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Viridien: opening the doors to new exploration

Geophysics, satellite mapping and digital transformation paving the way for important discoveries

By Beth McLoughlin

It is fair to say that mining is a sector facing several unique challenges.

The energy transition has created unprecedented demand for critical minerals. But on the other hand, the vulnerability of our supply chains, exposed recently by COVID-19 and Russia's invasion of Ukraine, has added to the pressure the industry faces. The need to develop a secure supply has intensified just as capital becomes more difficult to find.

"These trends are forcing the sector to become a lot more efficient when it comes to finding the critical minerals we need to electrify the future and help us meet our sustainability goals," Michel Cuvillier, Viridien's global business development lead for Earth data, minerals and mining, told *Mining Magazine*.

"The problem is that this promising horizon is somewhat overshadowed by stagnant recovery rates."

Many of the easy pickings from shallow ore bodies have already been had, at least in jurisdictions with legal frameworks and other conditions that appeal to mining companies. That necessitates

deeper, more costly exploration where geophysical data is lacking.

"Explorers have a big bias towards areas that are data-rich," Cuvillier said, meaning that areas with big potential get overlooked since there is not enough available data on them. "There is a common joke in the industry – 'Where do you find copper? Where others have already found it,'" he said, summing up the situation.

Miners often put the emphasis on brownfield exploration for its short-term financial benefits – but they could be missing out on the long-term value generation that greenfield exploration could offer.

The time it takes to get a project from exploration to production can be as much as 18 years, "longer now, because of the ESG guidelines you must follow," Cuvillier added, along with the need to get a 'social licence', or buy-in from local communities.

"One of the reasons we believe it takes so long is that companies are not maximising their use of data," he said. "Right now, the mining industry is reaching a stage that was reached by oil and gas in the early 90s."

When that sector moved to deep sea exploration, where oil reserves had no obvious surface expression, the industry developed petroleum system analysis to find them.

Mining is now starting to use mineral systems

analysis, but outdated geological surveys do not provide enough data for greenfield exploration.

Investments by governments and international organisations are starting, but they are making slow progress.

DE-RISKING EXPLORATION

Junior miners are probably the ones facing the biggest headache. They account for more than 60%

of global discoveries, Cuvillier said, but struggle to advance their projects.

"True scarcity does not exist in terms of the raw materials themselves, but in capital and in cost-effective ways to advance projects," Cuvillier said.

One way to stimulate exploration is to de-risk it. Viridien, formerly CGG, brings together expertise in geophysics, satellite mapping and digital transformation to help the mining industry do this.

And while the oil and gas sector funds its own data collection, this costly option is not available to miners.

This means that exploration costs can become much cheaper. However, it also means miners will compete with each other.

"One way to make large data sets more accessible is the multi-client model, where rather than doing the studies on a proprietary basis, we sell a licence to access the data.

"All of a sudden you are able to reduce your exploration costs considerably. The only drawback is that you are going to have to share the data with others and compete," Cuvillier said.

This competition means what matters is no longer who has the data, but who has it first and uses it most effectively.

"What we do is level the playing field for miners, de-risk exploration and reduce their overall exploration expenditure," he added.

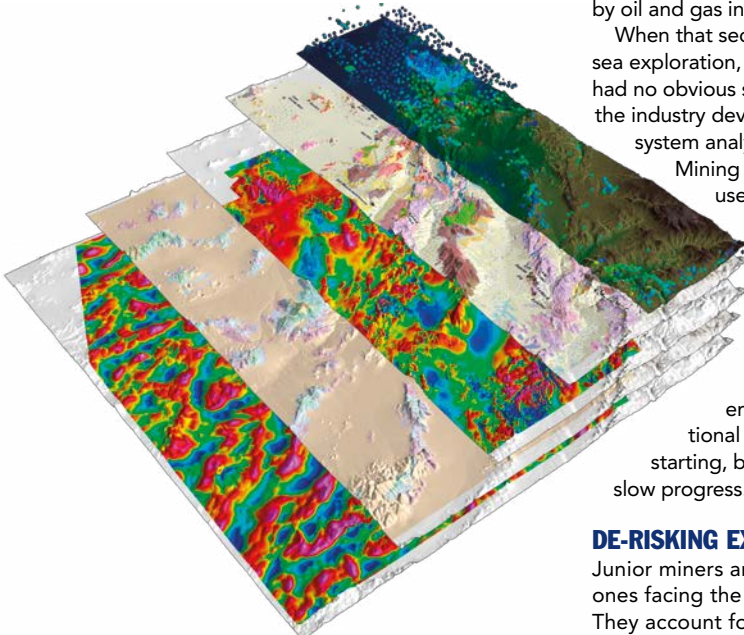
HOW IT WORKS

Viridien collects hundreds of thousands of square kilometres of data, acquiring primary data for exploration and development and aggregating secondary data that is in the public domain.

