



# Advancing Exploration

✉ editorial@miningmonthly.com

## Project generation lesson

One of our most successful junior explorers has uncovered a chunk of Queensland in South Australia's outback, creating surprise new opportunities to discover the next Ernest Henry or Cannington. By **David Upton**

**B**ig advances in geoscience and computing over the past 10 years mean we can look deep into the roots of our continent and unravel its long and complex origin story.

No-one thought it would be easy, however, Minotaur Exploration's discovery of Cloncurry-type rocks on the northeast margin of the Gawler Craton makes it clear there is still much more to learn.

The surprise find is a product of a Minotaur's Peake and Denison exploration project, south of Oodnadatta and about 750km north northwest of Adelaide.

Cloncurry is a long way away, about 800km across the Simpson Desert.

The project has already run for three years and a hole has yet to be drilled,

however, it is a brilliant lesson in how to create Tier 1 exploration opportunities through innovation, conceptual thinking and persistence.

These qualities have been hallmarks of Minotaur over decades and produced multiple discoveries, including Prominent Hill and the under-rated Jericho iron-sulphide-copper-gold deposit south of Cloncurry.

Tackling the Peake and Denison region is ambitious for lots of reasons, including remoteness, cover and minimal drilling by generations of defeated explorers.

Minotaur looks like it has cracked the code with the realisation the region is not a fragment of the adjacent Gawler Craton, as had long been assumed.

Minotaur executive director, Tony Belperio, said the company drilled a hole in the region a decade ago.

It had stuck in the back of his mind after returning some curious results.

The hole intercepted hundreds of metres of calc-silicate-epidote alteration, very similar to Cloncurry-style regional alteration and unlike Gawler Craton-type haematitic-sericite alteration.

"A couple of years ago with the new magnetic data being flown, we thought we would have another look because it is an area of intense magnetic anomalism," Belperio said.

Minotaur also turned to the University of South Australia to conduct geochronology on the age of mineralisation in historic drill holes.



Magnetic clay-like pipes, similar to those at Ernest Henry (pictured) have been found by Minotaur.



This is an innovative approach that focuses on mineral grains associated with the mineralisation, rather than grains within the host rock.

The dating effort focused on a calcium-titanium mineral known as titanite, which is associated with the type of alteration found in the rocks of the Peake and Denison region.

“Lo and behold, everything we dated came out with ages of about 1500 million years ago,” Belperio said.

“Those ages are unlike anything in the Gawler but they are identical to Cloncurry, including Ernest Henry.

“That’s why we have come to the realisation that Peake and Denison is actually a bit of Cloncurry rather than the Gawler Craton.”

Explaining how this chunk of cratonic crust came to be separated from the Cloncurry region – part of the Northern Australia Craton – is not Minotaur’s concern, however, it does present the company with both opportunities and challenges.

The opportunity lies in having an entirely new, Cloncurry-type domain to itself.

The region was wide open when Minotaur revived its interest, enabling it peg about 2500 square kilometres of the most magnetically interesting terrain.

The challenge is how to find the best exploration targets in a region of intense magnetic anomalism, which is made even more challenging by artesian aquifers in the cover sediments.

“Once you accept this is a bit of Cloncurry it completely changes the exploration approach you would use and it also explains why there is so much magnetic alteration there compared to the rest of the Gawler,” Belperio said.

“The magnetic alteration is much more intense and pervasive.

“It appears as if the host strata are strongly magnetic because of meta-basalts and meta-volcanics, and then there has been an alteration event which is highly magnetic as well. The two together make it quite a complex magnetic terrain.

