This abstract is part of the session of 10-minute talks

The Eastern Goldfields high-resolution 2D seismic survey

by

SHD Howard, I Zibra and K Gessner

The Department of Mines, Industry Regulation and Safety manages the Western Australian Exploration Incentive Scheme (EIS) — a State Government initiative that aims to encourage exploration in Western Australia for the long-term sustainability of the State's resources sector. A major component of EIS is the acquisition of new geophysical data throughout the State, with programs managed by the Geological Survey of Western Australia (GSWA). As part of EIS, GSWA plans to acquire six high-resolution 2D seismic reflection traverses in the Eastern Goldfields for a total linear coverage of 250–300 km. Acquisition is anticipated to commence in February 2019, along sections of roads and tracks between Broad Arrow and Kambalda for completion (i.e. release of data and results) no later than November 2019 (Fig. 1). The objective of the project is to provide mineral explorers in the region with subsurface information in a depth range of about 300–5000 m to complement information from other sources, and to delineate areas that might be suitable for 3D seismic surveys for mineral exploration and targeting.

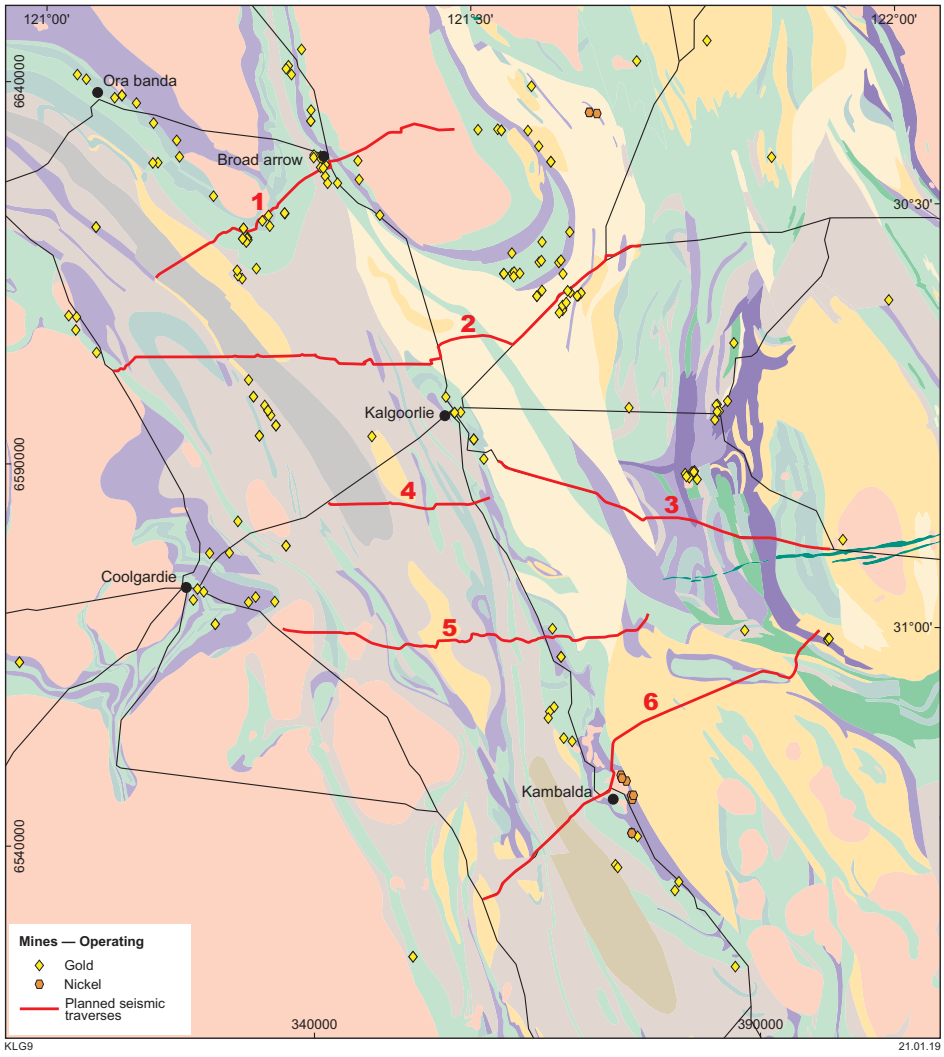

Figure 1. **Proposed locations of high-resolution seismic lines for the Eastern Goldfields survey, overlain on the 1:500 000 State interpreted bedrock geology map**

