The next generation of outcrop: MinEx CRC and the National Drilling Initiative in Western Australia

by

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Introduction

The Mineral Exploration Cooperative Research Centre (MinEx CRC) is the world's largest geoscience research consortium, with cash and in-kind funding of more than $230 million over a 10-year lifespan. Research partners in the MinEx CRC comprise several universities, mineral exploration and service companies, the Commonwealth Scientific and Industrial Research Organisation (CSIRO), State and Territory geological surveys and Geoscience Australia (GA). Research within the MinEx CRC is to be conducted over three 3-year phases plus start up and shut down phases of six months over the 10-year lifespan. The first year of phase 1 is now complete, and the initial research direction established is discussed below.

MinEx CRC consists of three programs: Drilling Technologies, Data from Drilling and the National Drilling Initiative (NDI). The Geological Survey of Western Australia (GSWA) participates in both the NDI and a project within the Data from Drilling program (Project 6: Automated 3D Modelling). Within the NDI, projects are focused on the proposed drilling campaigns, including Maximizing the Value of Data and Drilling Through Cover (Project 7), Geological Architecture and Evolution (Project 8) and Targeting Mineral Systems in Covered Terranes (Project 9). Research in Western Australia within the NDI will concentrate on mapping 'The Gap' as discussed in Gessner et al. (2019; Fig. 1).

Research highlights

Automated 3D modelling

The Automated 3D Modelling project, led by Professor Mark Jessell and Dr Mark Lindsay at The University of Western Australia, has a goal of reducing the time taken to generate mine-scale 3D probabilistic models to one week. Presently, generation of a single 3D model can take months and does not capture the uncertainties inherent in 3D modelling, which requires adopting probabilistic approaches and necessitates the production of ensembles of models rather than a singular 3D model.

Project research to date has focused on automated extraction of data and knowledge from publicly available data sources (e.g. GSWA's online databases and maps), enabling 3D modelling to include more complex structural data, and on exploring the data requirements around value of information. This includes an analysis of the optimal geographical areas or methods for further data collection to better constrain 3D models, key elements to successfully reducing the time taken to produce models.

The work of the Automated 3D Modelling project is directly aligned with the Loop 3D OneGeology Australian Research Council Linkage project. The MinEx CRC project is leveraging investment in that initiative to make strides in mine-scale to regional-scale modelling.

The National Drilling Initiative: demonstrating discovery across scales

Within the MinEx CRC, the State and Territory Geological Surveys and GA are collaborating on the NDI along with Program 3 research partners: The University of Adelaide, University of South Australia, Curtin University, University of Newcastle, Australian National University and CSIRO. The goal of the NDI is to investigate and demonstrate how novel techniques developed within the MinEx CRC can better delineate mineral prospectivity under cover. Research within NDI is geographically and scientifically diverse. Projects within the NDI focus on:

- enhancing knowledge from data, especially using modern artificial intelligence/machine learning approaches and data delivery and visualization (Project 7)

- geological research into understanding terranes including petrophysical to geophysical research, regolith geoscience, and basement terrane fingerprinting through isotopic and geochronology approaches (Project 8)

