FRESH PERSPECTIVE

TECHNOLOGY TRENDS AND SOLUTIONS FOR MINERAL EXPLORATION
A FRESH PERSPECTIVE

In today’s challenging climate, mining and exploration companies are using the latest technology and new approaches to focus and re-energize their exploration programs.

Demand for innovative solutions remains strong, as explorers search for deeper deposits and develop projects within more complex and challenging environments.

Read on for

→ A review of current demands and emerging technology trends from Geosoft Product Management Directors and Chief Technologist.

→ Solutions for meeting today's challenges in exploration information management, mapping and analysis and exploring with GIS.

→ Perspectives on strategies and results from Areva, Vale, Teck Resources, Rio Tinto, HudBay and other explorers.
What are the current demands and the latest advancements in exploration software and solutions? Geosoft’s product management directors and chief technologist field questions on current and emerging trends.

What are some of the current demands from the exploration sector?

We’re seeing more interest and investment, industry-wide, in data management. Within exploration companies of all sizes there is a stronger focus on understanding the information you have, making it more easily accessible and preserving it for future exploration projects. We are actively working with exploration companies like Areva, Vale, Teck Cominco, Rio Tinto and others to design and implement Exploration Information Management Solutions (EIMS) that deliver greater transparency of data and decision-making and better data access for global exploration teams.
Improving exploration capabilities within GIS is another requirement. Most exploration companies are now using GIS systems as a core technology, and explorers need better tools for working with their data and projects within GIS environments. This is an important focus for Geosoft. We have made continual improvements to our exploration geology and geochemistry workflows for ESRI's ArcGIS to ensure they meet explorer needs.

**In what areas of exploration are Geosoft software and solutions used?**

Geosoft software, services and solutions support explorers in all areas of exploration, from opportunity assessment and target generation to advanced exploration and pre-feasibility. The exploration sector generates and consumes vast amounts of geospatial data. Geosoft solutions provide a full range of capabilities that help explorers manage their exploration information and projects and generate insight from the data in maps, sections, 3D models and integrated interpretations that aid project evaluation and guide drilling programs.

“There is a stronger focus on understanding the information you have, making it more easily accessible and preserving it for future exploration projects.”

**What are your latest software capabilities for exploration, and what areas do they target?**

Our 2010 software release targets three key areas: improving access to data and information; simplifying workflows to make exploration tasks like reporting and map creation more efficient; and creating an environment where explorers can move from 2D to 3D more seamlessly.

We have introduced Seeker, a new tool designed to help explorers find and start using data quicker. Seeker provides a single interface for handling the entire data access workflow –
“A number of recent discoveries have been credited to the application of modern technology to old projects.”

from structured metadata querying to the viewing of results and from data extraction to the explorer’s desktop application.

We’ve improved statistical and reporting capabilities within our Target exploration geology workflow, making it easier to highlight, report and assess significant intersections in drilling projects.

We also continue to expand 3D capabilities within the Geosoft platform. Effective 3D rendering of the subsurface has become essential for presentation and collaboration; however, a great deal of exploration work is still completed in 2D plans and sections. To help bridge the gap, we have added new support for crooked geophysical sections that will enable more accurate representations of the data in 2D and 3D.

What impact have you seen on the demand for exploration software and solutions?

In today’s challenging climate, there has been a significant pull-back of activity in the exploration sector. As a solution provider, we’ve worked with customers to understand how we can help them become more efficient with fewer resources.

Within the junior sector, explorers have focused on preserving funds and many have slowed down aggressive drilling projects. This has led to more data analysis, more integration of data and smarter application of technology.

As many explorers decelerate, we are seeing greater use of advanced 3D capabilities and more time spent generating integrated interpretations (combining geophysics, geology and geochemistry) to focus their projects, and minimize risk, before making the decision to drill.

A number of recent discoveries have been credited to the application of modern technology to old projects. As an example, recent discoveries at HudBay’s Lalor Lake and Rio Tinto’s Bingham Canyon mine were both attributed to fresh perspectives that came from applying deeper exploration techniques and 3D visualization capabilities.
Among our larger customers, we’ve also seen a focus on realigning resources and operational efficiency. Deploying corporate-wide technology projects, with limited in-house IT resources, continues to be a challenge. In many cases we’ve supplemented our technology with services to support our customers’ data management needs.

