Condor Reflection Seismic Survey, Arnhem Land, Northern Territory

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Introduction

Deep Yellow Limited is exploring for unconformity-style uranium deposits in the Alligator River Uranium Province (ARUP), Arnhem Land, Northern Territory. This style of deposit is typically relatively high-grade – in the range 0.25–5% U_3O_8 – with a comparatively small three-dimensional footprint, making it a high-value yet challenging target. The Condor project area is located on the Wellington Range tenement (EL5893), 250 km northeast of Darwin on the Cobourg Peninsula 1:250 000 map sheet (**Figure 1**). The project is operated by Viva Resources Pty Ltd, a 100% owned subsidiary of Deep Yellow Limited.

Mineralisation in the ARUP is related to the unconformity between the McArthur Basin and the underlying crystalline basement of the Pine Creek Orogen. Associated chemical and rheological contrasts led to dilation during a protracted history of structural reactivation. Uranium mineralisation occurs at sites of fluid mixing between basement-derived and basin-related brines, controlled by coincident highly transmissive sedimentary units and fault zones.

For that reason, exploration focuses on faults that intersect and affect the McArthur Basin/Pine Creek Orogen unconformity. 3D mapping and characterisation of the unconformity and cross-cutting faults, together with petrophysical characterisation, are fundamental in driving exploration efforts. Geophysics plays a key role, but the efficacy and signatures of each technique vary across geological domains and position in the weathering profile.

In October 2025, a high-resolution 2D reflection seismic survey was undertaken at Condor by Fleet Space Technologies (Fleet). The project was co-funded by the Northern Territory Government in Round 18 of the Geophysics and Drilling Collaborations (GDC) program, which is administered by the Northern Territory Geological Survey (NTGS). The survey was completed safely and efficiently, and the dataset and processed outputs are of excellent quality. An initial interpretation has been completed by Fleet but work with this dataset is ongoing.

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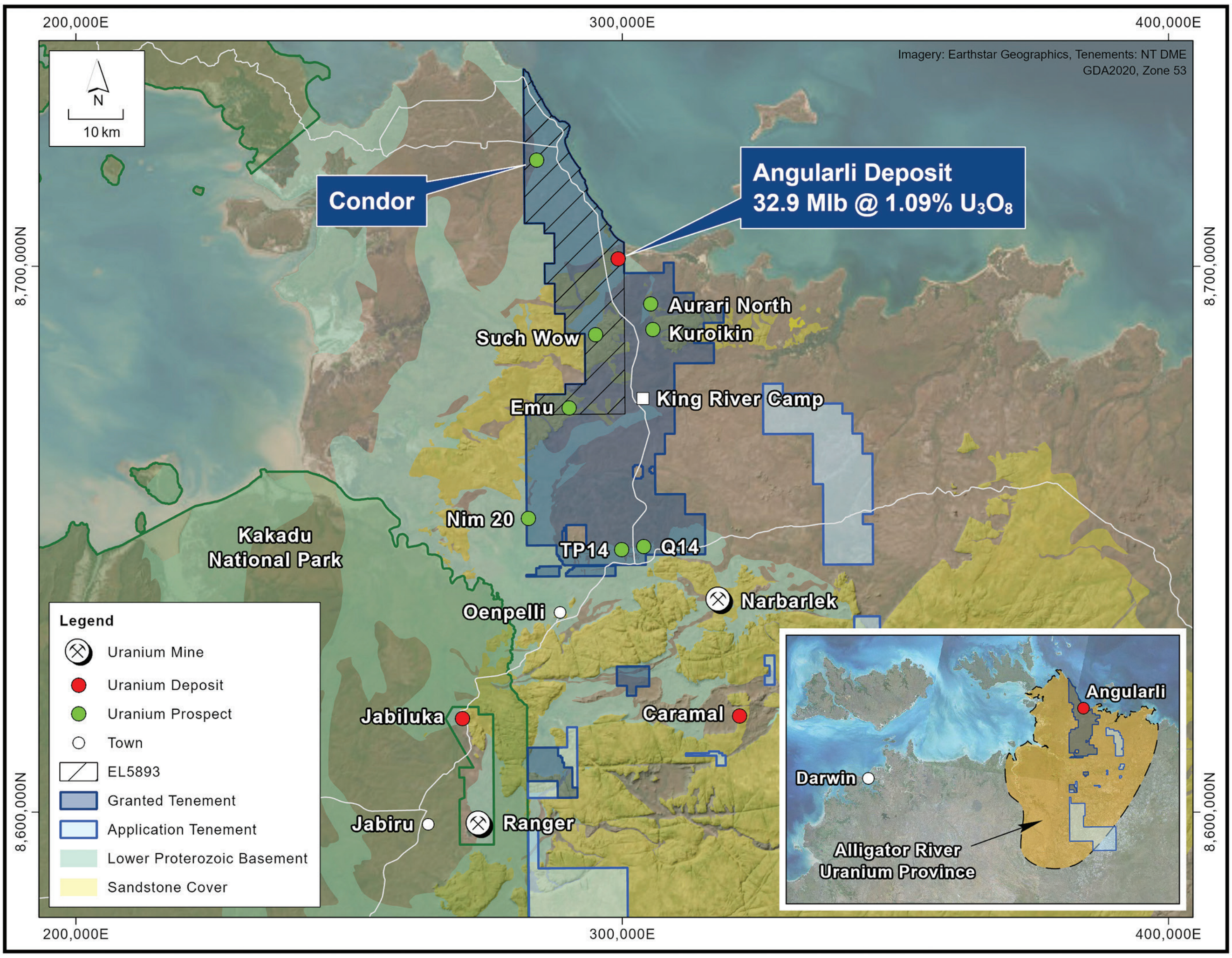

