MRIWA M530 Yilgarn 2020 Project

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Minerals Research Institute of Western Australia

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GOLD ROAD RESOURCES

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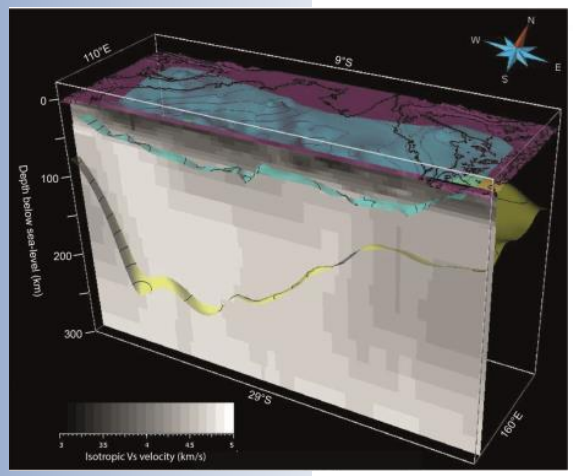
Evolution MINING

Centre for EXPLORATION TARGETING

MRIWA M530 Yilgarn 2020

(3 year research program)

Module 1 Composition and Evolution of the Yilgarn Craton Lithosphere

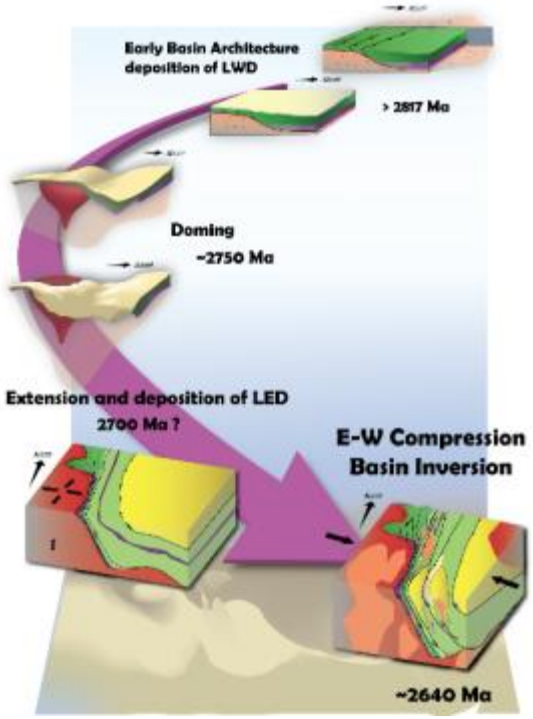


AuSREM compilation showing Vs, Moho and LAB models.

Q1 2019 Start

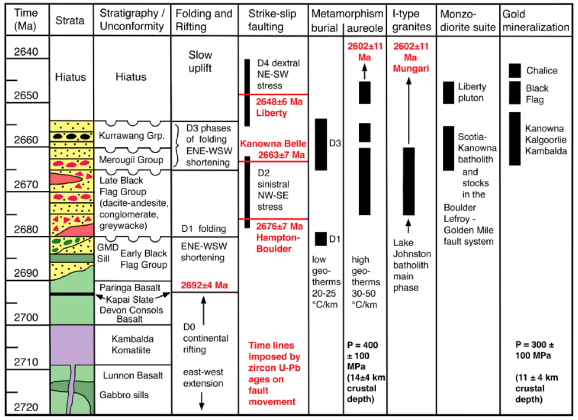
$1.2 M cash from industry
$0.8 M cash from MRIWA
$1.1 M (in-kind) from UWA
$0.49 M (in-kind) from GSWA