Have exploration companies changed their approach to technology in recent years?

More exploration companies are consolidating their technology spending to focus on core platforms and tools they consider to be the most essential to exploration. They’re being more prudent with discretionary software spending. Geosoft exploration software is used extensively across the exploration project cycle, including drill hole mapping, data integration, 3D visualization and generation of interpretations and reports. In many cases, Geosoft has been deployed as a standard platform within exploration companies. As a result, our customer base has remained stable. In some cases we’ve been able to develop stronger relationships and new opportunities with existing customers.

We’ve also found exploration companies to be more receptive to using services to supplement internal resources when deploying larger technology projects. We’re working on a number of Exploration Information Management projects where Geosoft is providing a complete solution, one that combines technology with value-added services to support things like information and metadata preparation, workflow customization and change management.

People still need improved workflows, better user interfaces, and better access to data, and we continue to work on all fronts to address these needs. So, in many ways, things haven’t changed.

What will be the next developments in exploration software?

The next developments will be focused around the web, in particular the emerging model of cloud computing (Internet-based development) and the delivery of web services. Our ability to efficiently manage tasks, like handling the vast amount of data generated from exploration, through personal computers is limited. And as we continue to face the demographic challenge of meeting growing global demand for resources with fewer people and tighter financial constraints, the need for efficient access to information and tools within the exploration sector is greater than ever.

Web-based development provides new opportunities for connecting explorers to data and tools that allow for more effective, efficient decision-making and empower collaboration within global exploration teams. Building this shared and interconnected future with explorers is motivating future developments at Geosoft.

We’re also working on earth modelling, and how we can make complex techniques like geophysical inversions (which convert geophysical data into 3D earth models) more useful and accessible to exploration professionals. We recently welcomed Dr. Robert Ellis, an industry leader in inversion and modelling of geophysical data, to our R&D team in the role of Senior Scientist, Earth Modelling.

Inversion techniques have progressively moved from university research labs to industry exploration environments, where they have helped to develop further insight into the subsurface and reduce risk in exploration for minerals and oil and gas. However, they remain highly specialized and complex. We are working with Dr. Ellis on the next generation of modelling capabilities that will make 3D modelling accessible to many more explorers. Although we are still in the early stages of development, we are very encouraged by progress so far.

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Questions were answered by Louis Racic and Steve Randall, Geosoft Product Management Directors, and Ian MacLeod, the company’s Chief Technologist.
EXPLORATION INFORMATION MANAGEMENT

Today’s Challenge

As more and more exploration data is collected, digitized, and stored, we are facing a digital data explosion. Industry-wide, explorers are establishing a stronger focus on understanding the information they have, making it more easily accessible and preserving it for future exploration projects.
Stronger capabilities for managing and sharing your data

The delivery of stronger spatial data access and management capabilities through Geosoft Exploration Information Management Solutions (EIMS) helps explorers work faster and smarter by organizing and sharing data and information across teams so they can manage and make sense of large amounts of digital data for exploration decision-making.

Geosoft has built its EIMS solutions around its core DAP server and search technologies. The technology is augmented by professional services that support information and metadata preparation, workflow customization and change management. Geosoft’s Custom Development team has also partnered with global exploration organizations to design and implement custom solutions for managing metadata and enabling Web Based Reporting for Data Managers and Geoscientists to understand the wealth of data available to them within their organizations.
Explorer Success

Areva improves productivity by managing and sharing data more efficiently

Areva Resources Southern Africa has an impressive portfolio of exploration projects throughout the continent. But while project diversity is a blessing in exploration, it can also create data management challenges. Taking a strategic approach to Exploration Information Management has resulted in a complete technology solution and new standards for effectively managing and using all their exploration data assets in South Africa.

“Our Geosoft DAP server is enabling us to build a library of maps and information for each project that we can share not only with geologists within our group, but with all exploration groups within our company.”