Figure 1. Locality map.

Geology and mineralisation

The Wellington Range tenement (EL5893) is located near the eastern margin of the Neoarchean Nanambu Complex and Paleoproterozoic Pine Creek Orogen. There is a thick (100–250 m) cover sequence of Mesozoic and Cenozoic sediments and no outcropping Neoarchean or Paleoproterozoic rocks in the Condor survey area. Uranium mineralisation was discovered within the Wellington Range tenement in 2009 at the Angularli prospect, which is about 24 km southwest from Condor and hosted within a multiply reactivated, highly silicified, NNW-trending fault (King *et al* 2010).

Metasedimentary rocks of the Paleoproterozoic Cahill Formation and Nourlangie Schist are interpreted to overlie the Neoarchean stratigraphy unconformably. This contact zone hosts known uranium deposits elsewhere in the ARUP (Needham 1988).

Unconformably overlying the Neoarchean and Paleoproterozoic stratigraphy is the Mamadawerre Sandstone, the basal member of the Kombolgie Subgroup. This sandstone unit outcrops as the Wellington Range escarpment and dominates the southern part of the tenement, whereas the Condor area is characterised by Mesozoic sediments overlying directly Neoarchean/Paleoproterozoic sequences.

The Mamadawerre Sandstone and the Paleoproterozoic rocks are intruded by rocks of several mafic intrusive suites. The Oenpelli Dolerite is the most common of these mafic intrusive suites and forms voluminous sills, lopoliths and dykes within pre-existing structural corridors and along stratigraphic discontinuities.

Targeting and previous exploration

The exploration target for the Condor area is a high-tonnage, unconformity-related uranium deposit similar to the world-class Ranger and Jabiluka deposits. Ranger and Jabiluka are hosted by strongly sheared metasedimentary rocks, including graphitic pelite, calcsilicate, marble, and magnetite-bearing pelite, all of which are part of the Paleoproterozoic Cahill Formation. There is a strong spatial correlation between the low-angle shear zones hosting these deposits and the Neoarchean/Paleoproterozoic contact, where mineralisation typically occurs within 2 km of the contact (Needham 1988). Cross-cutting faults play an important role in mixing fluids and focusing fluid flow, resulting in structural compartmentalisation and favouring uranium mineralisation.

