Freeing up time for mine-finding: the Cameco solution

Best targets yet to be drilled at Promesa’s Alumbre

Is your historical data the key to the next big discovery?

Articles
Geophysical inversion boosts confidence
Where there is one VMS...
Quick find me a target
Cameco is clear on its corporate objectives to become a more efficient, streamlined and standardized organization. Cameco’s exploration department’s data management strategy and implementation is striving toward this goal while applying best practice.

Members of Cameco’s exploration team are anticipating a time when their data management is so efficient that they can carve out an extra day in their weekly schedule to look for mines instead of spending those valuable hours searching for and manipulating data. “We’re hoping that everything we’re doing right now will make us at least 20% more efficient, not to reduce manpower, but to satisfy employees’ concerns that they just don’t have enough time to be geologists,” says Mike McClelland, director of land tenure and geospatial information, who is spearheading the uranium miner’s efforts to upgrade and standardize its data repositories and provide a common interface to access them.

Creating standards

Saskatoon-based Cameco has already built separate repositories for its key GIS, geological, geochemical, geophysical, and land management data. Every bit of data from the company’s active projects in Saskatchewan, Australia and northern Canada is being examined and either accepted into or rejected from the repositories.

Senior management approved the data management process in early 2013 after recognizing that although the exploration team had spent millions of dollars to collect and interpret data over the years, the information was scattered among various repositories in different stages of analysis, and sometimes even solely in the brains of those maintaining the data.

The biggest challenge was to standardize the data in the same formats for all of Cameco’s projects around the world. Until recently, the company’s geoscientists were using variety of software programs depending on personal preference. Now about 80% of their
interpretation work relies on standard platforms.

The other 20% (such as modelling) is so specialized that it can’t be centralized. “It’s impossible to standardize everything and we don’t want to constrain our really deep thinkers,” says McClelland. “I’ve seen more failures than successes at getting data in order by trying to account for every minute detail.”

Transparency also had to improve so that data could be found consistently in the same place and shared by everyone. Yet another challenge was to overcome natural human resistance to change. “If it wasn’t for the support of the end-users in exploration and their determination to adapt to change, our implementation efforts would never have been realized,” says McClelland.

But with support from the executive team and a general recognition that the painful adaptation would be worth it in the end, Cameco was able to make significant progress throughout the year.

“Compared to 12 months ago, the team I lead is able to access data much more quickly without having to ask others for it,” says Dave Thomas, director of exploration geoscience for Cameco. “They are operating much more efficiently now that everything is self serve.”

Using DAP to store hundreds of surveys

Cameco uses ESRI’s ArcServer for its GIS data, Geosoft’s DAP server for its geophysics and acQuire for geochemistry. Each repository is assigned a “subject matter specialist” responsible for ensuring QA/QC and uploading data to the server.

Cameco spent $45 million of their 2013 exploration budget continuing to focus efforts in Australia and Saskatchewan probing deep into the Athabasca basin. The depth of targets in the basin limits the use of surface geochemistry tools, so the company relies almost entirely on geophysics and downhole geology to find new mineralization.

“Because of the size of the targets and depths at which we are working, we put a lot of time, effort and thought into geology, more than for any other commodity,” says McClelland. “We’re not looking for a porphyries at 800 metres, we’re looking for pseudo vein structures at 800 metres.”

Cameco uses a variety of geophysical tools to find those structures. EM surveys target conductive horizons in the basement rocks that are proxies for the faults that control mineralization. For mapping alteration around the fault structures, resistivity and gravity are essential tools. And seismic techniques are applied to enhance regional exploration and help the mining group understand the geology of certain advanced projects before they break ground.

As a result, getting the DAP server up and running to handle results from about 600 geophysical surveys on several active projects was a key step in the data management plan. DAP allows explorers to efficiently catalog, manage, deliver and visualize large, geospatial data. So far, Cameco has uploaded about 40% of its survey results to DAP and hopes to complete the rest of the upload by the end of 2014. Once all the active project data is documented, the company will start working on historical data.

Taking out the trash

But before the information is uploaded, it has to be cleansed. By identifying duplicates and triplicates of data, different versions of the same grid and files that had no value, Geosoft’s service team was able to reduce the size of the database by 55%, from two terabytes to about 800 GB. Cameco reduced the size even further, to about 500 GB, after assigning a full-time DAP administrator.