-Olivier Masset
Manager of Resources and GIS

Vale builds an information asset that delivers value today and in the future

Vale, the second-largest diversified mining and metals company in the world, is turning exploration information into a corporate asset with a solution that focuses on three simple goals: data quality, security, and efficient flow to regional exploration teams for opportunity development.

“For management, there is also the value of transparency – knowing what information we have and where it is – and that it is all stored in a secure system.”

-Ana Maria Goncalves
Information Manager
Exploration and Project Development Division
Teck Resources supports team-based exploration with a stronger data foundation

As a growing company, Teck Resources saw both the need, and potential, to establish a data foundation and collaborative platform that could provide their global teams of geoscientists with faster, better ways to process immediate prospects and develop opportunities for the future. Their solution is based on having one family of software that works together seamlessly to capture, archive, deliver and ensure effective use of their data across the entire organization.

“It’s been said that our next ore body may well come from our own exploration files. The greater our ability to quickly and efficiently find and integrate that data, the better our potential for success.”

-Bob Holroyd
Director
Global Exploration Technology Group

Rio Tinto improves effectiveness with one-stop shop for data

Kennecott Exploration, a division of Rio Tinto Exploration in Salt Lake City, wanted to tackle the ballooning terabytes of digital information on the company’s server. They replaced a file directory and little sticky notes with a central server that is readily accessible to everyone in the company. Now, instead of relying on a colleague to retrieve and reformat data for them, geoscientists can access the information directly from their desktops, decreasing the time and cost of interpretation.

“People used to spend a lot of time running around looking for stuff they couldn’t find, but now they can find it right away because it’s all coming from one place. That has improved our effectiveness.”

-Peter Thurston
Data Administrator
MAPPING AND ANALYSIS

Today’s Challenge

Explorers need to effectively analyze, integrate, and strategically use more data, with fewer resources, to support business decisions. Mapping and interpretation requirements are integral to the exploration lifecycle. Use of advanced 3D capabilities and more time spent generating integrated interpretations can provide a fresh perspective, focus exploration projects and minimize risk before deciding to drill.
Mapping platform for your global exploration team

Geosoft’s mapping and analysis solutions are ideally suited for today’s multidisciplinary and team-based exploration. With our purpose-built workflows for geophysics, geochemistry and geology, and advanced analysis tools, your team can maximize insight and value from all available data resources. Maps and results, created within your Geosoft platform, are always easily shared with others. Working across your Geosoft and GIS system is seamless, with ArcEngine built-in and support of other industry GIS.

The three dimensional view has become essential to surface and subsurface exploration, and rich 3D capabilities are included as part of Geosoft’s core exploration platform.

We support over 50 data formats, enabling you to work with your GIS, Technical, Engineering and Resource data formats as well as Exploration data within one environment.

Geosoft also has built-in optimization for handling, viewing and analyzing large volumes of geoscientific data. As your exploration projects expand, and your project numbers grow, requiring the use of more data and greater varieties of data, Geosoft provides a technology foundation you can count on.

**Exploration Geology**

Visualize and manage your drilling projects. Create borehole plots, sections and plan maps to refine drilling programs. Create powerful 3D models, presentations and reports.

**Earth Mapping**

Manage your advanced earth mapping projects. Process, map, QA and interpret all your data, including ground airborne survey geophysics, geochemistry and geology.
**Explorer Success**

**Deeper, three dimensional insight contributes to higher success rates for Eaglecrest**

Sometimes, viewing exploration results from a different perspective can change the direction of a project. That’s what happened when Hans Rasmussen, a former senior geophysicist for Newmont and Rio Tinto, took the Eaglecrest Explorations Ltd. helm. He observed that the company needed to update the software being used on drill projects and bring in technology that enabled deeper, three dimensional insight.

“We can incorporate GIS data and exploration data – from technical information to topographic data – and view it all in three dimensions within our Geosoft platform. That’s a core strength for our advanced exploration.”