Various teams with different areas of expertise work on this, including a satellite mapping division, providers of lithological, spectral and structural

Fundamental geological data layers of gravity, multi-spectral satellite, magnetics surface geology and geochemistry captured at scale

Photo: Viridien



mapping. There is also a multi-physics team, experienced in acquiring and processing non-seismic images and geophysical data, and a digital transformation arm, known internally as the Data Hub.

The Data Hub began as an internal project to organise Viridien’s historical data, and is now one of the company’s fastest-growing divisions, helping customers extract, sort, digitise and curate millions of documents that are either scattered in various separate places or trapped in different formats.

This is supported by a high-performance compute service, originally built to satisfy Viridien’s own immense computing needs, and now available as a service.

“We currently have 500 petaflops, and we’re going into 700 in the next few years,” Cuvillier said. “Just to paint a picture, one personal laptop uses or has a single teraflop in capacity. You would need more than 500,000 laptops connected to each other to equate to our compute power.”

Data that could take some companies years to process can be processed in hours.

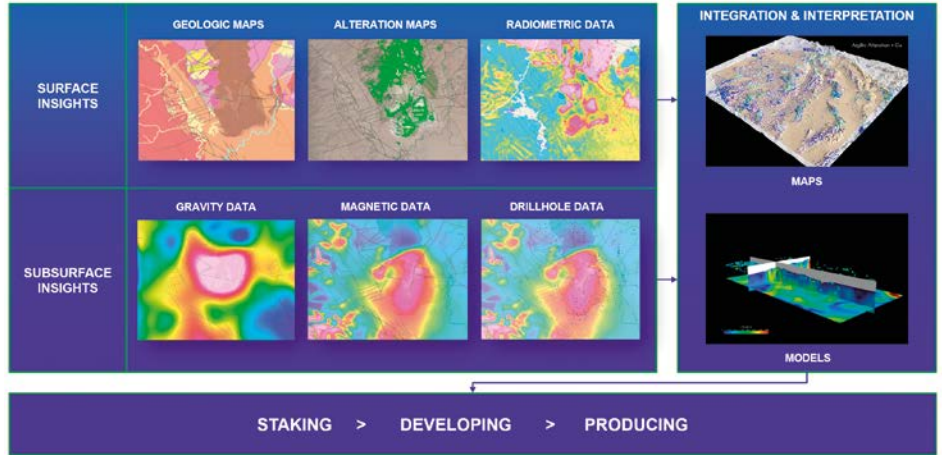
Viridien also has a minerals and mining team who specialise in large-scale or regional exploration and minerals systems analysis.

Viridien enhances existing cartography by adding new datasets. Geological maps, designed for multiple purposes and not exploration specifically, can be enhanced by overlaying spectral data, for instance, to show variations in the lithological composition that point to where mineralisation could have occurred.

For a miner in Arizona, the company flew over a 55,000sqkm area using magnetics, gravity and radiometrics, with a primary spacing of 200m and control lines every 2,000m.

“Magnetics gives us information about metallic bodies that are sitting below the ground and are susceptible to magnetism,” Cuvillier said. “Gravity gives us information about the depth of the potential target by looking at density variations. Radiometrics gives you insight into surface chemical composition based on how it reacts to electromagnetic radiation.”

Viridien uses this information to model the subsurface, at a scale and resolution way beyond what



government surveys tend to achieve. “A lot of government surveys have a spacing of 10km,” Cuvillier explained. “Ours is 50 times more granular than that.”

AN ACCURATE REPRESENTATION OF THE SUBSURFACE

At the same time, Viridien uses technology to identify and extract all the known geoscientific data available to a region.

This data is downloaded and catalogued using advanced language models. “Once we have an understanding of everything that is contained within the data, our experts start reviewing these documents and extracting anything of worth,” Cuvillier said, explaining the interface between automation and human expertise. “The benefit if you are an explorer is that now you have everything in a single place, standardised under one taxonomy and format.”

Part of this process involves judging which datasets are more trustworthy and valuable, which are then

used during the geophysical inversion process to create the most accurate representation of the subsurface possible.

“Unfortunately, in mining, there is nothing like a smoking gun that will tell you ‘this is a massive copper deposit,’ for example,” Cuvillier said. “But using the right data can narrow down that possibility.”

“We are interested in supporting the junior market with a commercial model that allows junior companies that might not have large exploration budgets to succeed. We believe that if we want to see the mining industry succeed, we have to cater to junior explorers.”

Since Viridien has all these different solutions under one roof, he said, this could open the doors to new exploration sooner rather than later.

“This is not only what the mining industry needs, but what society needs, if we are going to find the critical minerals we need for our future.”

“Everybody benefits.” ♥

Viridien’s data integration and visualisation
Photo: Viridien

Detailed lithological surface mapping of rock units and their structural grain at the surface
Photo: Viridien

