



New Radiometric Map of Australia

Improved datasets to identify energy, geothermal and mineral resources

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Geoscience Australia is about to release a new full-colour Radiometric Map of Australia at a scale of 1:5 million. In a world first, Geoscience Australia commissioned the flying of an Australia-wide airborne geophysical survey (AWAGS). The processed radiometric data from the survey was used to adjust all of the radiometric survey data held in the National Radiometric Database to a common standard, or datum. The levelled database is now being used to produce the first Radiometric Map of Australia, derived from levelled and merged composite potassium (K), uranium (U) and thorium (Th) grids over Australia at 100 metre resolution. These grids are being used to

generate a number of derivative products, including the new full-colour ternary map of the continent. The new radiometric map, and all the digital data that underpin it, will be available early in 2009.

The new Australian radioelement datum

Geoscience Australia and the state and Northern Territory geological surveys have systematically surveyed the Australian continent for over 40 years using airborne radiometric surveys to map potassium, uranium and thorium elemental concentrations at the Earth's surface. The radiometric data in the national database were not all registered to the same datum. This was because the data had been collected and processed using a range of specifications, technologies and procedures over this period. This made it difficult to combine surveys into regional compilations or to make accurate comparisons between radiometric responses over different parts of the continent which limited the value of the database (figure 1).

To solve this problem AWAGS, costing \$2.6 million, was funded

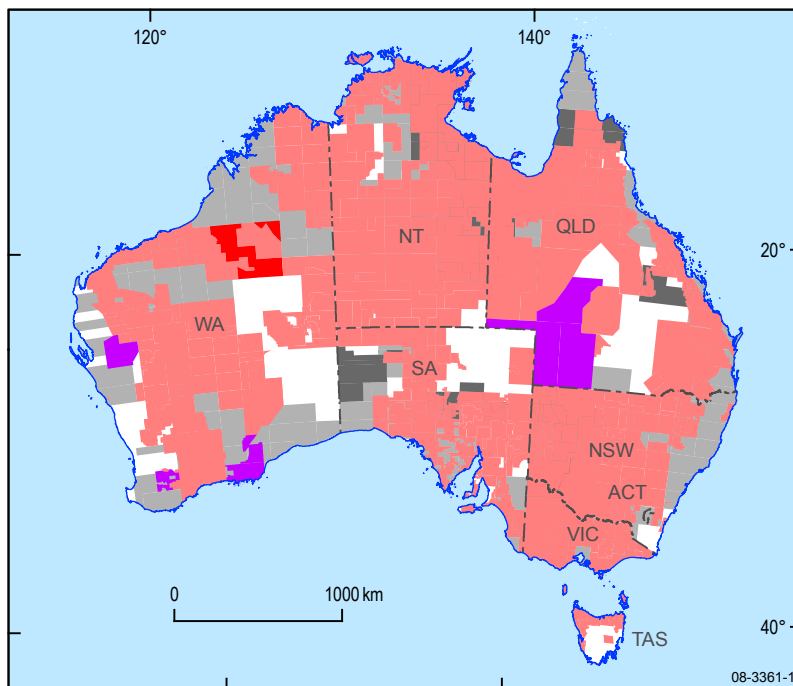


Figure 1. Radiometric data acquisition by Geoscience Australia and state and Northern Territory geological surveys.

under Geoscience Australia's Onshore Energy Security Program. The flying phase of the survey was completed by UTS Geophysics Pty Ltd in December 2007, and the final processed radiometric data was delivered to Geoscience Australia in June 2008. The survey covered the entire continent with north-south flight lines spaced 75 kilometres apart, and east-west tie lines spaced 400 kilometres apart (see *AusGeo News* 84).

Gamma-ray spectrometric data, acquired at an 80 metre height along the flight lines during AWAGS, were processed according to international specifications, and the final estimates of the concentrations of the radioelements (potassium, uranium and thorium) comprise the new Australian radioelement datum. The national radiometric database was levelled by minimising both the differences in radioelement estimates between surveys (where these surveys overlap) and the differences between the surveys and the AWAGS traverses (where these overlap). This effectively levels the surveys to the new national datum (figure 2).

“The improved datasets will lead to an increased understanding of the geology, structure, geochemistry and geomorphology of the continent.”

The Radiometric Map of Australia

The radiometric responses and patterns shown in the ternary image (potassium shown in red, uranium in blue and thorium in green) largely reflect the surface geochemistry and mineralogy of bedrock and regolith materials. In general, actively eroding felsic volcanic and igneous rocks are delineated by high concentrations of the radioelements and appear in white to reddish hues (figure 3). Low radioelement concentrations (black hues) correspond to ultramafic rocks and quartz-rich sandy materials (such as quartzites, sandstones and unconsolidated sands). Water bodies appear black in the ternary image.

Most of the gamma-ray responses relate to the distribution of regolith materials (for example, weathered bedrock, alluvium and colluvium) that reflect the overall antiquity and geomorphic stability of the Australian continent. Many of the relatively high thorium and low potassium responses (green and green/blue hues) relate to ferruginous lags and weathered materials.