This abstract is part of the session of 10-minute talks

Capricorn Orogen passive seismic array

by

RE Murdie, H Yuan[1,2], M Dentith[1], SP Johnson and K Gessner

The study of incoming seismic waves from teleseismic earthquakes can be used to investigate the deep structure of the Earth's crust and upper mantle. Resolving the deep crustal structure and locating potential mantle-tapping structures is critical for understanding the metallogeny of mineral deposits at the surface. From 2014 to 2018, a network of 83 seismic monitoring stations was progressively moved across the Capricorn Orogen. This Exploration Incentive Scheme (EIS)-funded survey was intended to complement the previous deep crustal seismic reflection lines, and although the resolution was lower, the survey covered the majority of the orogen and provided different geophysical information.

Results already available from studies of receiver functions provide the depth to Moho and average composition of the crust for the orogen. The distribution of more felsic crust and a deeper Moho outline the extent of the Archean Glenburgh Terrane in the central part of the orogen. Common conversion point (CCP) studies provide a view of compositional layering in the crust, and have led to a revised interpretation of the 10GA-CP2 seismic reflection line (Fig. 1). Intriguing features within the upper mantle obtained by bodywave tomography have yet to be interpreted within the context of the tectonic evolution of the orogen.

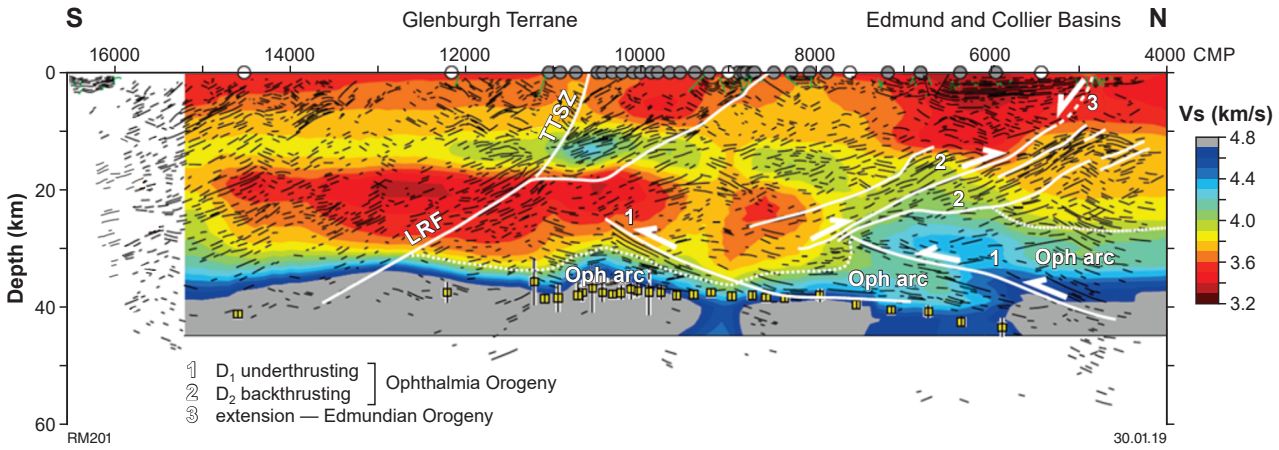

Figure 1. **Ambient noise profile of shear wave group velocity (Vs) along the 10GA-CP2 line, overlain by black line work representing the interpretation of 10GA-CP2 and a new interpretation of the tectonic features in white, as proposed after examination of the results from receiver function and ambient noise analyses. Yellow squares with error bars are depth to Moho as indicated from receiver function analysis. Grey and white circles show the position of seismometers. Abbreviations: LRF, Lyons River Fault; TTSZ, Ti Tree Shear Zone; Oph, Ophthalmia; CMP, common mid-point**