“We only have to do this right once and it’s done for eternity, unlike a folder structure when you have to keep continuously cleaning out the folders year after year,” says McClelland. “That value can be realized on present or future projects or even sold to third parties. You don’t really know what you’ve got until it’s all in one place.”

Designing a common interface

The downside of having different types of exploration data in separate repositories is that while data integrity is ensured, interoperability suffers. So now Cameco is working with Geosoft on a common web interface.
that connects the repositories on the back end so that explorers can retrieve data quickly and easily.

The Geospatial Envision Technology & Information Transfer (GET-IT) System provides a single web interface to data that is managed by the ArcServer (GIS, geology, and land management data), DAP (geophysical data) and acquire (drillhole and geochemical data) servers. Geoscientists, management and other permitted users will be able to access the GET-IT system via a web browser and then search, preview, interrogate, and extract data from the connected servers and make use of simple map-making capabilities.

In other words, geoscientists will be able to zoom into an area of interest and find all of the data ever collected from that area, whether that be drill summaries, geochemical reports or land permits. Once they’ve found the data, they’ll be able to click on an icon to launch everything onto their desktop application for further analysis using “Cameco-centric” symbols, colours and templates that are consistent throughout.

“We’ll actually be able to get down to the interpretation instead of spending days trying to find the data, massage it and manipulate it without ever really knowing if we have the right data in front of us,” says Thomas. “GET-IT will allow us to put our brainpower into how and where to drill the next hole.”

McClelland says the work Cameco is doing now to organize, standardize and make data accessible should put the company in an excellent position to take advantage of future software applications that will be able to analyze massive amounts of exploration data based on certain criteria and, from that analysis, identify targets.

“Hopefully, as we get into cloud environments and perhaps even a different realm of partnerships and joint ventures, companies and individuals will be able to combine data in a systematic manner and use computer algorithms to help process it.”

Best targets yet to be drilled at Promesa’s Alumbre project in Peru

With drilling costs averaging more than $200 per metre, explorers are looking for ways to improve confidence in the drill targets they choose. Australian junior Promesa Ltd (ASX Code: PRA) believes it may have found an answer in geophysical inversion or, more specifically, Magnetization Vector Inversion (MVI).

“Detailed surface and subsurface geology, geochemistry, geophysics and the recent 3D modelling using the MVI process has increased confidence in our exploration model,” says Ananda Kathiravelu, executive director of Promesa, which is exploring the Alumbre copper-molybdenum-gold porphyry system in northern Peru. “There is now a substantial body of information in support of the district-scale potential of the project.”

Magnetization Vector Inversion (MVI) takes into account geological processes and geophysical effects that alter magnetization direction such as deformation, anisotropy, remanent magnetization and high susceptibilities – all obstacles for traditional susceptibility modelling. MVI is particularly effective at low latitudes, where the low inclination of the Earth’s magnetic field can make magnetic interpretation challenging.

The MVI technique is part of Geosoft VOXI Earth Modelling, a cloud-based geophysical inversion software that generates 3D voxel models from airborne or ground gravity and magnetic data. By harnessing the processing power of the cloud, VOXI has made large, multi-parameter inversion modelling faster, more responsive and effective as a tool for target delineation.

At Alumbre, Geophysicist Barry Bourne, Principal Consultant at Terra Resources PTY Ltd, reinterpreted historical ground magnetic data (Fig 1) using the MVI methodology to estimate magnetic susceptibility. The resulting model suggests a significant link between surface Cu-Mo-Au mineralization and a large subsurface area with a strong magnetic signature (Fig 2). There is potential for multiple porphyry intrusive centres.

Recent drilling has provided further validation of the model, intercepting seven metres grading 0.72% copper coincident with increased magnetite (Fig 3). The combination of magnetic susceptibility, MVI and downhole and surface geochemistry indicates mineralization associated with strongly potassic felsic to intermediate intrusives, hydrothermal breccias and andesitic tuffs may continue at depth, west and north of the discovery hole.

By incorporating the drilling data, Promesa will further refine the MVI model and use it to target boreholes for a second phase of drilling in August. Ground magnetic anomalies extend throughout the project area and the established association between copper and magnetite (Fig 4) increases their prospectivity.

