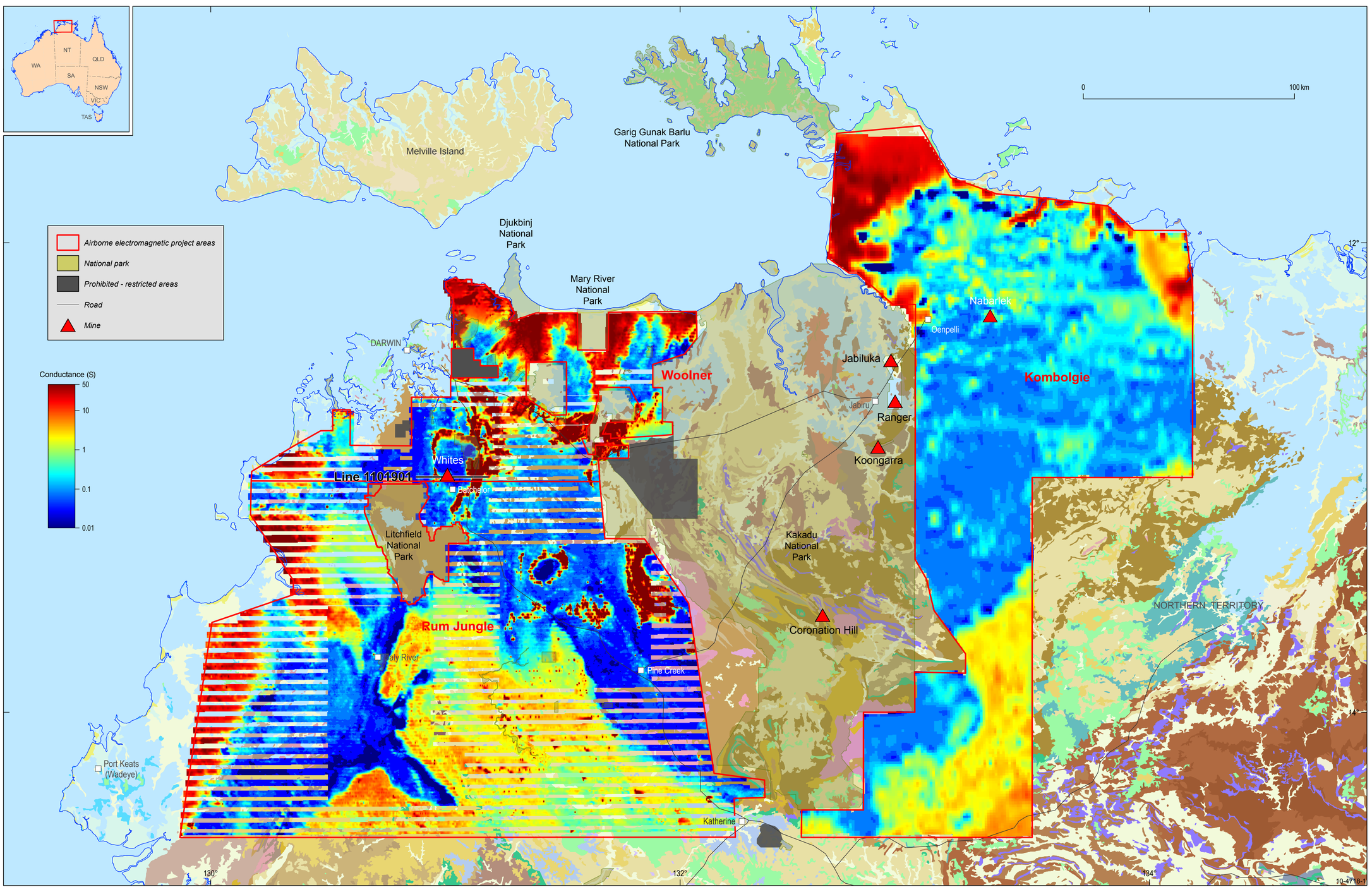
In 2008-2009 Geoscience Australia contracted Fugro Airborne Surveys and Geotech Airborne Geophysical Surveys to acquire airborne electromagnetic (AEM) data with broad line spacings (up to 5 km) covering more than 71 000 km² in the Pine Creek region, Northern Territory. Funded by the Australian Government's Onshore Energy Security Program (OESP), the surveys are designed to reveal new geological information at regional scale in areas considered to have potential for uranium or thorium mineralisation. TEMPEST™ data were acquired for the Woolner Granite and Rum Jungle survey areas which cover a total of 21 100 line km and an area of 43 200 km². VTEM™ data were acquired for the Kombolgie survey area which covers a total of 9 000 line km and an area of 30 500 km².