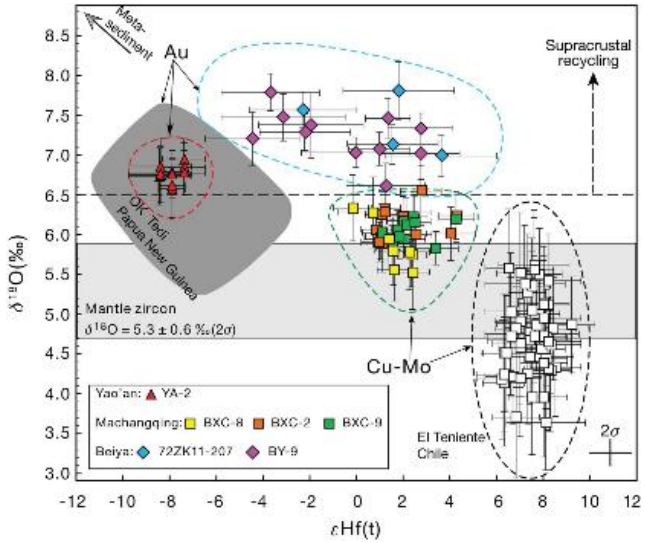
Module 2
Understanding Camp-scale Crustal Architecture



Geology/geophysics integration to map early architecture and controls on alteration

Module 3
Mapping Mineral Fertility





Mapping of fertility & development of a fertility index.

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Alan Aitken
Klaus Gessner
Mark Jessell

Yilgarn 2020 Module 1

Composition and evolution of the Yilgarn Craton lithosphere

Goal: To use the wealth of available geological data that exist for the Yilgarn Craton to further understand the nature of the lower crust and upper mantle

Deliverables:

1. 3D property volumes for the Yilgarn lithosphere element: 3D voxet and depth-slice grids of Vp, Vs, Vp/Vs and density (from inversion) isosurfaces

2. Maps of crustal density that provide insight into the structure and architecture of the crust

3. Petrophysical inversions (LitMod) results that provide maps of the modelled temperature and composition of the lithospheric mantle

4. Interpretation of the Yilgarn Craton lithosphere evolution and associated metallogeny by combining geophysical results with geochemical and isotopic datasets

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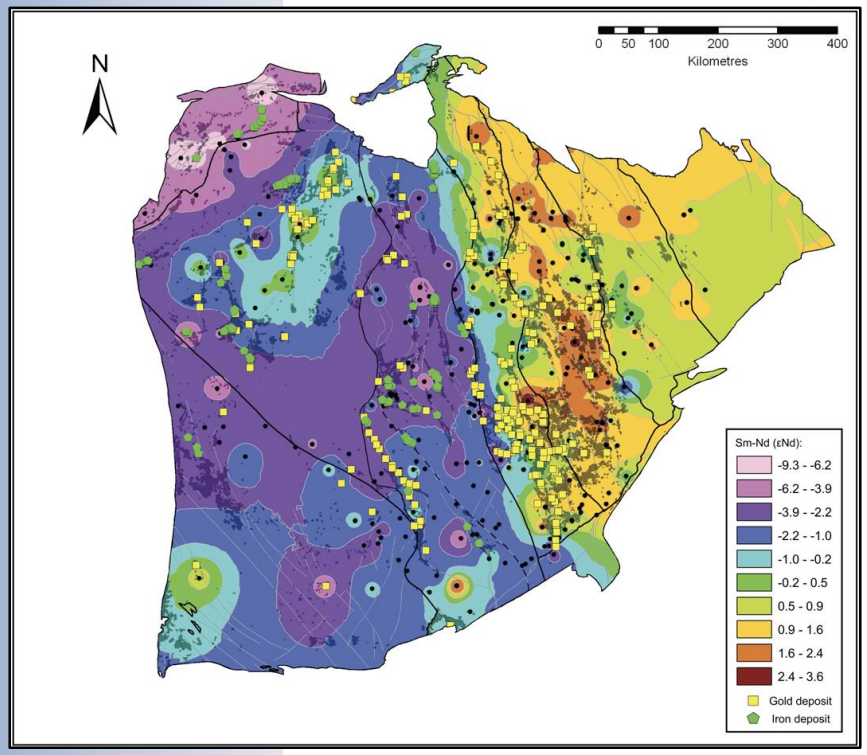
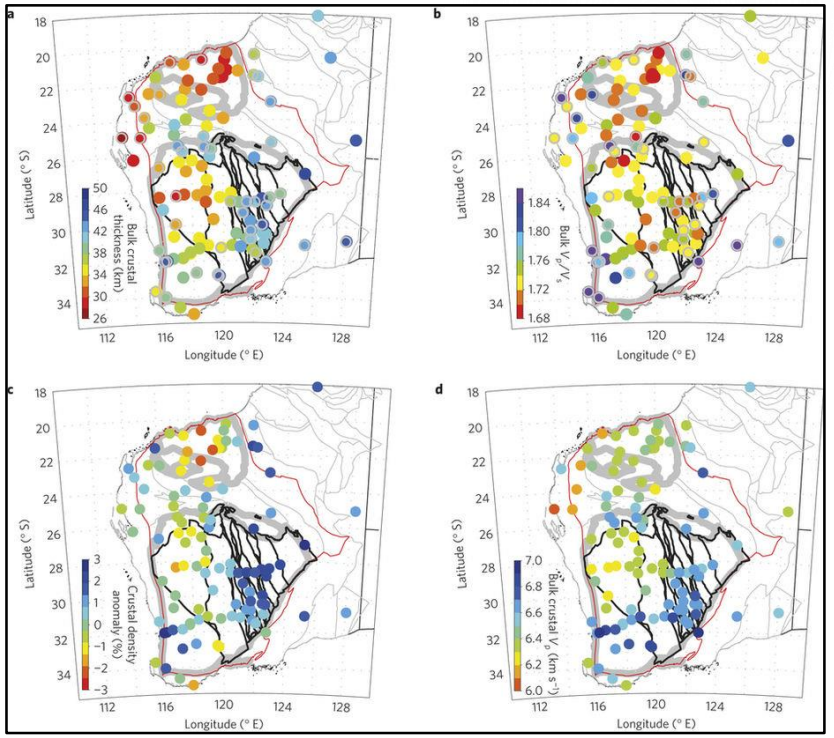
Whole lithosphere architecture and mineral systems location through time?