Alumbre has never been systematically explored for porphyry style deposits, but magnetic modelling using methods such as MVI is catching on as an effective means of generating targets within similar porphyry systems, particularly at low latitudes.

“Magnetic inversion has developed into an important tool for targeting potential porphyry systems at Alumbre,” Promesa noted in a recent release. “This evaluation has resulted in a significant new interpretation of the magnetic susceptibility model of the project area.”
“Detailed surface and subsurface geology, geochemistry, geophysics and the recent 3D modelling using the MVI process has increased confidence in our exploration model,”

- Ananda Kathiravelu
Executive Director, Promesa Ltd.

FIGURE 1: The image on the left shows the historical ground based magnetic data (i.e. Total Magnetic Intensity) and the image on the right illustrates 3D MVI inversion in grey underneath with historical ground based magnetics in the background and drillhole traces Stage 1 program.

FIGURE 2: Plan view of the magnetic susceptibility 3D MVI inversion with Stage 1 drillhole traces (Magnetics (pink) – Isosurfaces of susceptibility, $+10 \times 10^{-3}$ SI* in pink and dark pink $30 \times 10^{-3}$ SI isosurface).

FIGURE 3: Cross Section View at 9,065,750 N of drillholes 3, 4 and 5 with andesitic volcanics (green colour) overlying porphyritic tonalites and diorite intrusives (beige colour) at Alumbre.

FIGURE 4: Plan view - Magnetic susceptibility 3D MVI inversion with copper field sample (Magnetics (pink) – Isosurfaces of susceptibility, $+10 \times 10^{-3}$ SI* in pink and dark pink $30 \times 10^{-3}$ SI isosurface).
How geophysical inversion boosts confidence at every exploration stage

By Virginia Heffernan

From validating geology on grassroots projects to finding new ore around existing mines, geophysical inversion is taking some of the risk out of high stakes mineral exploration.

Mineral explorers have traditionally ruled out running inversions in all but the latest stages of exploration because they are complex and time consuming. Recent technology developments, however, have turned inversion into a fast and responsive tool that can be used at every stage to delineate targets with greater speed and accuracy.

STAGE 1: Project Generation

Until the 1960s most deposits were discovered by prospecting, or looking for clues on the surface with the help of outcropping geology. But geophysical techniques are increasingly taking the role of the prospector as exploration moves deeper into the subsurface.

In most cases, especially in countries with robust government databases, airborne geophysical information is available to help locate a prospective area. Until recently, however, many explorationists wouldn’t have considered running an inversion at such an early stage because of the complexities in setting up the inversion parameters, accessing the appropriate computing power and the inability to iterate inversion results to support time-critical exploration decision making.

Cloud-powered applications such as Geosoft’s VOXI Earth Modelling have resolved these technical challenges, making large, multi-parameter geophysical inversion modelling faster, more responsive and effective as a tool to assist with project generation. A challenge that remains for many explorers is understanding how inversion benefits exploration at the different stages and knowing what to expect from results.

For project generation, 3D inversion of gravity or magnetic data can provide clues to what is happening in the subsurface even if there is no outcrop to be found.

As exploration moves ever deeper into the subsurface, the next generation of prospect selection will ultimately be driven by just this kind of predictive model, according to Rio Tinto’s head of exploration Stephen McIntosh who presented on technology’s potential to improve mineral discovery success at the 2013 ASEG-PESA International Geophysical Conference in Melbourne.

STAGE 2: Prospect Targeting

The more information gathered and integrated into the conceptual model, the more detailed and reliable that model will be. Explorers can manipulate and interrogate 3D inversion models from any perspective to pick up on subtleties in the data they might have missed had they been confined to a 2D picture.

“By converting plan maps of field data to physical property solids, you make them much easier to integrate with geology,” says Bob Ellis of Ellis Geophysical Consulting Inc., who is routinely running 3D inversions for his clients using Geosoft VOXI. “The explorationist is more inclined to use the information in that form than as an image of the data.”

If drill data are available, 3D inversion can be especially helpful in delineating new targets. For example, Aben
Resources’ goal is to find more gold zones on their Justin project in the Yukon that are similar in nature to “POW,” a mineralized zone delineated by airborne magnetics and subsequently confirmed by drilling.

