

Panel probes big geological questions

The truth about big data in resource evaluation, and exploration data management? Well, as respected BHP Billiton principal geoscientist Cam McCuaig indicated in a recent forum focussed on future trends in data collection and interpretation, most of us might not be able to handle the truth!

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Too much exploration data is never enough: Panel turned that suggestion on its head.

The forum*, on the sidelines of a Perth mining investment conference, brought together McCuaig, Rio Tinto Iron Ore resource evaluation manager Mark Tait, and renowned SRK geostatistics expert Daniel Guibal to address a range of key questions about – essentially – the future roles of geoscience professionals in greenfields and brownfields exploration.

Interspersed in the big existential discussion was talk about using data, and advanced new data management tools, to refine mineral system understanding and add more value, earlier, in greenfields exploration; and making more of relatively data-rich brownfields environments.

(Geologists, by the way, do seem sure to have a role to play in future exploration and mining scenarios in which robotics will become more ubiquitous.)

“I think a big question,” McCuaig said at the outset, “is what data do you actually need?”

“When we ask people – geologists, engineers, mine planners, metallurgists – what they want from data, they all say they want the truth.

“And I say, well you can’t handle the truth.

“You get a fire hose ... of everything coming at you. What are you going to do with it?”

“I think one of the challenges we have is defining what is the data we actually need to acquire, when, and then how do we interpret and model it. And then, what is the best way to internally communicate the findings to the rest of the people in the business?”

“What we are really after then is knowledge, not just data. The data comes with uncertainty [geological] and we need to also be able to define the uncertainty and, again, communicate that. What level of uncertainty are we prepared to accept, given the scale and stage of a project? We don’t get the answer to that if we’re not asking the right question.”

Tait suggested the brownfields perspective was not dissimilar.

“That does start to define the problem,” he said. “What is the question that you are trying to answer?”

“I think that’s where the geoscientist has to be really connected with the decision makers, the mine planners and the engineers, the metallurgists, whoever it is in the business, to understand what knowledge needs to be gained, and imparted.”

While connections between geoscientists and engineers (and others) have always been tenuous at best – “even greenfields geologists [and] resource evaluation people generally speak different languages”, one observer said – the panel agreed the need for change was, as ever, urgent and technology could help with answers. But maybe not all of them.

“We had an engineer in a discussion with us, just a few months back, and the engineer made a really insightful comment,” McCuaig confessed.

“He said, I always get what the geologist knows, [but] I’ve never received a picture of what the geologist doesn’t know. And essentially he was saying, they’re not telling me how different it could be. With resource estimation, every resource person will tell you that domaining is one of the number one issues, right. And getting the shapes right.

“We go and do all the complex work to populate those shapes with tonnes and grade, but what we tend to lose sight of is what we said at the start that was the most important thing: how different could the shape be? We really struggle to communicate it. I think as a geologist intuitively we know that there’s uncertainty, but we’re bad at actually capturing it, and then giving it to people who don’t have that geological background.”

Tait said in his experience engineers “don’t like to be told that things could be different – that there is variability”.

“They like to see things that are clear ... black and white. As geoscientists we’ve been trained over time to talk to our engineers in very clear and simple terms, and when we stray from that our credibility gets compromised, and the trust of the engineer or the mine planner goes with it.

“That is something that needs to change.”

But an open question from Tait to the large forum audience about how risk and uncertainty could be conveyed better between the core geological, engineering and metallurgical silos drew a fairly standard response: silence.

Another prominent geoscientist, not on this panel, has said previously that one of the biggest gaps in minerals geoscience is “between our understanding of ore deposit formation and application in resource estimation”.

He said that despite advances in areas such as imaging and analytics, and geostatistical methods (including computing capability that allows rapid processing and interpolation of vast amounts of drilling data), poor communication between mining's scientific disciplines still resulted in reduced resource classification confidence and "sometimes poor business decisions".