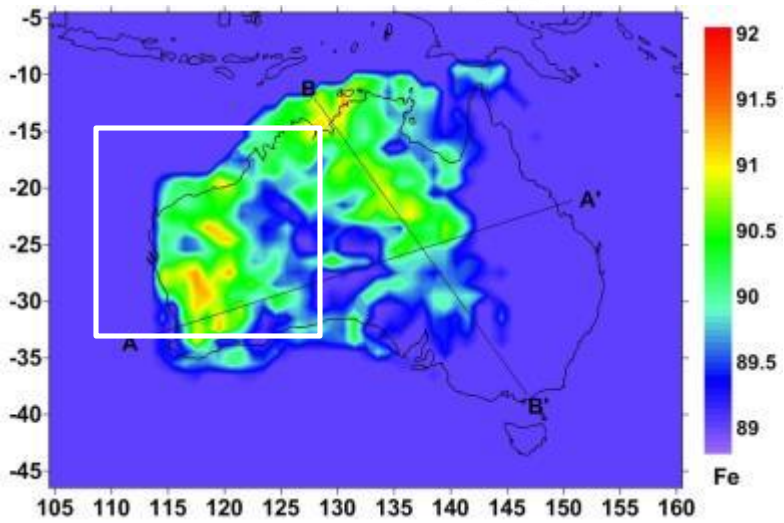
Mole et al., 2013



Yuan, 2015

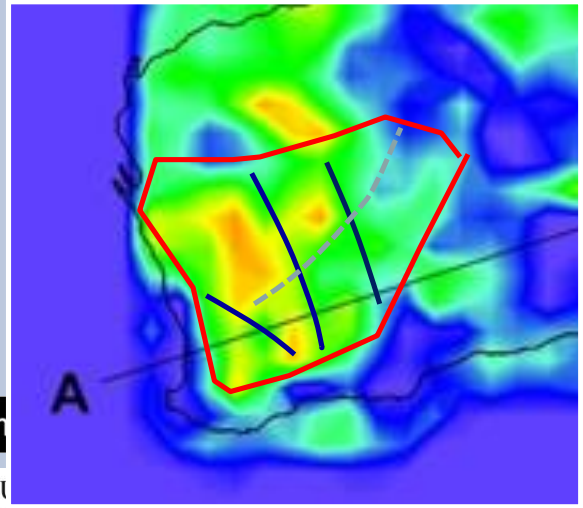
- Isotopic contour maps (Sm-Nd & Lu-Hf systems) provide proxies for terrane architecture through time
- Geophysical data provide images of current architecture – but preserve hints of the past (secular changes from cooling of the Earth's mantle)
- The Yilgarn Craton shows distinct and complementary trends in both types of data.