Using VOXI’s iterative reweighting inversion focusing (IRIF), the company created a 3D model of the magnetic data and compared it to the wireframe model derived from drilling results from POW. The two matched, giving Aben confidence that drilling similar targets on the property would yield new mineralization.

“I was really impressed with the VOXI IRIF technique and how well it fit with the geology we actually see,” says Mike McCuaig, a geologist for Aben’s consultant, Terralogic Exploration. “It just gives you way more confidence that your modelling is realistic.”

**STAGE 3: Resource Definition and Expansion**

As a project advances and even more information becomes available, inversions provide an opportunity to detect subtleties in the data that might have been overlooked otherwise.

At Gold Resource’s El Aguila gold-silver mine in southeastern Mexico, for example, where magnetic resonance can distort traditional magnetic inversions, a VOXI Magnetization Vector Inversion (MVI) of airborne magnetic data showed good correlation with the underlying geology and identified new targets with similar properties to the mineralization at La Arista, a producing mine just southeast of the El Aguila mine.

At La Arista, structurally controlled mineralization consists of quartz veins and stockwork hosted in Tertiary rhyolite intrusive, breccia, andesite, tuff, and agglomerate. In addition to the epithermal veins, Cretaceous sedimentary units below or adjacent to the mineralized host are targets for base metal skarn mineralization.

“In this case, we were looking for lithologies that occur near known deposits and low amplitude magnetic sources that would be consistent with skarn mineralization in the carbonate part of the sedimentary sections,” says Ellis, the geophysical consultant who identified susceptibility contrasts associated with skarn mineralization when he ran an MVI on the airborne data from the project. “The inversion modeling gives you the source geometry and depth to these targets so you can further evaluate whether they fit your targeting model.”

Another example of the value MVI can provide comes from the Osborne mine in Queensland, Australia. Osborne is an ironstone-hosted, replacement-type copper-gold deposit discovered in 1989 beneath 30-50 m of deeply weathered cover. Subsequent exploration delineated high-grade primary mineralization dipping steeply east.

To determine if MVI held any advantage over traditional susceptibility inversion in detecting the eastern extension, Geosoft ran historic aeromagnetic survey data for Osborne through both inversions.

While the susceptibility inversion failed to detect the eastern extension of the mineralization, the MVI susceptibility model showed the extension clearly. The ability to account for demagnetization, magnetic anisotropy, or remanent magnetization made the difference between seeing the mineralization or not.

Whether generating new prospects or finding new ore around existing operations, inversion can save time and money by providing a picture of the subsurface and more reliable targets for follow up and drilling.

“Inversion helps to prove a geological concept you can then take with you to another area that appears to have the same geological setting and do so with confidence,” says Geosoft’s Darren Andrews. “It’s a valuable tool for the geologist to have at every stage of exploration from grassroots to resource definition.”

A comparison of magnetization vector inversion with conventional susceptibility inversion, in the left and right panels respectively. The conventional susceptibility inversion completely fails to support for the eastward dipping extension.
Where there is one VMS, there is usually another

by Virginia Heffernan

In the high-stakes game of mineral exploration, companies that can test their model at an operating mine before venturing into the surrounding district are at a distinct advantage. It’s an approach that is paying off for Vancouver-based Atico Mining as the junior searches for volcanogenic massive sulphide (VMS) deposits near the El Roble copper-gold mine in Colombia.

“Having access to the mine workings helps us understand the geological and structural controls on mineralization,” says Atico CEO Fernando Ganoza, “and that in turn is helping us find additional resources.”

Atico uses the data collected from ongoing brownfields exploration combined with historical data to create 3D models using Geosoft’s Target and Geochemistry for ArcGIS. The models help guide exploration below the current workings and within the prospective host horizon that extends along strike from the mine.

“We input all of the geophysical and geochemical data into ArcGIS and then, based on the understanding of the geology, set parameters in the software,” explains Senior Exploration Manager Joseph Salas. “That’s how we generate targets.”

In early 2011, Atico signed a deal to earn a 90% interest in El Roble in return for paying its Colombian owners US$2.25 million in cash over two years plus a lump-sum payment of US$14 million due in January 2014. Over a production history of roughly 22 years, the underground mine has turned out 1.5 million tonnes grading an average of 2.5% copper and 2.5 grams gold per tonne.