- mineral systems research, concentrating on how best to apply mineral systems approaches to cross scales and produce regional-scale discovery methodologies applicable to the NDI focus regions for each participating State and Territory (Project 9).
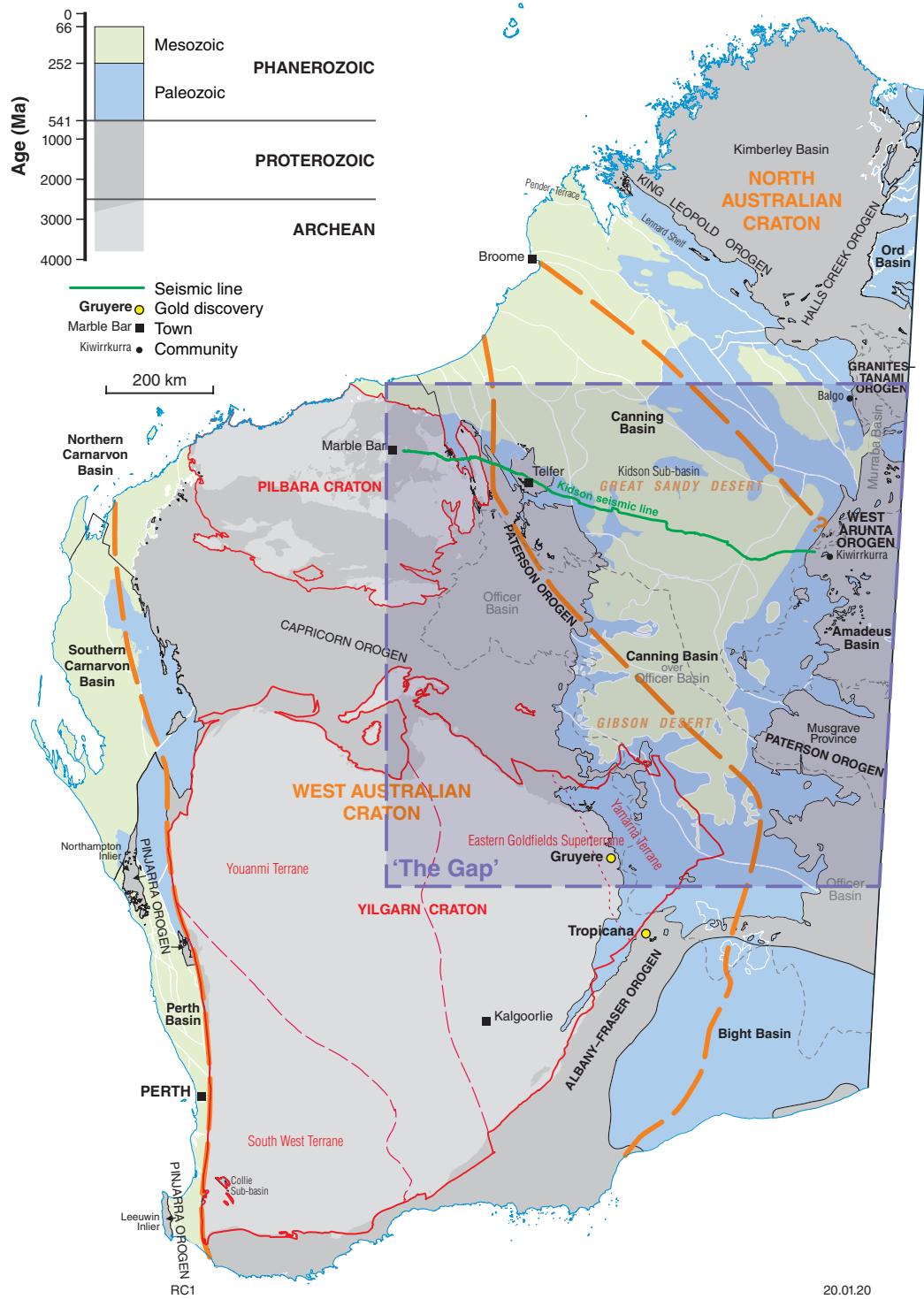
Figure 1.   'The Gap' is the informal name referring to basement underlying and proximal to the margins of the Canning Basin in northern and central Western Australia, as this region is characterized by a gap of scientific data

The chosen NDI focus areas vary across the States from enhancing prospectivity near known mining centres to investigating greenfields prospectivity. Within the Gap region, areas of interest for mineral prospectivity are the:

- West Arunta Orogen west of the Northern Territory Border, including the region around the Kiwirrkurra Community

- Paterson Orogen, especially the poorly understood terranes of the Rudall Province, and the Yeneena Basin

- Canning Basin, a potential host for mineralization

- Yamarna Terrane, in the eastern Yilgarn Craton, with its well-known potential for Au and Ni mineralization.

Phase 1 will focus on the West Arunta and Paterson Orogens. In the West Arunta Orogen, work is underway on Exploration Incentive Scheme (EIS) Co-funded drillcores. A new mapping campaign will commence in 2020 to investigate the structural evolution and lithological links to known prospects in the region, including those in the adjacent Northern Territory. This region is prospective for Cu, Au, Zn, Pb and possibly U; previous GSWA geochemical soil surveys identified several samples with elevated and anomalous concentrations of Au. Additionally, elevated concentrations of Zn and elements such as Ti in regolith and/or spinifex associated with the Stansmore Fault indicate potential buried mineralization hosted in sedimentary rocks consistent with sedimentary exhalative (SEDEX)-style mineralization. In the Paterson Orogen, the focus over the next 12 months will include drillcore analysis of EIS Co-funded and exploration drillcores, linked with activities of the Minerals Research Institute of Western Australia (MRIWA) M521 project. The Paterson region is prospective for Au, Cu, Pb, Zn, W and U and is the current focus for a number of exploration company drilling programs.

For research within both of these regions, a key goal will be to demonstrate targeting methodologies applicable at the challenging camp scale. With a focus on greenfields undercover exploration likely to continue, guiding principles on how to best utilize geophysical and rock property data will be a key area of research alongside improving drilling and drillsite data acquisition technologies. This will help identify the undercover mappable expressions of the key basement terranes and their margins, which are likely to be the prime controls on mineralization.

References

Gessner, K, Tyler, IM, Hall, CE, Spaggiari, CV, Beardsmore, TJ, Duuring, P, Johnson, SP, Smithies, RH and Wingate, MTD 2019, The future of mineral exploration geoscience at GSWA: EIS 4 and MinEx CRC: Geological Survey of Western Australia, Record 2019/2, p. 1–4.