-Hans Rasmussen
President and COO

**Innovative techniques help HudBay uncover new potential in old camps**

Winnipeg-based HudBay Minerals identified the Chisel Lake Basin where Lalor Lake occurs as prospective, but it was an experimental deep penetrating TDEM (time domain electromagnetic) survey incorporating proprietary “innovative techniques” that identified a large bull’s eye anomaly, according to project geophysicist Alan Vowles. Using 3-D computer modeling software, HudBay geophysicists defined the conductor as a flat-lying, tabular body within favourable stratigraphy at a depth of 800 m. They plotted it using Geosoft software, and won approval from management to test it with drilling.

“We believe we have in hand one of the most significant zinc discoveries in Canada in recent years and, of course, we are now fast-tracking that opportunity.”

-Peter Jones
President and CEO
Data integration for discovery: a Sudbury success story

Wallbridge Mining, Xstrata Nickel and Vale Inco created a rare opportunity to generate new targets outside the Sudbury Basin in northern Ontario when they pooled their exploration data for maximum impact on the western margin of the Sudbury Igneous Complex (SIC). The area presented an opportunity to refine the exploration model outside the boundaries of the basin when the companies shared results from 3-D seismic surveys and detailed aeromagnetic work.

“The process of creating an exploration model has become much easier and more efficient with the advancement of exploration software, such as Geosoft, which provides a platform for integrating different datasets – magnetic, geochemical, topographic – bringing them all together as a single resource.”

-Professor Bill Morris
School of Geography and Earth Sciences, McMaster University

Etruscan develops and shares exploration knowledge for advantage in their developing projects

While some explorers are content to move from project to project using the tools at hand, Etruscan Resources has taken care to establish simple corporate guidelines, and a common exploration platform to support its project development. This has ensured it can easily capture and share the rich experience and knowledge being developed. Etruscan used Geosoft as the principle exploration platform at its Youga gold mine both during the feasibility stage and currently while developing additional resources outside the mine site, to monitor the progress of drilling programs.

“We’ve found it easy to use Geosoft as our corporate standard because we’re able to bring in information from any of the main GIS and resource systems used in exploration.”

-Geoff Day
Project Geologist
GIS WORKFLOWS

Today’s Challenge

Most exploration companies now use GIS systems as a core technology. However, working with multidisciplinary datasets and sharing results between exploration software and GIS applications can be a challenge. The development of specialist workflows, which provide effective tools for working with exploration data and projects, has been critical to the uptake and effective utilization of GIS within mineral exploration.
Better workflows for exploring with your GIS

In collaboration with ESRI, Geosoft is building next generation solutions utilizing ESRI GIS technologies for exploration industries and the geosciences sector. The partnership between Geosoft and ESRI leverages Geosoft’s industry experience and robust workflows for managing and analyzing large earth datasets within ESRI’s GIS platform.

Geosoft’s geology and geochemistry workflow solutions for ArcGIS fill critical functionality gaps, and allow you to easily share your data and maps between your exploration software and GIS environments.

Geosoft’s Geochemistry workflow provides the ability to efficiently conduct your geochemical QA and analysis inside ESRI’s ArcGIS. It builds on the success of our subsurface geology extension, Target for ArcGIS, which enables you to visualize drillhole and borehole geology data and quickly integrate it with your exploration data within the ArcGIS environment. Together, the two provide a powerful solution for exploring your data, and generating results, in GIS.

“We look forward to an increasingly tight global partnership with Geosoft going forward, to build integrated workflow support for the explorer of tomorrow.”

-Geoff Wade
Natural Resource Industries Leader for ESRI
Lonmin combines geophysics and geochemistry to narrow the search for deposits

Geochemical tools that can probe a little deeper are becoming increasingly important complements to geophysics in the search for buried ore deposits. In their search for PGE-bearing deposits associated with the Antrim basalts that underlie the northeast part of Ireland, Lonmin is integrating geochemical and geophysical datasets to narrow down areas of interest and establish drill targets.

“Now that we have the Geosoft Geochemistry for ArcGIS module, the junior geologists are involved in making preliminary maps to confirm that we are working in the right area and are on the right path in terms of our exploration strategy.”