ARC linkage to extend Module 1 (Aitken) after Year 1



Goal: Integrated study of the entire lithosphere

1. Joint magnetic and gravity modelling of greenstone belts
2. Whole lithosphere seismic-gravity modelling
3. 3D LitMod modelling (versus 1D)
4. Craton-wide thermal/compositional modelling
5. More detailed and thorough synthesis and interpretation of isotopic and geochemical data focusing on craton evolution at large-scales

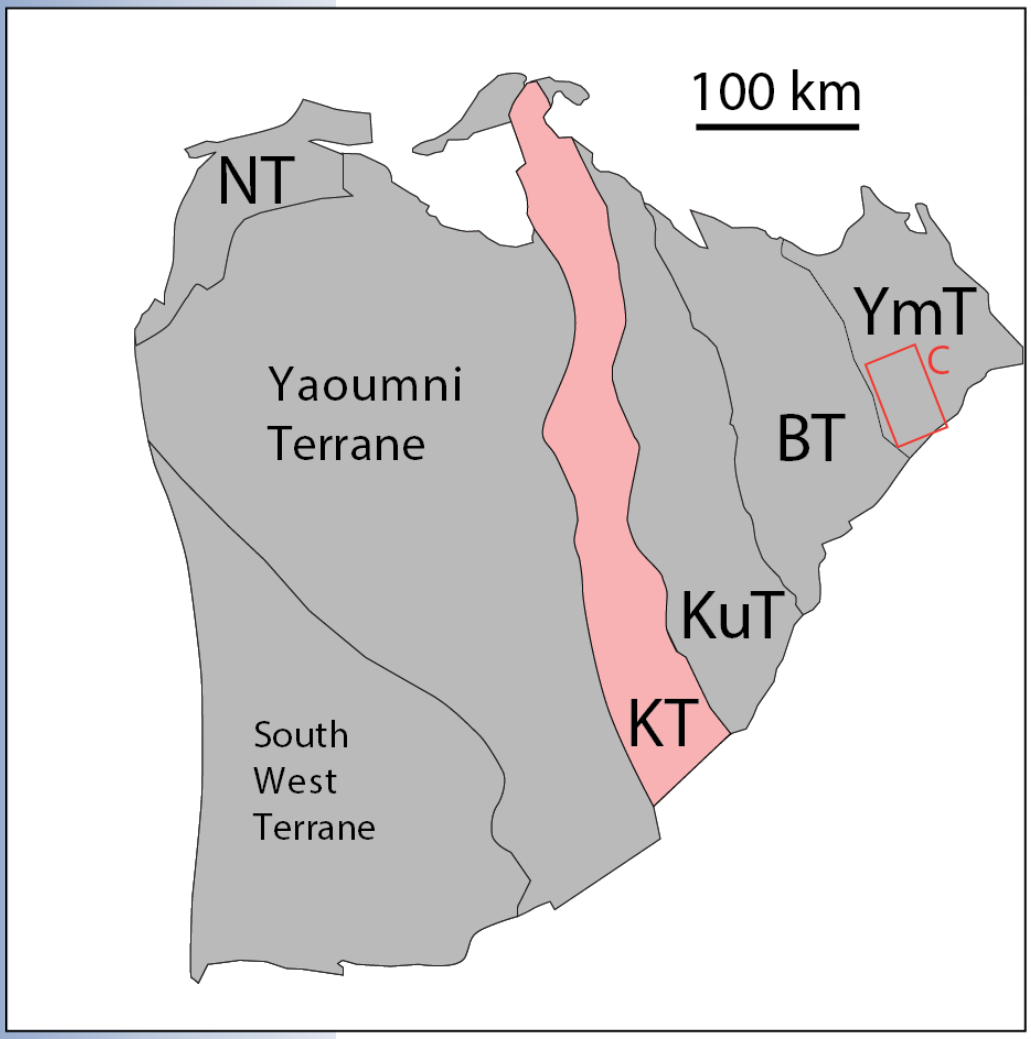


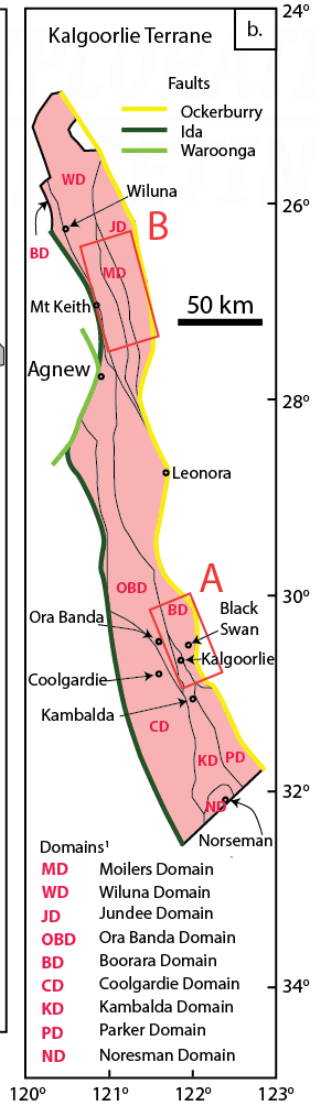
Low-resolution petrophysical inversion of Australia (Tesauro et al., in prep)

– Note apparent variable Fe depletion of Yilgarn Craton elements

These require validation and refinement with higher resolution studies

Study areas for modules 2 and 3





Preamble

- data rich (including drilling data)
- both well endowed and less endowed camps
- Areas of interest to sponsors