An additional exploration target is a resource of the same style as Nabarlek and Angularli, but with a greater uranium endowment. The known deposits of this style in the ARUF occur along north-northwest-trending, high-angle faults with associated reverse and/or strike-slip movement. Mineralisation at all these deposits in the ARUP occurs primarily within the basement, but, as in the case of Angularli, primary mineralisation may also extend across the unconformity into basal Mamadawerre Sandstone.

Identifying dilation zones is important for both structural settings, as they are areas of focused fluid flow and brine mixing. Such zones are characterised by a change in dip and/or azimuth of fault zones. Therefore, one of the main aims of the Condor survey was to test whether seismic reflection could resolve dilation zones and guide their identification in other geophysical datasets.

Historical drilling at the Condor project by the previous operator of EL5893 (Cameco Australia Pty Ltd), involved campaigns from 2006 to 2009, and, in collaboration with the NTGS under the CORE initiative, campaigns in 2015 and 2016. That drilling targeted the Neoarchean/Paleoproterozoic contact based largely on the interpretation of airborne magnetic data but also ground time-domain electromagnetic (TDEM) test lines and gravity surveys. Rock types characteristic of the Lower Cahill Formation were intersected, which confirmed that the Condor project is in an equivalent stratigraphic setting to Jabiluka and Ranger (Melville 2007, Melville *et al* 2008, King *et al* 2009, King *et al* 2010, Sinclair 2016, Sinclair 2017).

The survey

Reflection seismic was chosen to enhance the interpretation and modelling of the coincident magnetic and gravity data, which had been primarily used to generate the historical drill targets. Previous airborne and ground EM surveys showed limited efficacy in Condor due to its proximity to the coast and presence of conductive brines in the overlying cover. It was determined that seismic would provide the appropriate penetration to map the depths to the unconformities, as well as the resolution to map structure, geometry, and possible dilation within the Neoarchean/Paleoproterozoic basement stratigraphy.

Fleet were engaged to acquire, process, and interpret a high-resolution 2D reflection seismic survey at Condor. The survey consists of four (4) lines – three (3) east-west lines and one north-south tie line – totalling 24.9-line km at 10 m shot point spacing and 5 m receiver point spacing. The seismic lines were designed to cross historical drilling and to utilise existing tracks as much as practicable (**Figure 2**).

One 26 000 lb UniVib was utilised as a source vehicle, delivering a single 20-second sweep through a linear function, with a frequency range of 4–130 Hz. The INOVA Quantum wireless acquisition system was used to record the data on an all-live spread. The fieldwork ran over six (6) days in October 2025, and a total of 2443 shots were recorded. Survey parameters are summarised in **Table 1**.

The processing workflow was specifically designed to handle the data characteristics acquired from the UniVib source and the high-resolution requirements for imaging shallow basement contacts and structures. This included preliminary data preparation, refraction tomography, comprehensive noise attenuation, and a final Kirchhoff Pre-Stack Time Migration (PreSTM).

Overall, the acquired data are of excellent quality, providing a strong foundation for imaging the targeted subsurface features. The use of the 26 000 lb source and 5 Hz geophone nodes resulted in good reflectivity and first breaks visible from up to 3 km. The terrain in Condor is well-suited for seismic acquisition, allowing for good node and vibrator coupling, which contributed to a high signal-to-noise ratio.