-Dermot Smyth
Northern Ireland Project Manager

Vale increases efficiency with better integration of their GIS and exploration software

For Vale, one of the largest mining companies in the world, using the right technology is key to keeping the exploration process efficient and focused. As the company becomes more global, being able to share information and expertise with other regions is increasingly important.

“In the past, our exploration applications didn’t connect with our GIS. We had to make all sorts of conversions, and with data sets such as geophysical grids, you can lose important information when you try to convert the data to other formats. Using Target for ArcGIS, our geoscientists can work with their geophysical, geochemical and geological data within the ArcGIS environment much more quickly and effectively.”

-Ana Maria Goncalves
Information Manager
Exploration and Project Development Division
Hunsaker adopts exploration software and GIS as a critical part of his tool kit

As a well-established consulting geologist working in the middle of the Nevada goldfields, Buster Hunsaker makes extensive use of exploration software and GIS capabilities in his projects. Hunsaker uses ESRI’s ArcView to visualize data in combination with Geosoft’s Target for ArcGIS to manage drill projects. Being faster and more efficient in using technology for geological insight and project management has given him an edge in what can be a competitive business. More important, it’s enabled him to produce better results for his customers.

“Our expertise in GIS has opened a lot of doors for us. As a consultant, bringing both our experience and technology to bear on projects is a tremendous advantage.”

-Julian Misiewicz
Consulting Geologist

Gold Fields applies technology to get the best value out of its data

Julian Misiewicz, consulting geologist for Africa and Europe with South African-based Gold Fields International, makes a distinction between essential and specialist software functionality in exploration. Database software, a GIS package and a drill hole processing package are deemed essential. Gold Fields uses ArcGIS as its GIS platform for exploration and Geosoft’s Target for ArcGIS for its ability to provide integrated drillhole plotting and surface mapping capabilities in ArcGIS.

“The better you can see and plot your data, the better you are able to understand it, firstly, and the better you are able to get the best value out of that data, and to use it effectively throughout the business environment.”

-Buster Hunsaker
Consulting Geologist

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CUSTOMERS SUCCESS STORIES
When France’s Areva, the world leader in technological solutions for nuclear power generation, acquired UraMin in mid-2007, the Canadian company was a junior success story.

UraMin had picked up some low-grade concessions in Namibia near the huge Rossing mine when the uranium price was still relatively low and proceeded to build its African portfolio. A rising uranium price made those acquisitions increasingly valuable and attractive to Areva, which was looking to diversify its resource base and secure longterm uranium supplies.

Renamed Areva Resources Southern Africa, the new subsidiary is expected to provide Areva with 7,000 tonnes of uranium per annum by 2012. Starting later this year, production will come from three main deposits: Trekkopje in Namibia, Bakouma in the Central African Republic and Ryst Kuil in South Africa.

Today, Areva South Africa has an impressive portfolio of exploration projects throughout the continent that are benefitting from Areva’s rare combination of expertise in uranium deposits and African exploration.

But while project diversity is a blessing in exploration, it can also create data management challenges. In 2007, the company recognized it needed a better way to handle and share its exploration data to improve productivity and ensure project managers had access to the best available information.

Typical of many global mining companies, Areva’s exploration geoscientists used several different software packages with no efficient way to integrate or share their knowledge and information. Meanwhile, the company’s data managers were getting bogged down with incoming data that – with the right tools and some training – the geoscientists in the field could manage. And visual presentations to the company’s decision-makers were not as clear and comprehensible as they could be.

They partnered with Geosoft to take a more strategic approach to Exploration Information Management that would establish a complete technology solution and new standards for managing and effectively using all their exploration data assets in South Africa.

Olivier Masset, Manager of Resources and GIS, and Nozuko Mani, GIS Manager with Areva South Africa, led the needs assessment and business strategy for the exploration technology initiative.

“We were spending a huge amount of time in data handling, manipulation and QC and we wanted a streamlined system with tools to empower data creators with self-managing their own data tasks,” says Mani.