Guibal said better conditional geological, and geostatistical, simulations that incorporated grade control and risk analysis could be on the horizon, though "we are not there yet".

"I think it's fairly difficult because what the geologist generally gives the mining engineer is a block model with lots of values and those values come with uncertainties and what the engineer wants is a final model without any uncertainty built into it. So the mining engineer will consider this as the truth, forgetting any questions that might be asked," he said.

"What is required is conditional simulation not only of the grades, which is the easiest part, but also of the geological model. This is the hard part. I think it's a challenge for the future because we can handle uncertainties on grade reasonably well but the uncertainty on geology is still something that needs to be looked at."

As discussed in the forum, the grade control stage of mining is where the industry tends to have the biggest concentration of geological information but also the least time available for people to make decisions about boundaries.

Guibal suggested implicit modelling was one potential bridge-builder between geologists and geostatistics experts, aided by current advanced software.

Returning to the need for better communication between geologists and metallurgists, Tait said in his experience metallurgists were often required to make decisions – "high value decisions" – on "relatively limited amounts of data". Understanding how rocks were going to behave, metallurgically, into the future, was possibly "the single biggest value lever ... any major miner has to pull".

"So that relationship between the metallurgical behaviour of the rock, and the fundamental geological characteristics of the rock, is a really important relationship," he said.

"Certainly at the moment it presents as a substantial risk for the industry, one that has to be managed as effectively as possible."



While not quite drawing an audible gasp from the audience, Tait's suggestion that geologists might in future sit at some (presumably) figurative table with a mathematician or data scientist to make sense of structural patterns in massive data sets had some in the room questioning just how far modern communication devices could take the industry, and others wondering [aloud] about a new branch of Chaos Theory.

Geologists, the audience was mildly surprised to hear, "aren't very numerate people".

"Perhaps this is a stepping stone to changing that – having us work together," the panel ventured. Or perhaps the value from such an alliance just wouldn't add up.

"It's not a skill of the geologist," Tait admitted.

"But I think the geologist's role will be to understand what that structural pattern is [and communicate it]."

McCuaig, in a suitably reassuring tone, said applied mathematicians were already demonstrating what they could do with geological and other mining data with important advances in areas such as implicit modelling.

Again, though, the panel agreed the geologist's interpretation was usually pivotal to proceedings.

"The geologist can come up with brilliant ideas, and models, but if he or she can't communicate with the mathematician, the engineer, the mine planner, the decision maker, they're going to be irrelevant [in future]," Tait said.

Such "boundary spanning" was a key skillset of tomorrow's geologist, McCuaig agreed, and that might be particularly so for a geo in a small exploration company.

“I think that, at least, the geologist of tomorrow is going to be part of integrated teams of people who, as a team, can effectively articulate a view at key decision points that adds maximum value to the whole business, [and] across a range of scales.

“If you’re in a place where you have a small team, or a team of one, that’s when that person needs to be a boundary spanner. You won’t be able to have the technical expert in one thing running the programme for the microcap, you will have to have a person that’s broad and knows where to bring expertise from outside to help them get answers.

“That’s my view. It will be hard for someone who’s a bit more of a technical hermit ... to be effective in that role.

“If a microcap doesn’t have a boundary spanner they’re going to struggle, is the point.”

For the geologist in the field juggling assays, drill-rig deployment and other aspects of the ‘boundary spanner’ role, McCuaig said modern communications, data and traditional networks (ie, those consisting of people) would be vital.

“It is all underpinned by data,” he said.

“But rather than just saying more data is better, it’s about real-time knowledge and the right information needed to make constant decisions.

“I do believe the geologist’s role will be much more fun in future because a lot of what we’ve seen in our careers as menial kind of geologists’ stuff will actually be removed [by technology], but they will remain connected to the rocks, which will always be important.”

**The forum was developed and hosted by Reflex and SRK Consulting to facilitate discussion and showcase industry leadership in cutting edge developments in the use of geological data and understanding project risk.*

Available on the Mining Journal Website [here](#).