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3D INVERSION MODELLING *in the Tanami region*

New modelling techniques that use existing gravity and magnetic data, such as the recently developed three-dimensional inversion modelling, can enhance our understanding of the Tanami region by enabling construction of 3D geological models.

The highly prospective Tanami gold region in central Australia consists of poorly outcropping basement rock that is largely obscured by thin alluvial cover. Efforts to 'see through' this cover to map the basement stratigraphy have therefore relied heavily on geophysical datasets, primarily gravity and magnetic.

New modelling techniques that use existing gravity and magnetic data, such as the recently developed three-dimensional inversion modelling, can enhance our understanding of the region by enabling construction of 3D geological models.

The Tanami region was the first central Australian region to be subjected to the application of this technique. The results provide enhanced information on the 3D architecture of the Tanami gold mineralising system, such as locations and orientations of structures acting as conduits for gold-bearing fluids, as well as locations of possible target rocks.

3D inversion modelling—which generates full 3D models in an automated environment—is an advance over the more traditional 2D forward modelling. The software was developed by the University of British Columbia's Geophysical Inversion Facility.

The technique transforms observed gravity or magnetic data into a 3D model populated by a mesh of cells carrying density or magnetic susceptibility values. The process is iterative, with adjustments being made to a starting model in order to minimise any misfit between observed and computed data. The final models, containing the density and magnetic susceptibility values, reproduce the observed gravity or magnetic field to within a small degree of error.

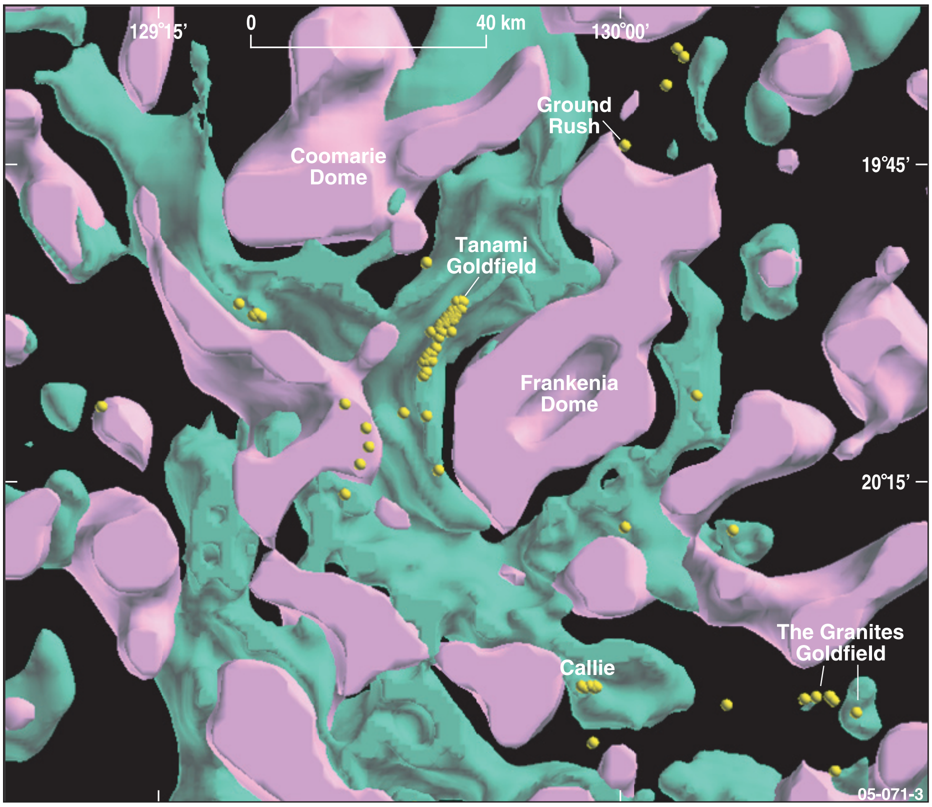

Figure 1. Plan view of a 'zoomed in' portion of the 3D inversion surfaces. Pink surfaces enclose regions of low density in the gravity inversion model, while green surfaces enclose regions of high magnetic susceptibility in the magnetic inversion model. The pink and green surfaces correspond mostly to mapped and interpreted granites and magnetic Tanami stratigraphy respectively, and are interpreted to map the 3D geometries of these lithologies. The locations of gold mineralisation, in yellow, highlight the relationships of the Callie deposit and the Tanami goldfield with respect to the magnetic stratigraphy.

The third-generation 3D Tanami model (figure 1) will be released in June 2005. It incorporates 3D inversion surfaces that were generated to enclose regions of anomalous physical property values. Surfaces enclosing low densities within the gravity inversion model correspond mostly to mapped and interpreted granites and are interpreted to simulate the 3D distributions of the granites.

Surfaces enclosing high magnetic susceptibilities within the magnetic inversion model correspond mostly to the magnetic stratigraphy (banded iron formations and mafic units) within the Tanami group sediments, and are also interpreted to simulate the 3D distribution of these units.

The inversion models, therefore, may be used as a regional-scale guide for determining where the magnetic units—considered to be potential traps for gold mineralisation—may appear at depth, as well as where they might sub-crop beneath younger cover.

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