Given the diversity of software packages being used in the field and different offices, and the fact that they had a variety of data repositories, integration was also crucial. “At the end of it, we wanted a simplified view of the different datasets for our managers, and a common way to access data for our geologists working on projects,” says Masset.

The anchor for Areva’s Exploration Information Management solution is Geosoft’s DAP server technology, which has allowed Areva’s geoscientists access to data on demand from a single interface instead of having to tap into separate repositories for information.

Integration with their Datamine MineTrust, Maxwell Dashed and LeaseControl systems expanded the breadth of data available to explorationists throughout the organization.

“Our DAP server is enabling us to build a library of maps and information for each project that we can share not only with geologists within our group, but with all exploration groups within our company,” says Masset.

Areva South Africa has also standardized on common tools for their exploration projects: Geosoft’s Oasis Montaj for advanced mapping and data processing of geophysics,
geology and geochemistry; Target and Target for ArcGIS to create sections and 3-D models for subsurface (drillhole) data within their ArcGIS environment.

The tight integration between Geosoft exploration software and ESRI’s ArcGIS has been critical, and it’s meant that Areva geologists are able to access, explore and work with their data directly within their ArcGIS or Geosoft environment, depending on the project they are working on. Exchange of maps and data between the two environments is also fast and efficient with ArcGIS built into the Geosoft mapping platform.

Together, these tools have provided Areva Resources’ multi-disciplinary exploration team in South Africa with a suite of spatial analysis tools that improve workflow by increasing efficiency, making decision-making easier and supporting better communication between project team members and management.

“We can combine and consider not only the geology, but all the relevant project information.”

-Olivier Masset  
Manager of Resources and GIS

The improved productivity that comes from managing and sharing exploration information efficiently is seen as a key business benefit.

“Our Geosoft and GIS software helped us to map everything out and manage our projects more effectively,” says Olivier Masset, manager of resources and GIS for Areva Resources Southern Africa. “We can combine and consider not only the geology, but all the relevant project information. That accelerates our decision-making on – for instance – where to focus our exploration or whether to start drilling or resample.”

He says that before Areva Resources introduced the Geosoft software to its field offices, data would be sent to head office in Johannesburg, where it would be made into sections and field maps before being sent back to the field. Using common exploration tools, the geoscientists can now complete these tasks in the field, saving time at head office and allowing project managers to make immediate decisions about where to explore next.

Masset is particularly enthusiastic about the ability to integrate data from the field into the exploration model, continuously providing his team with added information and fresh perspectives on the mineral potential of a particular project.

Data mobility is also an important advantage. With their solution, managers and geologists can move from region to region and still have easy access to data housed in the DAP server in Johannesburg.

“Access to information and the ability to share information in real time is important to us” says Masset. “The ability to do this on a global basis, where someone from southern Africa can go to Canada and find the same data, is a competitive advantage that enables us to be more flexible and quicker in developing our projects.”

Compatibility with other programs, not only within the Geosoft suite but from other software providers (e.g. AutoCAD), is another feature that makes the job easier for Mani. “As a person managing the company’s GIS database which stores critical information about 3D maps, borehole plans and sections for analysis, I would say Geosoft has enormous capabilities, including bringing in data from different formats used in the mining and exploration industry.”

“We’re encouraged with our progress,” says Mani. “As more geologists and managers are trained on the new tools, they are gaining confidence in the quality of the data and their ability to extract information from their data. There’s no doubt this will impact our ability to develop our projects and make meaningful decisions.”

As a result, Areva has made its new Southern African subsidiary a test pilot for establishing a common platform for exploration including protocols, best practices and software tools that are standard across the organization.

If proven successful, the common exploration platform Areva Southern Africa is striving to create could become a model not only for its parent company, but for the mining sector as well.
Vale builds an information asset that delivers value today and in the future

Companhia Vale do Rio Doce (Vale), the second-largest diversified mining and metals company in the world, is turning exploration information into a corporate asset, with a solution that focuses on three simple goals: quality, security and flow. In this Q&A, we ask Ana Maria Goncalves, information manager for Vale’s exploration and project development division, to discuss how her company is ensuring it gets the most value out of data.

What is your vision for transforming Vale’s exploration information into a corporate asset?