Field localities

A- Kalgoorlie to Kambalda camp

B- Leinster to Wiluna camp

C- Yamarna belt

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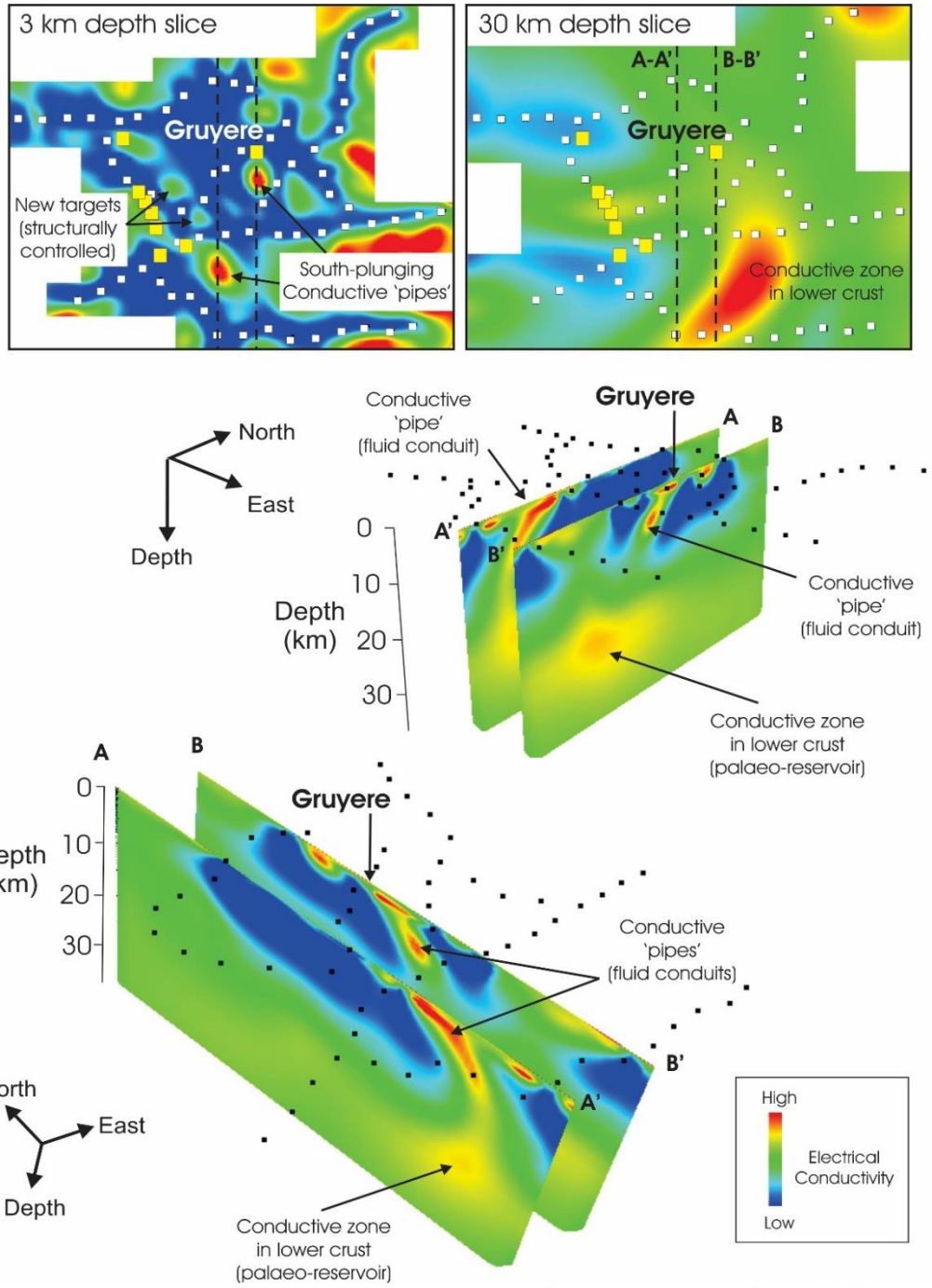
Yilgarn 2020 Module 2



Recent results from the Yamarna greenstone belt suggest magnetotelluric (MT) data can map fluid flow-related alteration in greenstone belts

- 'Palaeo-reservoir'
- Fluid flow zones

This very encouraging outcome needs to be:

- Tested in other camps
- Understood in terms of petrophysics of alteration

GSWA (partial) funding available

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Courtesy: Gold Road Resources Ltd, MRIWA

N. Thébaud
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H. Smithies
P. Hayman
S. Rowins

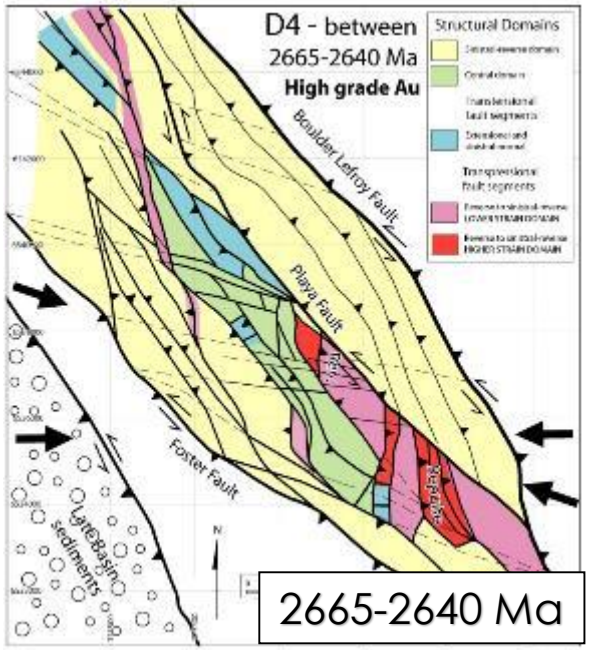
Module 2: Understanding Camp-scale Crustal Architecture

Goal

Despite the empirical observations that early-formed and long-lived structures exert a critical control on mineralization at the camp-scale, a workflow for reliably recognizing these structurally active pathways has not been developed.