1 Centre for Exploration Targeting (UWA Node), School of Earth Sciences, The University of Western Australia, Stirling Highway, Crawley WA 6009

2 ARC Centre of Excellence for Core to Crust Fluid Systems, Department of Earth and Planetary Sciences, Macquarie University, Balaclava Road, North Ryde NSW 2109

This abstract is part of the session of 10-minute talks

Compilation of the 1:500 000 State regolith map of Western Australia

by

S Jakica and N de Souza Kovacs

The Geological Survey of Western Australia (GSWA) aims to create a seamless 1:500 000 regolith–landform digital map layer of Western Australia. This will be available in GeoVIEW.WA and will complement the current State 1:500 000-scale interpreted bedrock geology map. The layer is being compiled in two stages. The first, which covers the northern half of the State, north of the 25ºS parallel, was released in early 2019 (Fig. 1). The second, which covers the remainder of the State, is planned for release in December 2019.

Regolith geology from existing 1:100 000 and 1:250 000 Geological Series map sheets has been compiled to produce a seamless digital regolith–landform coverage. The original line work was modified in order to produce a compilation suitable for viewing at 1:500 000 scale. This included the aggregation of small polygons with the same code into larger polygons, elimination of small polygons and simplification of polygon shapes using cellular automata model (GeoScalar plug-in for ArcGIS). Following this, manual editing was required for edge-fitting and topology cleaning to improve the polygon line work and comply with cartographic scale standards. The coding of regolith polygons follows the GSWA regolith classification scheme (GSWA Record 2013/7) with the addition of a suffix representing major geomorphologic physiographic provinces across the State (Fig. 1). Earlier generations of map products that did not conform to the current GSWA regolith classification scheme were recoded accordingly. The codes consist of a primary code (landform and landform qualifier), secondary code (compositional information) and physiographic province suffix. For the scale of this product, tertiary codes (parent rock or cement) were deemed too detailed and were rolled up into higher level codes.