A few years ago, we envisioned creating a global information management mandate. At that time, we had many of the elements in place (exploration software, GIS, databases) but no cohesive strategy for exploration information. Also, Vale as a global exploration organization was not yet a reality. Today the corporation has regional offices around the globe. With our growth and globalization, the need to consolidate and manage the flow of data has also grown.

We created an information management area in our exploration division, to address the requirement for standards and practices in how we collect, organize, process, store and manage our information. Our vision is based on understanding and supporting the diversity of exploration needs. In our organization, many different people need to access to exploration data, including field and project geologists, geophysicists, analysts and engineers. They all differ in how they work with and interpret data. There is value in that diversity. Our information management strategy must balance the corporate need for greater transparency of data and decision-making with the needs of our exploration professionals.

When you looked at delivering greater value through information – where did you start?

First we needed standard procedures and policies to address the basic issues of security, quality and data flow, both internal and external. We identified the different types of data that were most important to exploration, as well as the flow and use of data through the exploration project cycle. Once we understood the information, we identified the best tools and platforms for dealing with it. We then identified the integration that was needed to create a solution for Vale.

From the start, we saw our role as providing the resources, processes and technologies to help people organize data. We’re currently establishing data specialist roles in various regions of the world. We also have a team in Brazil that provides data support for exploration projects. On the technology side, we are well underway with getting the technology platforms in place, and a key focus now is communication and training.
Vale’s vision to turn exploration information into a corporate asset

How important is information management to the future of exploration at Vale?

It is essential. In exploration, we generate technical information and knowledge that show the value of projects. This information is confidential and strategic. That said, we need to understand, organize and manage our data as a corporate asset.

More and more, exploration companies are looking at information as an asset. When you consider that companies are spending more money and yet discovering less, it stands to reason that data management would be used to gain a competitive advantage.

The exploration industry is cyclical by nature, and these cycles can take their toll on historical data. Information management protects the value of data in the long term.

Among your new initiatives, which have demonstrated the greatest business value? What advantages have you seen?

We have seen great advantage in having a system for data maintenance, storage and security. Basically, we have a lot of data, and the ability to put it all into our Geosoft DAP server means that we don’t have to rely on CDs, DVDs, or the individual who last worked with the data.

For the longer term, we are building an information asset that will continue to deliver value in the future. Having main datasets and meta data within our DAP system means we can track and access data in a standard way, as well as identify the latest version.

For management, there is also the value of transparency – knowing what information we have and where it is – and that it is all stored in a secure system. These benefits are a reflection of our three goals of data quality, security and flow.

Outside of data management, we have seen a lot of benefit from our use of Geosoft’s Target exploration software for ArcGIS. Target for ArcGIS has come to play a big role as the link between GIS and exploration.

What are the biggest challenges your organization faces in building Information Management infrastructure to support Vale exploration?

Vale’s vision to turn exploration information into a corporate asset

There are challenges with any change in how you do things. Support from management is critical to making change happen. Information management needs to be part of the company’s plan.

Bringing people into a new environment is always a challenge. In our case, we didn’t change our core exploration applications but we did move away from using technologies that some of our people were used to. This challenge is quickly resolved with the right training, information and support.

For information management to work, you need collaboration, and achieving the right level of communication and relationships takes time. We need to continually support the use of information management and demonstrate the positive outcomes at all levels. At the end of the day, it’s all about providing solutions that improve the business of exploration.
Teck Resources supports team-based exploration with a stronger data foundation

When Teck Cominco looked into making changes to their exploration technology, they quickly recognized that technology had already changed every aspect of how they collected, analyzed and shared their data for the purpose of exploration and making new discoveries. Everything from data collection and observations in the field to the style of notations was being dictated by how they anticipated using and integrating that data within their GIS system. And yet, like most mining companies, they didn’t have a global plan or strategy for how they used technology as part of their exploration workflow. Development of this strategy became a focal point for their newly formed Exploration Technology group established in January, 2006.