The primary goal of module 2 is to develop a set of criteria or “toolbox” that may be applied to identify, rank, and target the critical fluid focusing structures within a given camp.

Kambalda: St. Ives



Miller et al., 2010

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Yilgarn 2020 Module 2

Deliverables

1. Lithostratigraphic, lithofacies and structural analysis including lithogeochemical characterisation of volcanic units and time constraints in the specific camps

2. New high resolution MT and seismic surveys (MRIWA, GSWA) to determine whether hydrothermal alteration assoc. with fault-controlled fluid flow has a recognizable petrophysical signature.

3. Development of a petrophysical stratigraphy to allow for the prediction of how the magnetic and gravity responses are controlled by the local stratigraphy in the targeted camps.

Module 2a
Stratigraphic analysis

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Module 2b
Geophysical mapping of gsb geology/alteration

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Recognition and mapping of early structures

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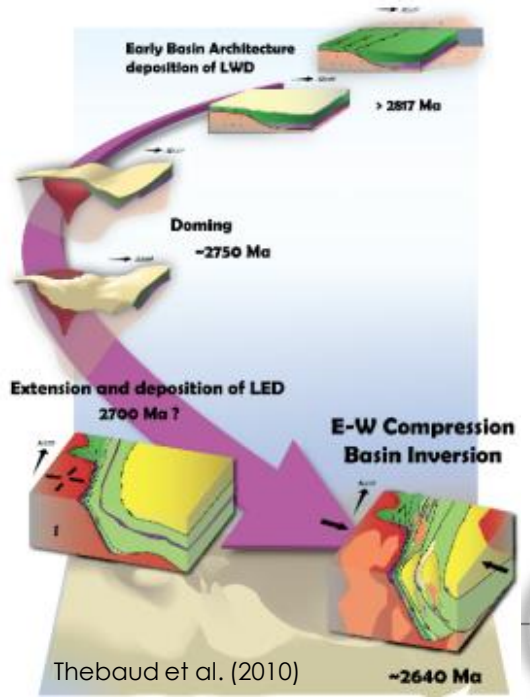
Understanding of camp-scale architecture, history and controls on mineralisation



Thebaud et al. (2010)

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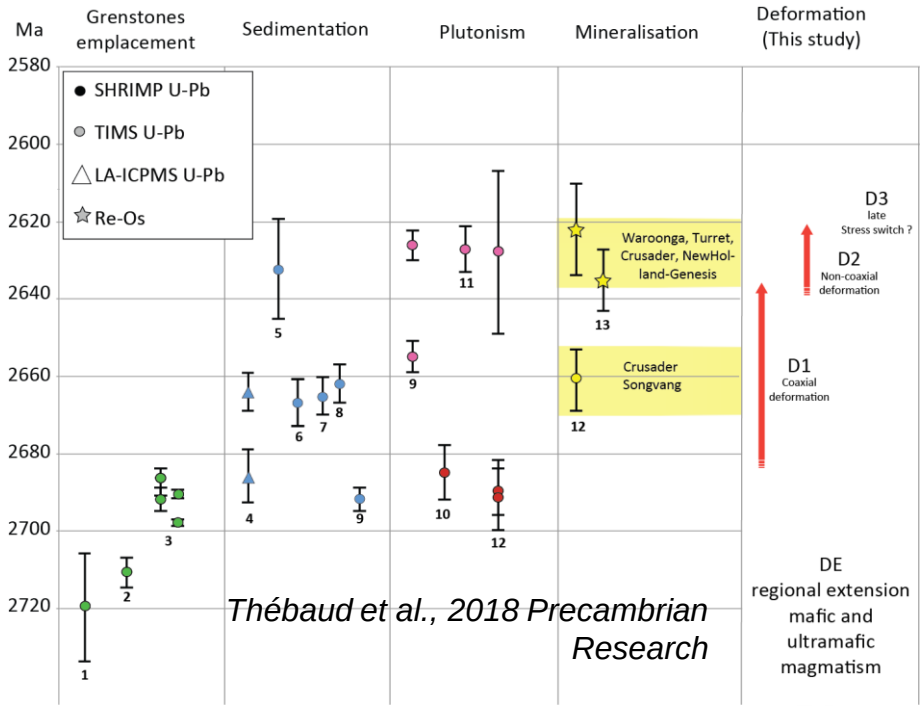
Module 3: Mapping mineral fertility