Woolner Granite area.


Rum Jungle area.



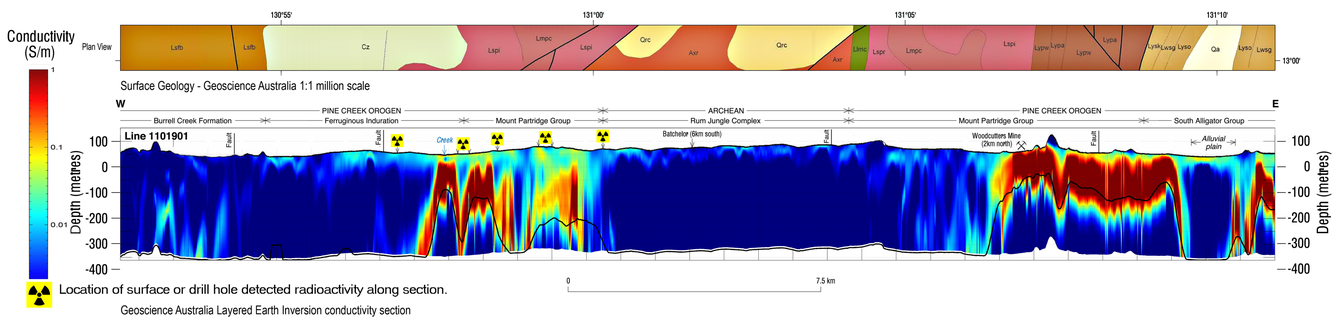


Figure 1. The Pine Creek AEM survey. Geological regions highlighted on conductance grids over the Geoscience Australia surface geology map. Woolner Granite and Rum Jungle GA-LEI conductance grid 0 - 400 m. Kombolgie EMflow conductance grid 0 – 400 m.

Figure 2. GA-LEI section for line 1101901 with the corresponding strip of 1:1million scale Surface Geology.

Conversion of the non-linear electromagnetic response data into estimates of subsurface conductivity allows for much easier and more accurate integration with independent subsurface information and facilitates better interpretation. The grids in Figure 1 show results from Geoscience Australia's sample by sample layered earth inversion or GA-LEI (Brodie and Sambridge, 2009) and EMFlow fast approximate inversion software supplied by the contractor. For the GA-LEI, both X and Z component total field data were inverted simultaneously. This inversion solved for the conductivity of 30 fixed thickness layers, constrained by vertical smoothness and a 0.001 S/m halfspace reference model. The inversion also solved for transmitter loop – receiver coil horizontal and vertical separation and receiver pitch. The depth at which the percentage data influence falls below 50%, a measure of depth of investigation, is shown as a black line on the section (Lane et al., 2004).

Data in the Woolner Granite and Rum Jungle survey areas were acquired using the TEMPEST™ fixed wing AEM system. The acquisition and processing were carried out by Fugro Airborne Suveys Pty. Ltd., under contract to Geoscience Australia. The contractor supplied data and the GA-LEI data have been publicly released by GA and are available from the GA website. Figure 2 shows the GA-LEI along line 1101901 with a strip of surface geology for comparison.

The inversion results have contributed to the improved understanding of the area's geology and mineral potential by mapping the conductivities of different geological and hydrogeological units under cover, in particular the interpreted presence and definition of conductive units in the Pine Creek Orogen.

Figure 3. Geoscience Australia undertook induction conductivity logging in the Pine Creek region. Conductivity logs were processed and used as input for forward models, and for interpretations.

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References

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Lane, R., Brodie, R. and Fitzpatrick, A., 2004. Constrained inversion of AEM data from the Lower Balonne Area, Southern Queensland, Australia. CRC LEME Open File Report ; 163. http://crcleme.org.au/pubs/.

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