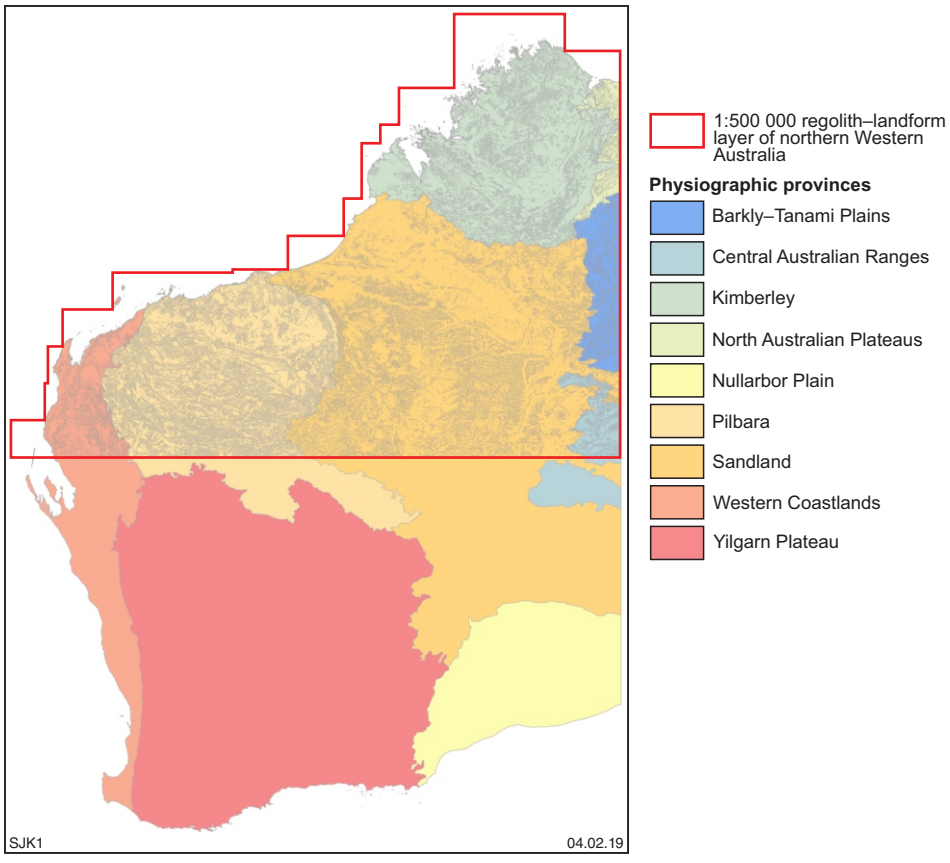

Figure 1. **Simplified map showing the distribution of physiographic provinces across Western Australia, and the outline of released 1:500 000 regolith–landform polygons for the northern half of the State**

This abstract is part of the session of 10-minute talks

The Abandoned Mines Program

by

I Mitchell

Mining has occurred in Western Australia for more than 150 years resulting in thousands of abandoned mine features across the State, such as shafts, costeans, large pit voids and waste rock landforms. The Abandoned Mines Program (AMP) was made possible following the enactment of the *Mining Rehabilitation Fund (MRF) Act 2012* in July 2013. The MRF provides a source of funding to address abandoned mine features in Western Australia. The AMP was formally established following the release of the Western Australian Government's Abandoned Mines Policy in January 2016. The Department of Mines, Industry Regulation and Safety selected four pilot sites to be rehabilitated/managed to set up and test the processes and procedures required to achieve the program's objectives. This presentation will summarize the status of the pilot sites.

This abstract is part of the session of 10-minute talks

New directions of metamorphic studies at GSWA

by

FJ Korhonen, SP Johnson, IOH Fielding and SS Romano

Over the last few decades, methods have been refined to unravel the depth, thermal, temporal and deformational history of geological terranes. Detailed observations at the map, hand sample and thin section scales can now be integrated with elemental and isotope data, and inverse and forward phase equilibria modelling, to retrieve more precise pressure (P)–temperature (T)–time (t) data from rock samples. We now apply a comprehensive and standardized approach to metamorphic studies across Western Australia. Modern techniques that we routinely use to quantify P–T conditions include conventional and trace element thermobarometry, as well as phase diagrams. These diagrams use internally consistent datasets of the thermodynamic properties of minerals, fluids and melts with activity–composition models for these phases. A major advance in applying phase equilibria modelling to natural rocks is using isochemical phase diagrams (pseudosections) to explore the assemblages and reaction sequences for a particular composition. These data can be integrated with the dating and composition of accessory phases, such as monazite, that are now analysed in situ to preserve their microstructural setting (Fig. 1). In this way, age results can potentially be linked with the stability of specific major rock-forming minerals. Our aim is to obtain robust P–T–t constraints from critical data points in order to generate a statewide metamorphic map and database.