Goals

- Mapping of fertility or development of a fertility index remains a missing ingredient in understanding mineral systems. It is a critical factor in the distinction between endowed and barren or marginally mineralised camps
- Understand the links between lithospheric-scale and camp-scale controls on metal fertility
- Development of new fertility indicators for Au and base metal camps
- Improve detection capability, required to locate metal fertile camps

Timing of events in the Agnew district



Thébaud et al., 2018 Precambrian Research

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Yilgarn 2020 Module 3 Deliverables

1. Lithogeochemical characterisation and geochronology of igneous (mm)rocks including dykes, stocks, & batholiths to be investigated in the deposits/camps

2. O isotope, Lu-Hf and trace element data on zircons from key igneous rocks

3. Paragenetic sequence of ore minerals and dating of mineralization

4. Integration of lithochemistry, structural, metamorphism, alteration and mineralization control in establishing a chronological framework for the orogen including gold mineralization

5. Results of application of work flow to sponsor nominated areas

Petrography, mineral-rock chemistry, geochronology ⟷ Module2 structural /geological context

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O, Lu-Hf, trace element analyses on zircons

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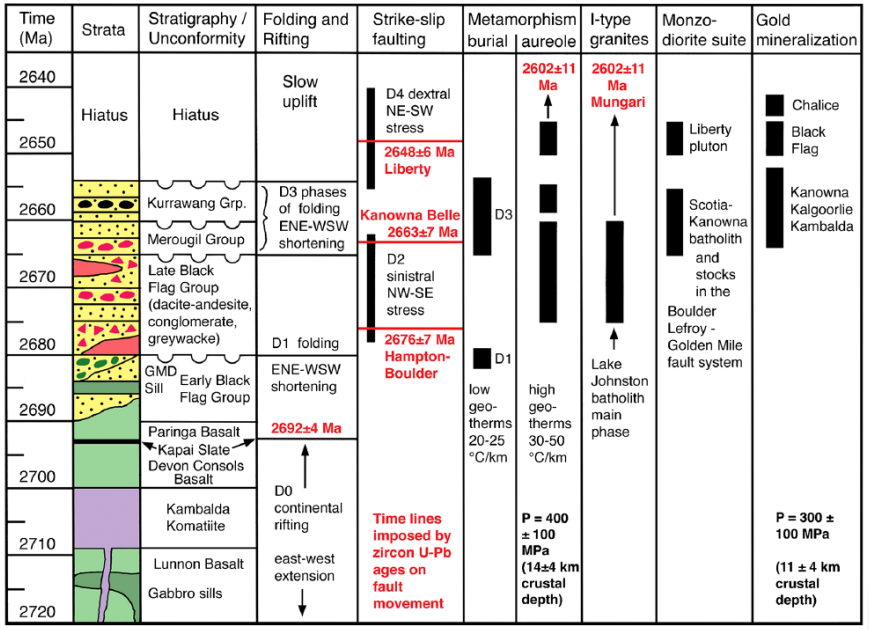
Magmatic and thermochronological evolution, and camp fertility



Mueller et al. (2016)

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Summary

Although the Yilgarn Craton remains one of Australia's most important mineral provinces, few coordinated multi-disciplinary research programs have been undertaken in recent years. This is due to both economic factors and the perception that the Yilgarn is a "mature" terrane. This perception has been challenged recently by discoveries at Gruyere in the Yamarna terrane in addition to brownfields discoveries at Invincible and Pegasus.

The 3 modules in the Yilgarn 2020 project offer a novel approach for the study of mineral systems in a Neoarchean terrane utilizing the collective expertise of the CET. Moreover, the techniques developed will aid in the discovery of the next generation of gold and base-metal deposits in the Yilgarn and may be applied to Precambrian terranes elsewhere.