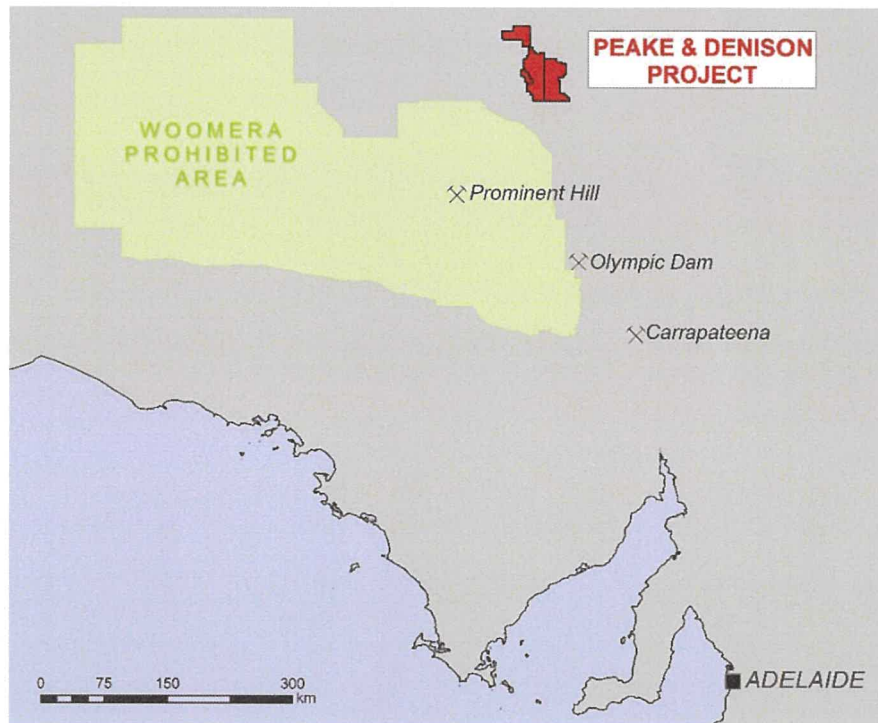
“When you think of the Gawler Craton, you think of Acropolis or Olympic Dam or Wirrda Well, which are isolated magnetic anomalies with a gravity anomaly.

“It’s a pretty simple targeting methodology, but it doesn’t work in Cloncurry.”

To find a way through the complex magnetics, Minotaur turned to Archimedes Consulting, an Adelaide-based geophysics consultancy that has forged a global reputation working in sedimentary basins for oil and gas companies.

Archimedes has developed a magnetic modelling technique that harnesses the power of super computers.

It detects millions of magnetic sources at different depths along magnetic profiles, which are then consolidated into a three-dimensional data cube.



A map showing the location of the Peake and Denison projects.

This technique computes the magnetic susceptibilities of the strata from the surface to a depth of several kilometres, leading to 3D images of the magnetisation of the crust.

“Because of the density of data points from the 3D cube you can actually see stratigraphy,” Belperio said.

“You can see structure. You can see intrusions and clusters of highly magnetic responses that may be associated with mineralisation.

“Archimedes had shown this technique worked in petroleum basins.

“We thought it should also apply in hard rock domains. And it has worked for us.”

Another invaluable product of this technology is information on the depth of cover across Minotaur’s Peake and Denison project.

The good news is cover is shallow, ranging between depths of 50m and 200m over most of the project area.

The next step for Minotaur was to identify exploration targets in the 3D data cube.

Software was used to allow its exploration team to visually “fly through” the cube and look for features of interest.

In this case, the team was looking for the kind of magnetite-dominated breccia pipes that delivered the riches of copper and gold at Ernest Henry.

In what is thought to be a first for mineral exploration in Australia, Minotaur was able to identify magnetic, pipe-like features from the data processed by Archimedes.

In fact, it found dozens of these possible breccia pipes, leading to yet another challenge to refine its drill targeting.

“We can’t go around drilling all of them so we thought how do we prioritise them?” Belperio said.

“In Cloncurry, we use induced polarisation or electromagnetic surveys, but the Mesozoic cover in the Peake and Denison is so highly conductive we don’t think those techniques will work.

“Our next step is to conduct a shallow magnetotelluric survey, which sees better through the conductive overburden.”

Cloncurry is also famous for world-class sediment-hosted deposits such as Cannington, which had their genesis in a separate and earlier event to the IOCG deposits.

So could sediment-hosted also be found in the Peake and Denison region?

“Quite coincidentally, we have seen a classic signature of a sediment-hosted deposit in a lovely setting almost identical to Cannington – a discrete bullseye magnetic anomaly with a small gravity anomaly right on a northwest-trending structure,” Belperio said.

The third stage of the project has won funding assistance under South Australia’s Accelerated Discovery Initiative program.

The SA government will contribute \$300,000 towards MT over half a dozen sites and follow-up drilling at the three or four of the highest-ranked targets.

If successful, it will be a spectacular proof of concept and open up another exploration hot spot in South Australia.

However, no matter what happens from here, Minotaur has given academics more to think about as they piece together the surprising history of our continent.