Although most of the historical resource, consisting of several VMS lenses, has been mined, Atico has found more ore at depth. These new targets were established by mapping the geology both at surface (1:5,000 and 1:10,000 scale) and underground (1:250 scale), following structural controls and mineral zoning patterns typical of VMS deposits.

Geophysics and Geochemistry

Zero in on Targets

On of the most significant conclusions from the surface mapping program is that the mineralized contact between basaltic volcanic rocks and black and grey cherts extends for 10 km across the El Roble concessions. Follow-up prospecting has confirmed that resistivity lows and chargeability highs can be used as indicators of the favourable chert horizon.

However, additional geophysical tools were needed to distinguish between conductive graphite in the chert and VMS mineralization. So Atico launched a ground magnetic orientation survey around the mine and reprocessed about 40 line-km of ground magnetic data collected in the mid-1980s by Nittetsu Mining, a former joint-venture partner on the property. The reprocessed magnetic map shows a weak magnetic anomaly over the El Roble mine and four stronger magnetic anomalies to the north.

In the air, Atico ran a 500-km versatile time-domain electromagnetic survey to cover the trend with lines every 100 m and a spacing of 50 m between stations. (Time-domain EM surveys are often effective in pinpointing VMS mineralization above a depth of 200 m.) A follow-up ground gravity survey further refined drill targets by identifying several anomalies that could represent pockets of VMS mineralization.

Although drilling along the trend has yielded little of interest so far, underground drilling is showing that a gold-silver halo in the black chert is a significant geochemical indicator that can be used for both brownfield and greenfield exploration. Results from the northern end of the operating mine include 119 m of 6.9% copper and 6.3 grams gold per tonne.

The host rocks at El Roble are part of the Cretaceous Cañasgordas Group, which can be traced for more than 800 km along the western cordillera of Colombia. Locally, mafic volcanic rocks include pillow basalts, tuffs, hyaloclastites, and agglomerates, while pelagic sedimentary rocks consist of chert, siltstone, and minor limestone.

The VMS mineralization is dominantly pyrite and chalcopyrite, mostly fine-grained and showing little internal structure or banding. Underground drilling between the 2,000- and 1,980-metre levels has identified stockwork mineralization consisting of chalcopyrite with subordinate pyrite in massive veins and patches in a gangue of stockwork quartz and chlorite veins.

Since VMS deposits tend to occur in clusters and the mined-out zones at El Roble represent only about half of what an average VMS cluster would yield, there’s a good chance Atico will find more ore along the 10-km trend as it uses information from the mine to seek out economic mineralization.
Quick, find me a target

In a rush to drill based on chasing anomalies, explorers may overlook the structural geology and miss the best drill spots.

By Graham Chandler

When geophysicist Hernan Ugalde was contracted by a junior mining company to help define drilling targets, he thought himself fortunate the company had an exploration vice president who believed there was more to it than choosing purple anomalies on remote sensing maps.

“It was an iron exploration project in Canada’s Northwest Territories,” recalls the Senior Consulting Geophysicist at Toronto-based Paterson, Grant & Watson Limited. The mining company had flown the magnetics, planning to use map anomalies for direct detection of iron deposits. Since iron is magnetic, then the large anomalies should be important targets, went the reasoning. Ugalde and the VP Exploration examined the magnetic data, but to improve confidence, recommended ground field work follow-up. It was fortunate they did. “The field work recognized that the Fe-formation was hematite, which is non-magnetic,” says Ugalde. “Instead of throwing out the data and claiming that the survey didn’t work, we used a think-out-of-the-box approach and modeled 2D sections.” He says working with a structural geologist helped him to separate what was geologically reasonable from what wasn’t. “We ended up with very detailed models that provided the company with targets, on which they will be following up this year.”

The episode points up a valuable lesson for mining companies intent on launching a drilling program in short order after looking at remote sensing data alone; which often happens when eager investors want to see some action.

Ugalde suggests starting from the regional, then going into more detail. He stresses the importance of field work, mapping and measurement of rock properties by the geologist and geophysicist, who should work in tandem. He says in the NWT example “without that, we wouldn’t have been able to recognize the different geological units that were the base of the model, instead of the usual blocks with no geological interpretation.”

