

A landscape photograph of a savanna. In the foreground, there is a large, gnarled acacia tree with a dense green canopy, leaning slightly to the right. The ground is covered in dry, golden-brown grass and scattered large, rounded rocks. In the background, more rocks and a flat horizon are visible under a sky with soft, colorful clouds in shades of purple, pink, and blue, suggesting a sunset or sunrise. The overall mood is serene and natural.

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Oil explorers are arguably better equipped than anyone to deal with the challenges of mineral exploration under cover. They were forced to adapt to a world of remote sensing almost a century ago when the last surface oil seeps presented themselves (the equivalent of outcropping mineral deposits).

Admittedly, big oil and gas accumulations are broad targets that generally conform with stratigraphy, unlike many orebodies. But there is more similarity than difference between petroleum and minerals exploration, especially in regard to sediment-hosted base metals.

Oil explorers who are masters in handling subsurface data are carving out exciting minerals opportunities and showing how much can be done with big precompetitive datasets.

BHP has talked in recent years about leveraging its petroleum exploration skills in minerals (not so much since it sold BHP Petroleum to Woodside). Sandfire has also provided an example with its Huckitta sediment-hosted copper project in the southern Georgina Basin, based on work by UK-based Getech. Some of the details are in a recent [presentation](#) by Daly Resources, which plans to acquire the project as part of its IPO).

By far the best look at how to leverage the crossover between petroleum and minerals comes from privately-owned Longreach Mineral Exploration, founded by well-known oil explorers Jan Ostby and Odd Larsen. Rob Bills, formerly of Emmerson Resources, BHP and WMC was appointed CEO in 2023.

The company recently went public with details of its [Chubasco project](#), targeting IOCGs within three permits (EPM 29115, 29116 and 29117) centred about 110 km southeast of Cloncurry.

Chubasco has been subject to very little exploration activity, sitting just outside an exploration fairway the rest of the industry has travelled up and down for decades. The central and southern permits of the group have never been drilled.

This seems a remarkable oversight, given the new project sits on extension of a line between Ernest Henry and Eloise. The deterrent for industry seems to have been depth of cover at between 150 metres and 300 metres. This is getting up towards Gawler Craton depths,

which IOCG explorers tend to go to Cloncurry to avoid.

Longreach put cover depth aside as a first order consideration and started with precompetitive data, targeting Proterozoic rocks across the country.

Within reason, cover depth doesn't matter if independent sets of precompetitive data come together to scream a compelling Tier 1 target, which is how things unfolded at Chubasco.

One of the things making Chubasco a strong story is the availability of regional, 2D reflection seismic. The Mt Isa Deep Crustal Seismic Survey, acquired in 2006 as part of the Onshore Energy Security Program in conjunction with GSQ, pmd*CRG and Zinifex. Two lines from that program (O6GA-M4 and O6GA-M5) intersect near the centre of the 800 sq.km project area.

Longreach's senior generative geologist, Dr Peter Frikken, told Precompetitive Review the deep GA lines were very informative about the crustal profile from the Moho to surface, "but the top parts where we explore lack resolution. Much of the original GA processing was focused on deeper, regional structures rather than the near-surface.

"Processing techniques have improved rapidly, driven by the demands of the petroleum industry. We use a range of processing companies, depending on their particular expertise to provide the geological uplift that we are seeking.

"In order to better understand the Chubasco area, we had the upper 5 seconds of three GA lines reprocessed by HiSeis with QC by Searcher seismic expertise to get better resolution of the Soldiers Cap Group and cover sequences. This has supported our idea that the SCG rocks show indications of intrusion and confirm fault reactivation through cover rocks as well as the depth of cover. Reprocessing the lines over Eloise and Chubasco has increased our confidence on where and how to plan our next exploration phase in this deep cover environment," Peter said.

The potential of the seismic to reveal melt history is particularly interesting. Peter said certain stratigraphic parts of the SCG appeared to be more reflective than others, particularly the Toole Creek Volcanics.

“We interpret cross cutting aseismic zones that have dome shaped reflectors along their paths to be melt fronts. These dome shape reflectors are interpreted as metasomatized zones where melts have made their way up through the crust, then lost pressure, metasomatized the surrounding country rocks until pressure resumes (sourced from subduction flux) and break through a new path of least resistance and so on, until the melt reaches the brittle-ductile transition and metals are exsolved in the upper crust,” Peter said.

Care needed to be taken with assessing aseismic zones because they could merely be inconsistencies in acquisition and processing, and/or influenced by other near surface geological units or processes. “However, these melt fronts can be observed throughout seismic lines and can be linked to intrusions cropping on surface, where we have deep seismic available. We consistently see them manifested directly under inverted, fertile Proterozoic basins, e.g. Olympic Dam, Osborne, Eloise,” Peter said.

Separate precompetitive datasets and research support the Chubasco story. Magnetics and gravity fit with the interpretation of deep-seated intrusions in an inverted basin. AusLAMP magnetotellurics shows deep, large conductive zones from below the Moho to shallow crustal depths. And a thick lithospheric edge, as mapped by Geoscience Australia’s famous LAB map, runs under Ernest Henry, through Eloise and then further south to Chubasco.

Rob said petroleum exploration skills and early use of seismic to derisk Longreach’s interpretations of

the geodynamic setting were a source of competitive advantage.

“Typically, we reprocess the data to pull out the detail in the top 400-500m, then integrate it with the MT and potential field data. The regional gravity and magnetics are not particularly diagnostic given the range of solutions, but when anchored with seismic, they become very powerful.”

That said, Longreach’s search space is not confined to parts of Australia with deep crustal seismic.

“Longreach has spent the last few years building a country-scale 3D model of Australia integrating all available datasets, for example, geology, MT, magnetics, gravity, EM, LAB, DEM, mineral occurrences, ore deposits, geochemistry/chronology and mineral titles. This model includes all open file seismic, not just the GA regional surveys, via a Searcher Seismic tool known as sAlsmic.

“Our focus has been on the Proterozoic, where the majority of copper has been discovered in Australia to date and we believe it is still prospective to host a Tier 1 deposit. Using our integrated dataset in combination with another Searcher product, GeoClerk, we are able to both generate new areas of potential and also rapidly review areas of interest.

“The large GA datasets have been instrumental in building the model around our backbone seismic data, however the seismic is not everywhere so carefully reviewing Proterozoic areas along strike with these other datasets is crucial,” Rob said.

Seismic and Magnetotelluric Comparison