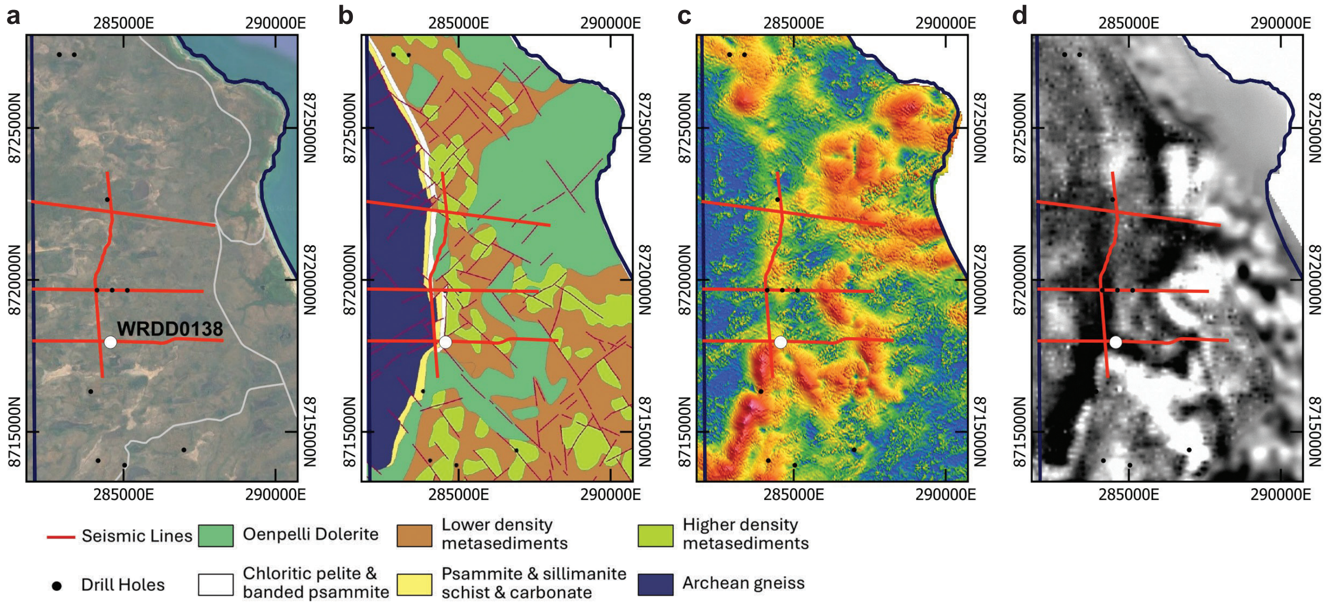

Figure 2. Condor 2D seismic lines on: (**a**) satellite image; (**b**) geological interpretation; (**c**) analytic signal of total magnetic intensity image; and (**d**) first vertical derivative of bouguer anomaly gravity data.

Table 1. Survey parameters.

Recording parameters:	
Record length	4000 ms
Sample Interval	2 ms
Low-cut	NA
Hi-cut	0.8 Nyquist set to 205 Hz
Notch	Out
Diversity Stack	Yes
Format	SEG Y (REV 0) to USB hard drive in field and record SEG Y (or SEG D)
Coordinate reference system	GDA 2020 Zone 53
Source parameters:	
Total number of source points	2443
Source Spacing	10 m
Sweeps/Hits per station	1
Source Array	1 INOVA UniVib (26,000 lb)
Sweep frequency	4–(150–130) Hz
Sweep length	20 s
Sweep type	Linear
Start taper	500 ms
End taper	750 ms
Receiver parameters:	
Number of Receiver Stns	4897
Active patch	3 km either side of source
Offset	Nominal ± 3 km
Group Spacing	5 m
Geophone Type	Quantum 5 Hz (PS-5GR)
Case	Land
Frequency	5 Hz
Geophones per Group	One (1)

Interpretation

The dataset has been interpreted using attribute analysis and correlation with historical drilling. The southernmost east-west seismic line was acquired over WRDD0138 (**Figure 2**), the final drillhole completed by Cameco at Condor. WRDD0138 intersected a sequence of metasedimentary rocks similar in composition to the Ranger/Jabiluka sequence, including an 18-m thick, auto-brecciated marble unit. This sequence of metasedimentary rocks unconformably overlies interpreted Archean gneiss. Anomalous uranium assay results were returned from intervals flanking the marble unit. The marble unit and the bounding fault zones are intensely Mg-rich chlorite-altered (Sinclair 2017)

Figure 3 shows the interpretation for the full PreSTM with WRDD0138 overlaid, and **Figure 4** shows detail of WRDD0138 together with the seismic interpretation and geological section. Three continuous horizons are interpreted across all the lines:

- Surface A: The Paleoproterozoic/Cretaceous unconformity.
- Surface B: Interpreted as either a paleo-weathering profile or a significant alteration boundary within the Paleoproterozoic.
- Surface C: Marked by a distinct change in seismic character. While currently unresolved, the geophysical response suggests a heterogeneous mix of lithologies, potentially including pegmatite injections within the basement sequence.