Key is to take time for the geology. “The main challenge is to get the message beyond the ‘can you find me a target?’ stage,” says Ugalde. “It is quite common to see a mining company operating with only one geologist, who is either too busy dealing with all the admin and raising funds, or doesn’t have the background to know what to expect from geophysics.”

Some numbers help drive home his point. “Airborne geophysics with 50 metre line spacing typically provides a resolution of just 10 metres per pixel making definition of precise drilling targets difficult,” he says. “However, once you can make the company understand the value behind the data beyond the drilling frenzy (i.e. extensive structural and lithogical delineation on areas where access is difficult...”
and/or have not been mapped completely), they realize that there is
great value in doing this kind of remote sensing mapping."

The big picture is often overseen. "When companies jump stages
on the large-to-small-scale approach, they sometimes lose track of what
factors they did use to filter in/out some areas and often end up making
an inefficient use of resources," says Ugalde. "There is a big rush to
produce an NI 43-101 [national instrument for the Standards of Disclosure
for Mineral Projects within Canada] with proven/inferred reserves.
It requires sampling—drilling—at 50 m, and in the rush to comply,
Ugalde says it’s not uncommon that structure is overseen and therefore
boreholes are placed where there shouldn’t be any, or at an inefficient
attitude/geometry. "To give you an idea, I have seen projects with <100
km of drilling where the general structure was totally overseen, but once
you plotted the grades it was quite evident that there was a structural
control (folding)." Taking some extra time to analyze the structure would
have definitely improved the efficiency of that large drilling program.

In the specific case of geophysics, results can be misleading
unless the whole story behind them is addressed. For example, "if
borehole planning is based on the wrong information (e.g. K-anomalies
associated to lithology instead of alteration; not addressing magnetic
inclination and/or remanence; overseeing that in an alteration zone you
are interested in the magnetic low around the large purple "blob"), then
you’re missing the whole story and this can lead to the waste of those
boreholes," says Ugalde. "It’s easy to just say geophysics did not work,
rather than understanding the overall fit."

Chris Vose, CEO of Brisbane-based Murrumbo Limited, has seen it
directly from the explorer side. "In my experience of small cap explorers,
there is way too much drilling before there is any understanding of
geoscience," he says. "Shareholders buy on rumor and sell on fact and
there is a perception that ‘drilling equals rumor’ and the day traders
and punters pump the stock when drilling is underway and results are
pending." He considers the rush to drill is driven by a financial imperative:
explorers often lack the ability to communicate their exploration strategy
without delivering some headline results for shareholders and investors.

Vose says that as a CEO and engineer he relies upon geoscientific
information and advice and often finds geologists differ on their
interpretations. "I think that what good geologists do well is to gather
evidence before advancing a theory or a model," he says. "In particular
geophysics, geochemistry, structural geology and geochronology are
critical to finding mineralization."

Though not a junior investment situation, Ugalde uses another
example of the value of ground control when interpreting geophysical
data: the Bathurst Mining Camp. A producing mine from the 1950s, it
was pretty much closed and the Geological Survey of Canada (GSC)
funded a new survey; new geophysics. He describes the entire area as
60 x 60 km with very few outcrops. "So we had lots of geophysics but
little matching ground control," he recalls.

"We did some modeling of gravity and magnetic data, in 2D
sections. The key here was having me working together with Cees
van Staal, GSC’s structural geologist who knew the way the faults were
dipping, and how many folded sequences did we need to put on." Combining
van Staal’s knowledge of the area with the resolving power
of geophysics, they ended up not only with a great 3D model based on
geophysics, but one that made geological sense too.

"The geological input from Cees was invaluable," says Ugalde.
"Modeling is a non-unique problem, so you can put an infinite number
of geometries and still fit the data. Having someone who knew what
was feasible and what wasn’t was very important."

Software plays a big role but needs to be applied properly, cautions
Ugalde. "We have software that makes life way easier and that almost
anyone can operate," he says. "However, knowing how to use the
software is not a replacement for knowing what you are doing from the
geoscience perspective." While a powerful aid, he sees a trend where
available software is not being used to its full potential, mostly because
of a lack of control on what is actually being done or what is the overall
goal. "More access to sophisticated tools needs to be balanced with
proper training and field experience."

