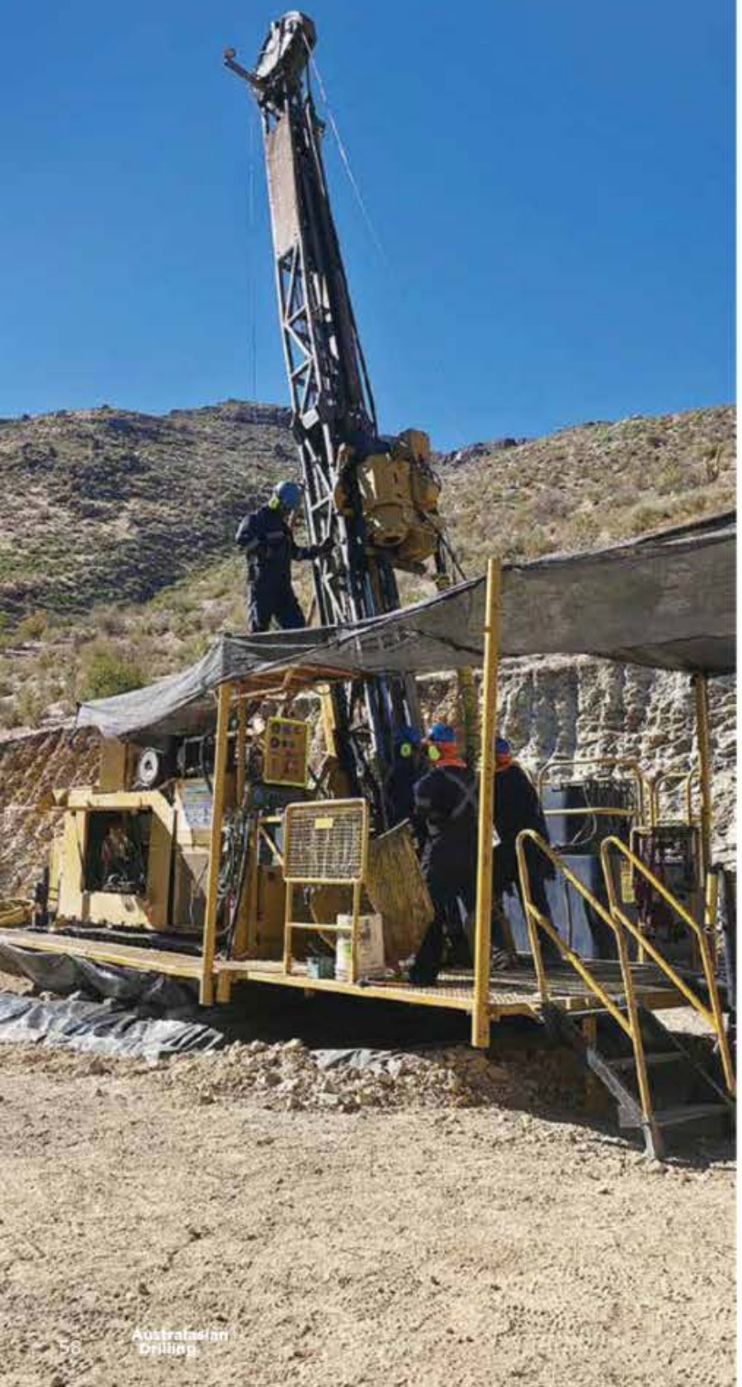
MINERAL EXPLORATION

Straight at 1,400 m: precision in deep porphyry drilling

Overview of the Target K drill pad at Llahuin, illustrating the scale and logistics required for deep diamond drilling programs. Each hole is positioned as a precision data platform feeding an integrated geological and geophysical model. Photo courtesy of FMR Resources.



Diamond drill rig operating at the Llahuin Project in Chile's Coastal Cordillera. Maintaining collar precision and managing deviation are critical when drilling beyond 1,400 metres in altered intrusive systems. Photo courtesy of FMR Resources.

The future of mineral discovery is deeper, more technical, and far less forgiving of poor drilling execution than ever before.

Across the global porphyry exploration sector, new discoveries are increasingly being made well beyond 1,000 metres below surface. Near-surface systems have largely been identified. Grades are trending lower. Targets are larger, subtler and often concealed beneath alteration halos and structural overprints. The drillhole is no longer simply a pathway to core recovery; it has become a precision data platform feeding three-dimensional geological and geophysical models that guide multi-million-dollar decisions.

For drilling contractors, that shift changes the rules.

Collar accuracy becomes critical because every degree of error is amplified at depth. Deviation is no longer a tolerable nuisance but a strategic variable. Hole cleanliness directly affects the viability of downhole geophysics. Communication between driller and geologist moves from useful to essential.

That is the operating environment facing **FMR Resources Limited** as it advances deep diamond drilling at its Llahuin Project in central Chile.

A system built for scale

FMR is an ASX-listed explorer focused on copper and critical minerals, with projects in Chile and Canada. While its Canadian assets target copper and rare earth elements at earlier stages, its operational intensity is firmly centred on Chile, where it is testing a large copper–gold–molybdenum porphyry system defined by integrated magnetotelluric, induced polarisation, magnetic and geological datasets.