The structural interpretation shows high spatial correlation with existing magnetic and gravity features, providing high confidence in the integrated structural model. A significant dolerite feature has been identified and its presence is also supported by available magnetic data.

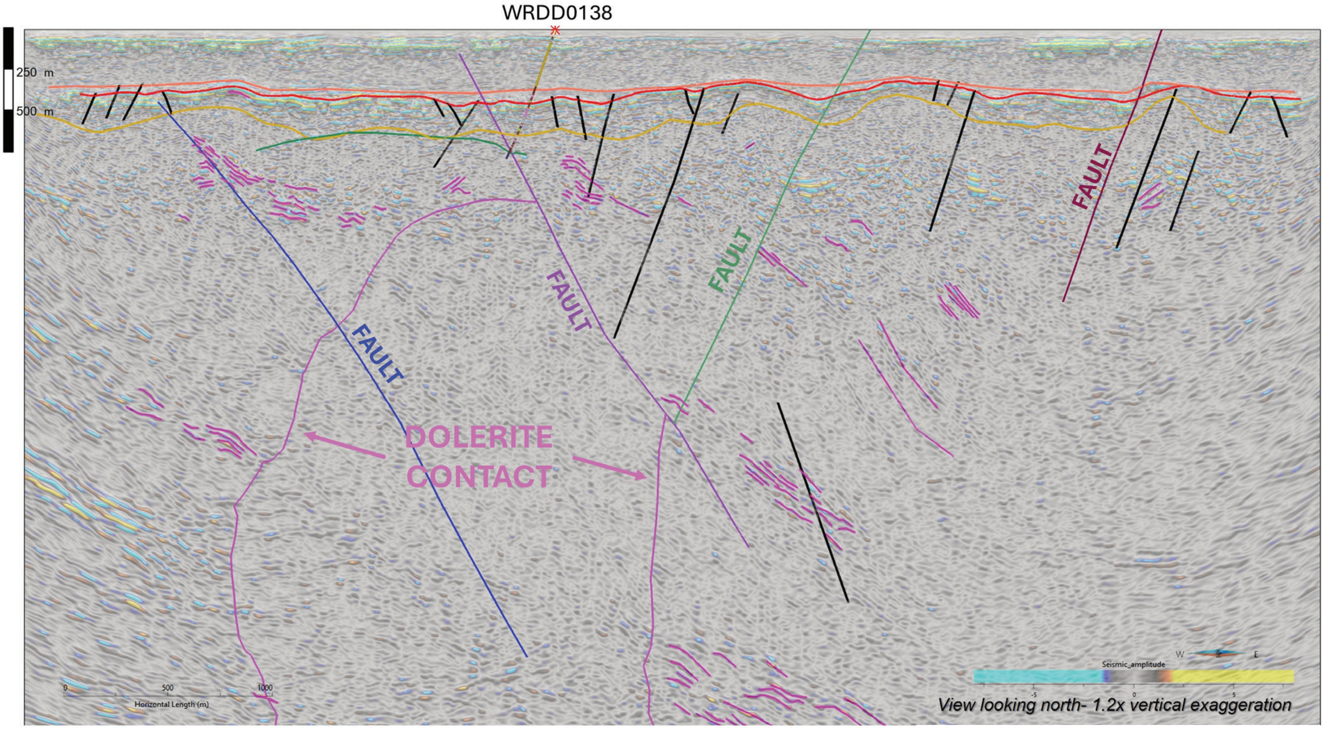

Figure 3. Interpreted Pre-Stack Time Migration with drillhole WRDD0138. Faults labelled and indicated by colour lines have been mapped in 3D.