To help provide this balance it’s equally important from the software
development perspective to ground advanced geocomputing with
the right geoscience. Software developer and former exploration
geophysicist, Ian MacLeod, Chief Technologist at Geosoft, explains the
approach. "We rely strongly on the expertise of our senior scientists,
working with industry collaborators, to build and develop new technologies. Impactful technology (based on our experience and understanding of what is proven and effective for exploration) is more important than pushing out the latest feature set.”

“Good technology accelerates labor intensive routines,” says MacLeod, “and it aids in the integration and visualization of the many dimensions of exploration—geology, geochemistry, geophysics, remote-sensing, field mapping, drilling—to help an explorer iterate and best understand their target environment. But proper understanding of all that data, and correct application of the tools, requires sound geological thinking and practical experience.”

What can be done to remedy the lack of interest in ground structural mapping as a geophysics follow-up? Lots of training and going back to basics, figures Ugalde. “We need geologists to understand more about geophysics so that in the future they know what to ask for and what are the limitations of each methodology based on geology, survey specifications etc,” he says. And conversely, “we need to train geophysicists to understand more about geology and see how geological processes affect rock properties and therefore the observed signature.” There’s a need for geologists to go back to basics too. “How many companies are there that actually do structural mapping as part of their standard exploration?” questions Ugalde. “How many companies take the time to build a geological model, rather than just grid the reserves?”

It’s not just software training he reckons, but knowing what to do with the data. “For that, we need to train people at all levels: university level (before graduation), and the current professionals doing the operations.”

Training at the university level is not a simple one he says. Ugalde has completed a PhD so has some firsthand observations. “Universities now have a mandate for self-sufficiency which has led them to teach programs that are more attractive for undergrad students, who are the ones who bring more money (tuition) into the departments,” he says. The result is that more and more geology departments are walking away from hard-rock geology and switching to environmental-based programs because that is what sells to students. “However, nobody bothers explaining to students what kind of jobs they can get with that background,” he says. “For example, talk to a second year undergraduate about a career in mining, he/she will probably refuse because of the bad reputation of non-environmentally-friendly mining.”

Indeed, judging from some recent group discussion on LinkedIn, many geologists are seeing this: a declining trend in hard-rock geology in universities. The trendy shifts today are increasingly on environmental studies, carbon debates, sustainable energy—which need to be explored too—but it is seen as significantly affecting the exploration industry. Structural mapping seems to be on the decline; some consultants are encountering exploration companies which even consider it a waste of time and money. But basic structural mapping by experienced people using the newest technologies should still be seen as a highly cost-effective exploration method.

University co-op programs can work well says Ugalde. Under these, students combine regular university terms with time working in the industry; it exposes them to real problems using real tools. But also “we definitely need to motivate more cross-training (geophysics for geologists; geology for geophysicists) in the industry,” he adds, “so that we develop a common language and everyone is clear on what to get from the data, and what kind of data to use on each situation.”

It may take a while to evolve, but ultimately exploration companies and their investors will realize the value of good structural mapping as an adjunct to their purple blobs.

**Hernan Ugalde, Senior Consulting Geophysicist with PGW**

Ugalde stresses the importance of field work, mapping and measurement of rock properties by the geologist and geophysicist, who should work in tandem.
Is data the key to your next big discovery?

Managing data is a growing and critical concern in exploration. Based on previous Geosoft Surveys, only 18% of explorers thought the issue was critical in 2011, and by 2013 that number had more than doubled with 44% stating that managing exploration data was a ‘top 5 issue’. Over 500 organizations, within resource and energy exploration, government and education have participated in Geosoft data management surveys in the past, resulting in valuable insights on data management challenges, priorities and solutions captured in these published reports.

Organizing and indexing historical exploration data has since emerged as a key issue and opportunity, and it is covered in this year’s survey. Other aspects of data management included in the survey are: key data and information management challenges, and who and how you are solving these issues.

We value your input!

Share your experience and learn from the experience of others, by participating in the 2015 Survey on Exploration Information Management.

www.geosoft.com/datareport2015

All survey participants will receive a copy of the 2015 Exploration Information Management Report and be entered into the Exploration Data Draw for an Apple iPad Air 2.

The Survey closes March 31st, 2015.