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A new investigation of some continental scale gravity lineaments in Australia

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Introduction

Major continental lineaments have long been recognised. One of the earliest and most important documentations was produced by the American worker W.H. Hobbs in 1911. Hobbs investigated basement fractures in many parts of the world

and observed their influence on surface topography and drainage patterns.

In Australia, the pioneering research by E.S. Hills between 1946 and 1956 showed that a number of continental scale morphotectonic lineaments where the underlying basement

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structure could be seen to dictate the surface morphology. Many of these lineaments are recognisable on the large scale "Great Relief Model" of Australia constructed by Hills between 1942 and 1954.

Another noteworthy Australian researcher, E.S.T. O'Driscoll, has studied continental lineaments since the late 1960's and has identified and developed the relationship between economic ore localization and major lineaments. He demonstrated the ore/lineament relationship in both Australia and other parts of the world.

Australian Gravity Lineaments

It can be readily observed that the location and orientation of gravity lineaments recognized by O'Driscoll often coincide with surficial morphotectonic lineaments documented by Hills, i.e. deep seated features are coincident with the geomorphic surface expressions.

As a component of the current study at Melbourne University on Australian lineaments, the author has reviewed and further examined numerous Australian continental gravity lineaments.

O'Driscoll used a diffused gravity image, produced by oscillating the negative of a Bouger Free Air gravity image during photographic development, to identify a continental network of gravity lineaments. Ingredient maps of Bouger Free Air gravity data have also been used by O'Driscoll and the author as a useful tool in the identification of deep crustal lineaments. Gravity lineaments can be recognised as pattern disruptions in a particular data set. These disruptions reflect linear dislocations in the lower crust-upper mantle.

The present study has identified the effects of the continental lineaments (often referred to as lineament corridors), on the geology, surface morphology and structure of the intervening terrains.

An important and observable feature of a lineament or lineament corridor is that it forms the locational focus for a variety of tectonic processes that are intermittently repeated through time.

The effects of the lineaments on the geology show their great antiquity and fundamental influence on the tectonic development and history of the Australian continent. Numerous case studies show evidence for such resurgence along lineaments from as early as Proterozoic and up to Recent times.

Because the majority of major economic mineral and hydrocarbon accumulations in Australia occur at major lineament intersections, the study of such lineaments assumes an important economic significance.

Summary

This study has demonstrated that:

Linear, deep seated gravity discontinuities can be identified in Bouger gravity data sets and the effects of these can be recognised in the surface expression of geology and structure.

Lineaments form a locational focus for a variety of tectonic processes.

Lineaments exhibit great antiquity as there is evidence for resurgent activity along their length from the Proterozoic to the Recent.

Lineament intersections assume an economic significance due to the common ore/lineament association.