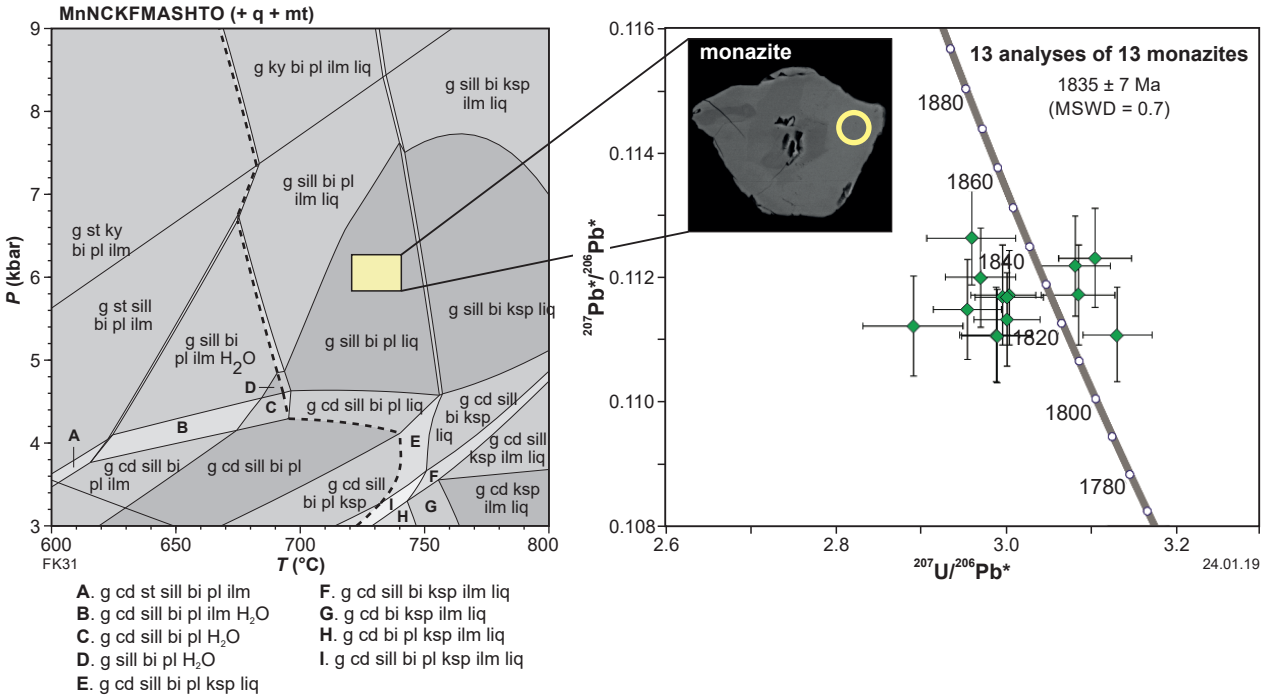

Figure 1. **P–T pseudosection and U–Pb analytical data for metamorphic monazite (backscattered electron [BSE] image shown inset). Monazites were analysed in situ, where textural relationships demonstrate that they form part of the peak metamorphic assemblage, thus providing a direct date for high-grade metamorphism**

This abstract is part of the session of 10-minute talks

Depth and composition of basement under the Carnarvon Basin — updated SEEBASE model

by

CM Thomas and G Sanchez*

Despite the many exploration successes in the offshore Carnarvon Basin, exploration in the onshore portion of the basin is hampered by sparse good-quality seismic data, which has led to many unknowns, including depth to basement and structural configuration. To help address this, Frogtech Geoscience was commissioned to update the SEEBASE (Structurally Enhanced view of Economic BASEment) grid over the Carnarvon Basin within the Western Australian jurisdiction, and to provide an interpretation of underlying basement composition. Input data included the latest gravity and aeromagnetic datasets (Fig. 1), Geological Survey of Western Australia seismic interpretations, published cross-sections and drillhole data. The Exploration Incentive Scheme (EIS)-funded 2018 Carnarvon Basin SEEBASE sees significant improvement in resolution compared to the 2005 OZ SEEBASE version.

Deliverables include a final Report, which details the methods and datasets used for interpretation of basement depth and lithology, and an ArcGIS project containing: SEEBASE grid, sediment thickness grid, processed and filtered gravity and aeromagnetic grids, crustal thickness grid, depth to Moho grid, stretching factor map, basement thickness grid, interpreted basement terrane and composition maps. The Report and ArcGIS project are available via the Department of Mines, Industry Regulation and Safety's eBookshop at <www.dmp.wa.gov.au/ebookshop> and on a USB.