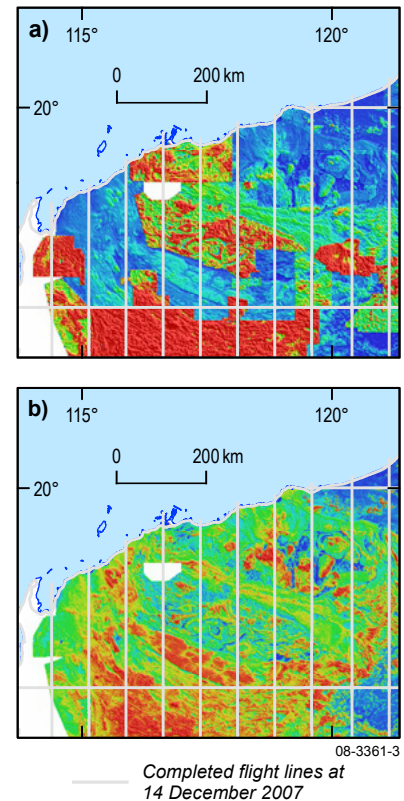


Figure 2. Dataset for the Pilbara region, Western Australia showing thorium data; (a) prior to grid levelling, and (b) after grid levelling.

New applications for improved geophysical datasets

The composite levelled, merged and feathered potassium, uranium and thorium grids of Australia allow explorers to compare the radiometric signatures observed over different parts of Australia, and to better appreciate the significance of broad-scale variations in radioelement concentrations. Consequently, Palaeozoic granites in eastern Australia can now be quantitatively compared and assessed for areas of potential mineralisation and geothermal prospectivity. A consistent

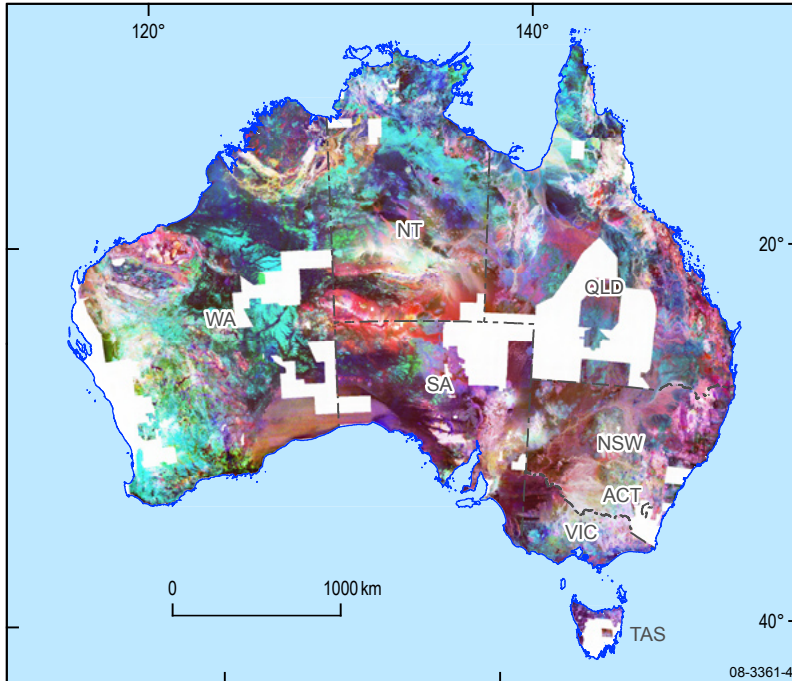


Figure 3. Ternary image (potassium in red, equivalent uranium in blue, and equivalent thorium in green) of Australia derived from the new levelled National Radioelement Database.

radioelement datum also enables the use of quantitative modelling and processing techniques, which enhance and integrate the radiometric imagery with other datasets (such as magnetics, satellite imagery and gravity) to be applied over much larger areas.

The new updated database will directly assist:

- uranium and thorium exploration through the ability to make quantitative comparisons between the radiometric signatures in different survey areas
- heat flow studies and assessment of geothermal energy resources
- geological mapping, mineral and petroleum exploration
- geomorphological studies and environmental mapping
- derivation of a radiation risk map of Australia.

The improved datasets will lead to an increased understanding of the geology, structure, geochemistry and geomorphology of the continent.

New digital radiometric products

The newly-levelled national radiometric database has enabled Geoscience Australia to produce a range of new digital radiometric products. The fundamental datasets are the levelled and merged composite potassium, uranium and thorium grids over Australia at 100 metre resolution. These have been used to produce grids at the same resolution showing the terrestrial dose rate, dose due to natural

sources of radiation (that is, terrestrial dose plus cosmic radiation), as well as potassium/uranium ratio, potassium/thorium ratio and uranium/thorium ratio grids.

The gridded datasets will be available free-of-charge in ERMMapper format from the Australian governments Geophysical Archive Data Delivery System (GADDS). Printed copies of the map will also be available from the Geoscience Australia Sales Centre early in 2009.

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Geophysical Archive Data Delivery System (GADDS)

www.geoscience.gov.au/gadds

Onshore Energy Security Program website

www.ga.gov.au/minerals/research/oesp/

AusGeo News 84: Onshore Energy Security Program underway

www.ga.gov.au/ausgeonews/ausgeonews200612/onshore.jsp

AusGeo News 88: Flight to find new energy resources

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