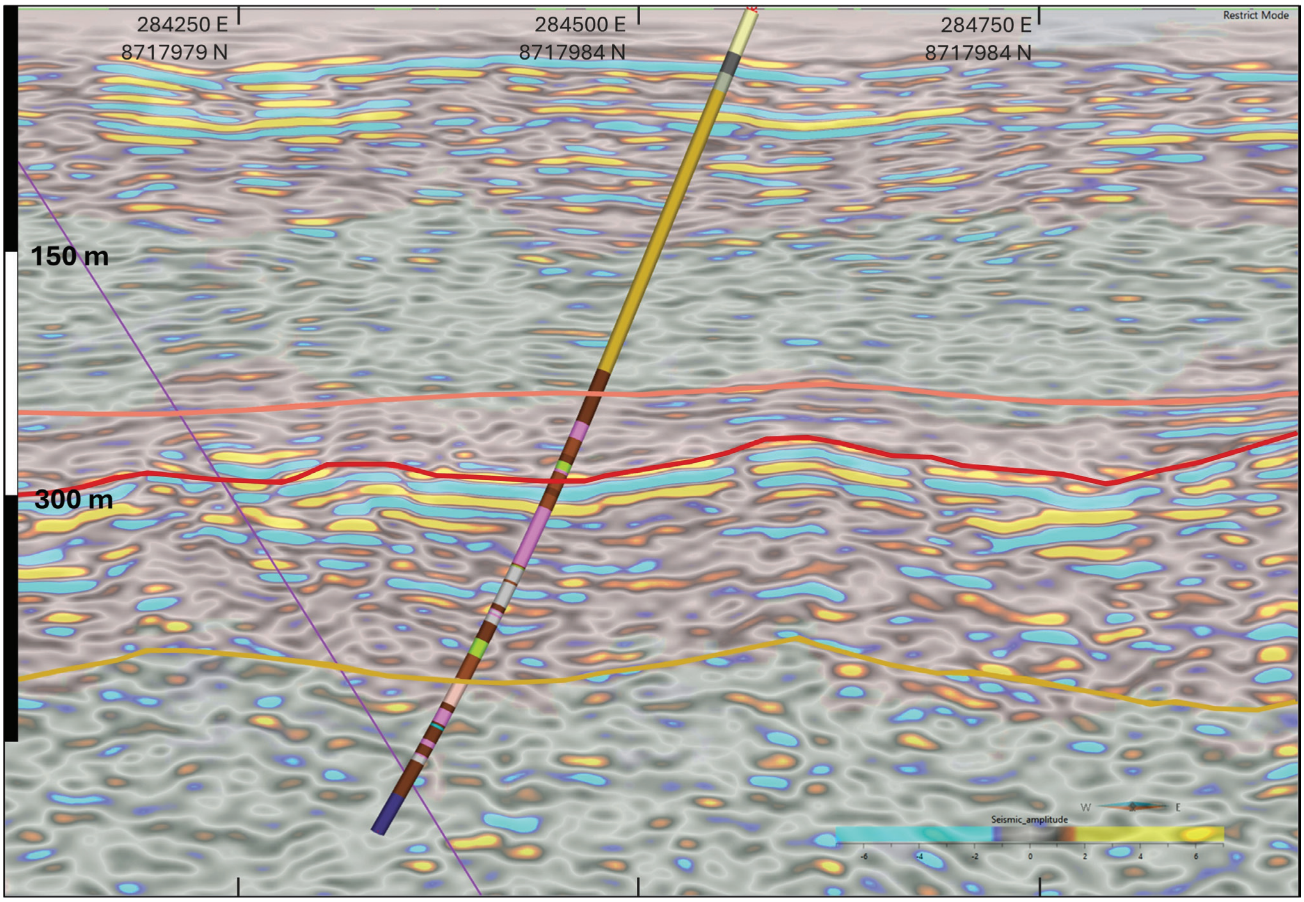

Figure 4. (**a**) Detail of lithologies intersected in drillhole WRDD0138 overlain with interpreted seismic *(continued on next page).*