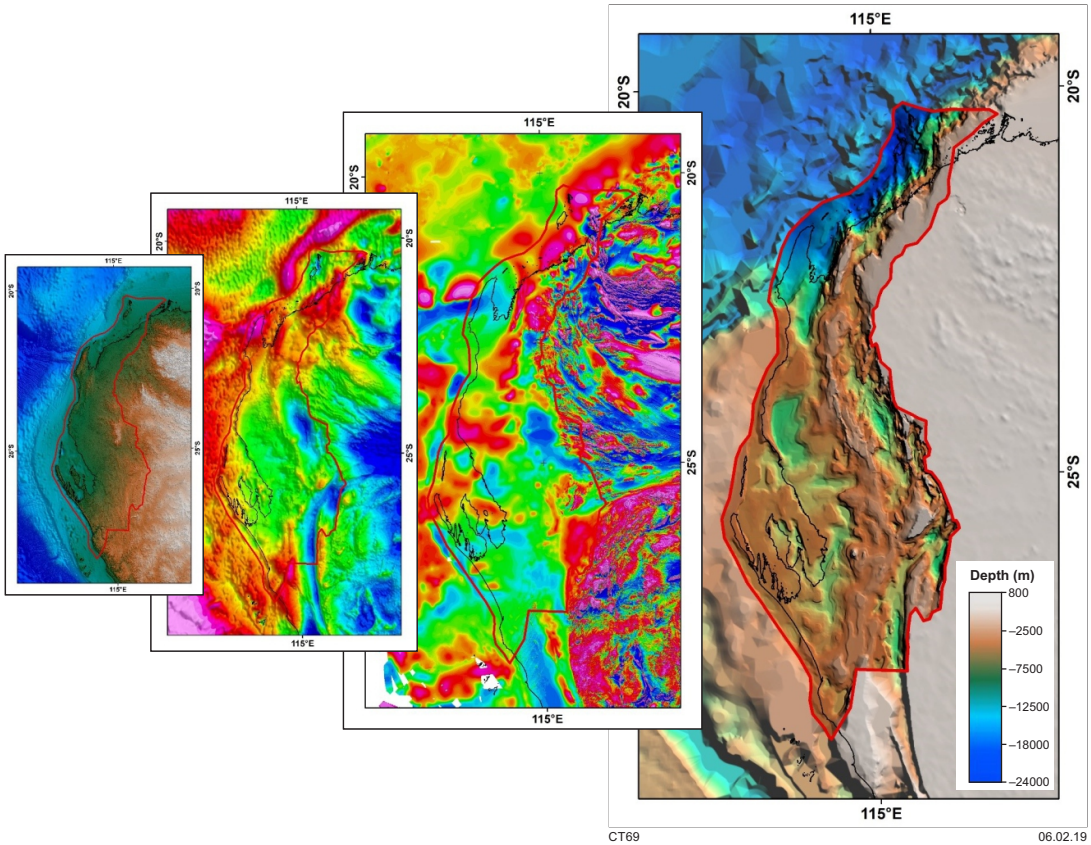

Figure 1. **2018 Carnarvon Basin SEEBASE grid (depth to economic basement, far right) and primary grid datasets used in its construction. Maps left to right: digital elevation model, Bouguer gravity, total magnetic intensity, 2018 Carnarvon Basin SEEBASE grid in project area (red polygon) compared to 2005 OZ SEEBASE version outside project area**

* Frogtech Geoscience, Suite 17F, Level 1, 2 King Street, Deakin ACT 2600

This abstract is part of the session of 10-minute talks

The Yilgarn 2020 project: a multiscale mineral systems approach to identifying the next generation of gold and base metal deposits in the Yilgarn Craton

by

SM Rowins*, N Thebaud* and Yilgarn 2020 Project Team

'Yilgarn 2020' is a three-year research project lead by the Centre for Exploration Targeting in the School of Earth Sciences at The University of Western Australia, with the support of the Minerals Research Institute of Western Australia and various industry, academic and government partners. The project has three integrated research modules and uses a multiscale mineral systems approach to enhance our understanding of the metallogeny of the Archean Yilgarn Craton. The first module uses existing geological data to examine the composition and evolution of the lower crust and lithospheric mantle. The second module focuses on understanding camp-scale crustal architecture by developing criteria that can be applied to identify, rank and target the critical fluid-focusing structures within a given camp. The third module examines the metal fertility of the Craton by examining how magmatic and metamorphic processes have contributed to the formation of the mineralized camps. The new knowledge and tools developed from this project will aid in the discovery of the next generation of gold and base metal deposits in the Yilgarn Craton, and may be applied to Precambrian terranes elsewhere.

