Targeting tin mineralisation using "3D Common Earth Models" in the Khartoum region, North Queensland, Australia

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Abstract

The use of modern day 3D GIS software packages such as GOCAD, GeoModeller and Leapfrog Geo has dramatically changed the way exploration targeting can be carried out compared to the last twenty years of using 2D Geographic Information System (GIS) for exploration. This is especially true in the last five years in which computer and GPS technology has developed to the stage where it is possible to digitally locate, accurately store, visualise and manipulate geological data in 3D at the scale of a mineral system, which is usually much greater than mine scale where most of the current 3D work is focussed. Most GIS can store, manage and manipulate data in 2D, with some able to visualise information in 3D. However, there are a number of packages that allow full 3D GIS functionality, including querying and modelling, allowing geologists to start exploration targeting in a 3D system. Auzex Exploration Limited owns a number of exploration tenements over the historically tin rich Khartoum area located near Herberton in North Queensland, Australia, exploring for Tin-Tungsten mineralisation. A 3D geological interpretation was created over a 60 km by 60 km region in Khartoum using Leapfrog Geo to improve targeting for tin systems adjacent and above buried granites and shallow dipping granite contacts, followed by 3D targeting using a Multi-Class index Overlay workflow of GoCAD Mining. The ranking of the 3D maps were based on a 2D prospectivity mapping exercise using the weights of evidence technique. By modelling geology and targeting in 3D, complex subsurface relationships and the correct vertical extents can be constrained. This will be invaluable for defining potential drill-hole targets.

Keywords: 3D geological modelling, mineral prospectivity modelling, tin-tungsten, Khartoum.

Introduction

Mineral prospectivity modelling using GIS is becoming more popular in the geoscience world. While two-dimensional (2D) prospectivity modelling is a powerful tool for exploration targeting that is often used by the exploration industry, developments in computer software, modelling techniques and availability of digital data are allowing us to work with greater detail. Feltrin et al., (2008), McInerney et al., (2008), and McGaughey et al., (2009) have extended the capabilities of mineral prospectivity modelling to now include three-dimensional (3D) analysis. There are a number of modelling techniques that can be used, including weights of evidence, fuzzy logic, artificial neural networks, and applied to a range of mineral deposit types (Porwal et al. 2010; Lindsay et al., 2014). The need to improve predictors of mineral deposits are driving the need to visualise exploration data in 3D space, pushing us towards a 3D analytical world.

The weights of evidence technique (Bonham-Carter, 1994) has been used to complete mineral prospectivity modelling in both two- and three-dimensional space for tin mineralisation across an area centred over several exploration licences owned by Auzex Exploration Limited (AEL) near the Mount Garnet Township (Fig. 1). Information from a 3D geological model created for this project was has been used to improve the results of the 2D prospectivity model (Payne et al., this volume), from which the results have been critical for the development of the 3D