The Llahuin Project sits within Chile's Coastal Cordillera, a region known for significant porphyry copper systems. Within the broader intrusive corridor, the Southern Porphyry target has emerged as a priority. Surface mapping has identified argillic alteration, silicification and epithermal quartz veining consistent with the upper levels of a telescoped porphyry system. Historical drilling and re-logging have reinforced the interpretation that a larger intrusive and hydrothermal system lies beneath.

Testing that interpretation requires drilling well beyond 1,400 metres.

Every degree counts

At those depths, minor inaccuracies at collar translate into significant displacement at target.

"First and foremost is the ability to keep the hole straight and on target," managing director **Oliver Kiddie** explains to *Australasian Drilling*. "This requires accurate survey setup at the collar. Every degree here is amplified at target depths of 1,400 metres and beyond."

For experienced drillers, this is self-evident, yet the practical consequences at 1.5 kilometres below surface are stark. Rock fabric influences swing. Structural anisotropy can induce lift or drop. Rotation and pressure settings subtly affect trajectory over hundreds of metres. In altered intrusive systems, behaviour can change as lithologies shift.

"When drilling new terrain for the first time, it takes some 'suck and see' to understand how the rocks are behaving," Oliver explains. "We monitor drill progress very closely to understand if we are getting lift or drop, swing with rotation or with rock fabric."

Rather than accepting deviation as an unavoidable consequence, FMR treats it as a controllable parameter. Following completion of the first deep hole at Target A, the technical team met with the drill supervisor to review hole behaviour and adjust collar setup to deliberately allow for predictable drop and rotation. Survey intervals were reduced to improve both control and production efficiency.

"This is a win for both contractor and client," Oliver says.

Real-time downhole geophysical data displayed during logging operations. Conductivity, magnetic susceptibility and spectral gamma responses are integrated into FMR's evolving three-dimensional model to refine targeting beyond 1,000 metres depth. Photo courtesy of FMR Resources.

" Every degree at the collar is amplified at target depths of 1,400 metres and beyond."

Oliver Kiddie,
FMR Resources MD

Field technician preparing downhole geophysical equipment for deployment. Clean, stable drillholes are essential to ensure probe access and data integrity in deep porphyry exploration programs. Photo courtesy of FMR Resources.

Precision with realism

Southern Porphyry is a large system, but precision still matters.

FMR aims to remain within 50 to 75 metres of target over 1,400 metres of drilling. In deep porphyry exploration, that tolerance reflects operational realism. The company recognises the physical limits of drilling in hard, altered dioritic rocks and designs its targeting accordingly.

As the program evolves, daughter holes are expected to play a larger role. Parent holes may be used to establish platforms from which multiple daughters can be drilled, expanding coverage efficiently while controlling cost.
In that scenario, trajectory control and structural understanding become even more critical.

Clean hole, clean data

Drilling at Llahuin is not simply about intersecting mineralisation. It is about enabling data.

Downhole IP, conductivity, magnetic susceptibility and spectral gamma surveys are integral to refining the three-dimensional geological model. Surface geophysics defines broad conductive anomalies, but downhole data sharpens interpretation and vectors toward the porphyry core.

"Clean drillholes are the key for any downhole geophysical probe work," Oliver says. "If this means extra flushing prior to exit, we do it."

Ground conditions, particularly broken zones
or faulted intervals, are discussed openly between the drill crew and technical team. Staged casing removal and careful management of unstable ground are used to preserve the ability to run probes. Losing access to downhole geophysics because of preventable hole conditions is not considered acceptable.

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Planning beyond planned depth

Geological logging is effectively live. Alteration intensity, structure and sulphide mineralisation are monitored continuously during drilling. When geological indicators suggest a hole should be extended, the company forecasts that requirement up to 48 hours in advance.

"We give the driller as much notice as possible, especially when additional rods and casing are required," Oliver says.

That forward planning reflects an understanding of contractor logistics. Deep holes require rod inventory management, transport coordination and crew planning. Extension decisions are data-driven rather than reactive, and communication is maintained to avoid operational disruption.

The direction of travel

The broader context is unmistakable. Oliver believes the trend toward deeper discovery is accelerating.

"New large greenfields discoveries are getting scarcer, grades are decreasing, and depths of discovery are increasing," he says. "You cannot just drill blind and waste shareholders' money."

Instead, exploration demands integration. Geological mapping, surface geophysics, downhole probes, petrography and drilling performance data are collated into an evolving three-dimensional model. Each hole informs the next.

"The old saying is you need an ounce of luck in exploration," Oliver reflects. "But luck, to me, is arming yourself with all available data – geoscience, geophysical and drilling technical advances – to position yourself for success."

At Llahuin, holding the line at 1,400 metres is not simply a geological challenge. It is a drilling challenge – and one that reflects where the industry is heading.

For those prepared to meet it, deep exploration drilling represents not just greater technical demand, but greater opportunity. ▲

JAMIE WADE

Diamond drill core from Llahuin's Southern Porphyry target showing quartz–anhydrite veining and disseminated pyrite within altered intrusive host rock. At depths approaching 1,400 metres, such alteration and sulphide textures are critical vectors toward the porphyry core. Photo courtesy of FMR Resources.

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