* Centre for Exploration Targeting (UWA Node), School of Earth Sciences, The University of Western Australia, Stirling Highway, Crawley WA 6009

This abstract is part of the session of 10-minute talks

Confidence in carbon storage in the South West of Western Australia

by

D Van Gent and S Sharma*

The South West Hub Project, led by the Department of Mines, Industry Regulation and Safety in Western Australia, has been investigating and characterizing the Lesueur Sandstone (Fig. 1) as a potential target for the injection and storage of carbon since 2007. As expected, with an unconfined saline aquifer, the project started with limited data, particularly when compared to sites based in oil and gas field areas. Working with research institutions and private sector expertise, the project has judiciously acquired data on a stage-gated decision basis. Starting with 2D seismic data over 110 line-km in 2011 and a deep well to 2945 m in 2012, the project was able to move through various modelling stages and uncertainty tables, before undertaking a complex 3D seismic investigation in 2014. The 3D seismic data covered over 115 km^2 and was followed in 2015 by the drilling of three shallow- to intermediate-depth wells (1350, 1550 and 1800 m) that gave good areal coverage and significant core and logging data on targeted critical subsurface formations. As more information became available, the level of sophistication and granularity of the models was revised. In 2010, the first-generation models comprised >100 layers with 10 million cells, by 2013 the second-generation models had >357 layers with 30 million cells and by 2016 the third-generation models had >1100 layers with 214 million cells. The South West Hub is unique as it relies on proving primary containment through migration assisted trapping (MAT, sometimes referred to as migration assisted storage or MAS) in the Wonnerup Member of the Lesueur Formation, a relatively homogenous sandstone layer that is 1500 m thick. Security of secondary containment is considered through the overlying paleosol packages in the Yalgorup Member, a sequence of sand and paleosol deposits that is 800 m thick.

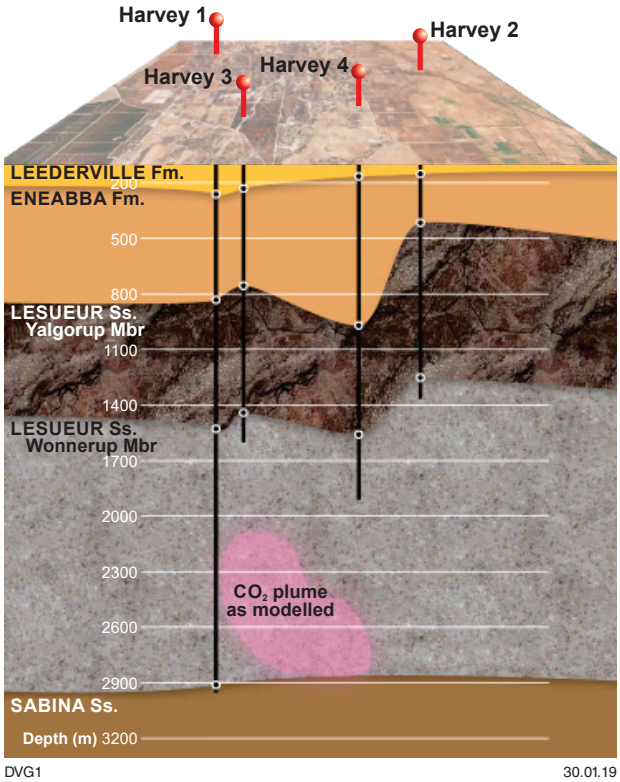

Figure 1. **Schematic section showing the stratigraphy of the southern Perth Basin in the region of the Harvey drilling, and the location and depth of stratigraphic wells**

* Carbon Projects Pty Ltd, 5 St Johns Wood Boulevard, Mount Claremont WA 6010