Biography - Sandra Occhipinti

Sandra Occhipinti is a structural geologist who has worked with AngloGold Ashanti, Fugro Airborne Surveys, the Geological Survey of Western Australia and the Centre for Exploration Targeting. She completed a BSc Geology at Monash University in 1992 and an MSc in 1994. Her MSc research was on Structural Geology, Metamorphism and Metasomatism in a low-temperature, high-pressure metamorphic belt in New Caledonia. After working as a Regional Mapping Geologist for the GSWA she received a PhD from Curtin University in 2004 on the tectonothermal development of the Southern Capricorn Orogen using $^{40}Ar/^{39}Ar$ geochronology and structural and metamorphic analysis.

Sandra's key research interests are centred on understanding how disparate mineral systems develop, and developing systematic techniques in order to explore for them – moving away from, but not ignoring ore deposit models. This involves the methodical integration of geological, geophysical, and geochemical datasets to develop sound 3- and 4-D interpretations to hypothesise about the geodynamic/tectonic development of a region through time.

To flirt or marry – the dilemma of mineral system(s) modelling

by

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Introduction

Modelling geological systems is something the geoscience community routinely does, but has also struggled with for decades. Now, with big datasets and super-computing power, there is an expectation to use computer-assisted analyses to expedite data integration complete complex multi-variate studies, and ultimately develop a model that mimics or approximates very well a natural geological system.

In a bid to increase mineral exploration success, we must improve our data integration and targeting techniques, which are increasingly falling on Universities to develop, such as at the CET. Geological models, including mineral prospectivity models can either be used blindly or simply as a guide i.e. something to flirt with, but not necessarily to take to the altar.

Mineral systems analysis is an aid for exploration targeting that attempts to define zones of mineralisation through the use of conceptual models. The analysis involves defining mappable proxies of geological features or elements interpreted as being critical to the development and preservation of a mineral system. Many studies have been completed using such mineral systems analyses, with some being translated into prospectivity models and maps. The models are built upon understanding ore deposit models, extracting their salient features (Fig. 1), integrating them into a workflow, and combining the data in different ways.

The mineral systems concept was first introduced in 1994 using a source–pathway–trap model, borrowed from the oil and gas industry (Wyborn et al., 1994). Since then, experience from this approach has led the minerals industry to increasingly complete targeting through the integration of large, disparate datasets to aid anomaly detection. the

The mineral systems concept recognizes five critical elements as necessary for the formation and preservation of ore deposits (Fig. 1):1) deep crustal scale structures, 2) geodynamic throttle (tectonic framework/triggers), 3) depositional site, 4) fertility, and 5) preservation. Mappable proxies of these critical elements can be combined using computer-assisted data integration techniques, 'prospectivity maps' can then be produced at a range of scales, replacing or as an additional tool for traditional exploration targeting practises.

Advantages of this mineral systems workflow are that targets are identified that otherwise may not have been notedthrough traditional visual data-overlay techniques. The disadvantage of this technique, however, is that prospectivity 'heat maps' can producebogus anomalies due to an insufficient understanding of the mineral system or theinput of spurious data.

To fully commit to a model typically involves further investigations i.e. spending more time and money on a project. In addition, the importance of particular critical elements in the prospectivity model is often 'lost' in the overall result – i.e. you forget why you proposed in the first place. This is an important issue, and one that we have addressed at the CET through the development of GIS toolboxes that can be modified and re-run by end users. These toolboxes allow the user to continually flirt with a model, adapting and shaping their results in order to find the perfect 'mate'.

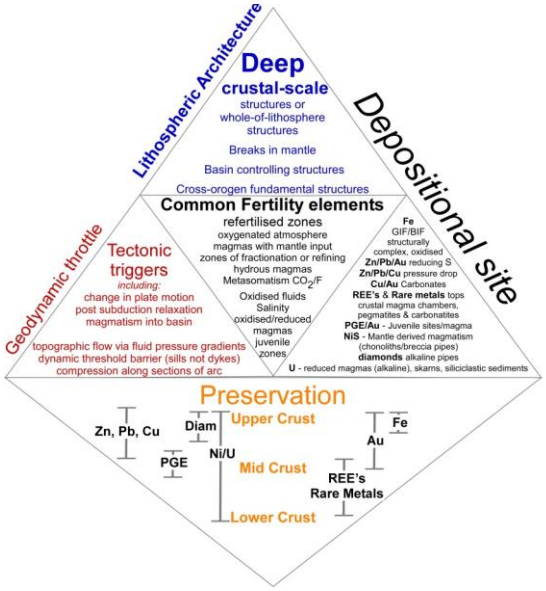

Figure 1. Mineral Systems diamond summarizing some of the critical elements required to form and preserve a mineral deposit