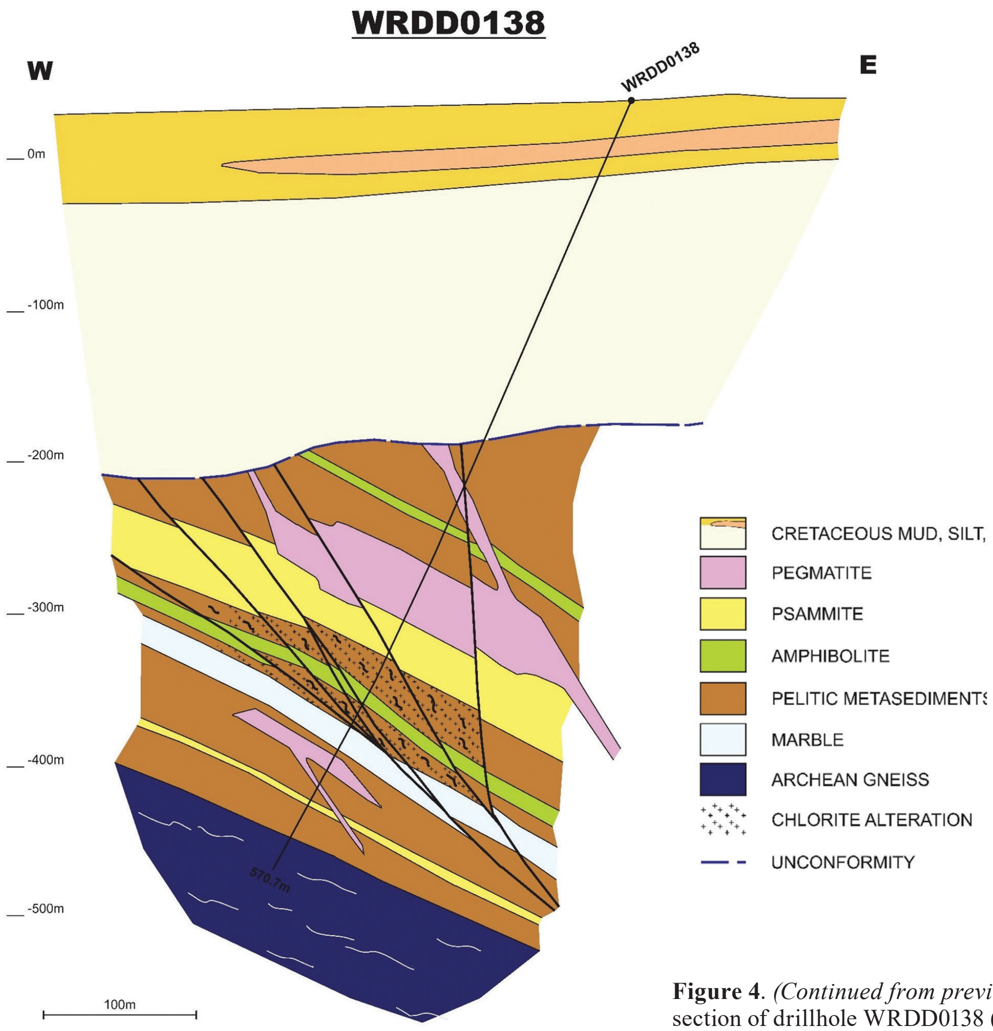

Figure 4. *(Continued from previous page).* (**b**) geological cross-section of drillhole WRDD0138 (Sinclair 2017).

Conclusion

The Condor reflection seismic survey has successfully mapped the depth to the Paleoproterozoic/Cretaceous unconformity as well as horizons within the Paleoproterozoic basement. Fault surfaces have also been picked with high correlation to magnetic and gravity features. The Neoarchean/Paleoproterozoic contact is less well constrained but work on this dataset, and its integration with other geophysical data, is ongoing.

Acknowledgements

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