Alongside the technology revolution, was the data explosion. Millions of dollars were being spent on geophysical surveys, field mapping and drilling to support expanding projects with more drills than the company had ever had before on any one project. Much of this critical data, however, was still being used for short-term projects only, leaving its true value as a corporate resource unexplored.

Vast amounts of geological, geophysical and geochemical exploration data were shelved, or stored, in the corporate library on CDs, hard disks, maps, and old reports, some going back 50 years or more. Historical field results were often poorly indexed, and lacked the metadata required to organize them for future use. Despite a proliferation of tools, exploration data was still hard to find, use, and share between regional offices, horizontally across their operations, and vertically from exploration to resource calculation and engineering groups.

What struck Teck Cominco most, however, was not the size of the problem but the huge opportunity. As a growing company, Teck Cominco saw both the need, and potential, to establish a data foundation and collaborative platform that could provide their global teams of geoscientists with faster, better ways to process immediate prospects and develop opportunities for the future.

“With the explosion in the number of drilling projects being worked on, and the amount of data streaming through, we saw the benefit of having a global exploration technology solution that could scale to our growing data requirements, allowing us to share vast amounts of data across our company, and support our team-based approach to exploration.” Says Bob Holroyd, the director of Teck Cominco’s Global Exploration Technology Group.

The solution for Teck Cominco meant having one family of software that worked together seamlessly to capture, archive, deliver and ensure effective use of their data across the entire organization. Their newly chosen platform is based on ESRI’s ArcGIS system integrated with Geosoft’s Oasis montaj and Target to analyze borehole data and process geological, geophysical and geochemical datasets. The solution relies on Geosoft’s DAP server technology to archive data and make it accessible to geoscientists throughout Teck Cominco’s exploration offices worldwide.

“We selected Geosoft and ESRI technology because we saw a strong fit with our need to establish a solid data foundation, and company-wide standards for our exploration systems. Having worked with Geosoft for over 15 years, we had confidence in their ability to deliver a global solution” says Holroyd. “The interoperability of all our exploration software platforms is absolutely critical, and ESRI’s ArcGIS system together with Geosoft’s DAP data server technology, Target and Oasis montaj applications, gives us everything we need within one solution.”

Teck Cominco started to build its data foundation, within Geosoft DAP, three years ago, in its Vancouver headquarters, and the technology was implemented company-wide in 2006. The main considerations for deploying DAP were efficiency and time savings. While the company is still working to upload all of its data to the DAP server, their geoscientists are already saving hours, even days, by going directly to the server – instead of several different sources – to retrieve data.

The decision to standardize on ESRI’s ArcGIS system quickly
followed. “Our previous GIS software was a great out-of-the box package – you could just load the software onto your computer and start working with it,” says Paul Roberts, a senior project geologist and veteran GIS user. “But it just didn’t scale to the level of our requirements for sharing data and developing teams of people working together on projects.” Roberts says the partnership between ESRI and Geosoft gave Teck Cominco the opportunity to move towards the enterprise solution the company had been looking for.

But it’s no longer just about the software, says Roberts, it’s about the workflow; understanding the way your geoscientists use the data, and how the technology fits with your global business needs. As a first step to forming Teck Cominco’s strategy, Roberts lead a company-wide assessment that looked at how they collected, used and extracted value from their data. Considerations such as what type of data should be collected and how it should be used and shared among geologists, ore reserve estimators and others was critical at this stage.

“We wanted to make sure this was the right solution for us, and we spent the better part of a year talking with geoscientists throughout the company, from field geologists to experienced GIS users, about their data needs, and how they used data as part of their jobs,” says Roberts. “Based on our understanding of how the data fits within our workflow, we see tremendous advantage in having a global solution that makes it possible for us to efficiently manage and direct the flow of data among our geologists when and where needed.”

The way forward, for Teck Cominco, has meant going back to the grassroots level. “We knew we had to change the way we plan our field programs to maximize the collection, archiving and storage of the most critical data, based on its use today and also how we anticipate using it into the future,” says Roberts. Developing and testing in-house field templates was a key building block of their global strategy. The standard global templates can be applied to any exploration project worldwide to record significant field observations such as lithology, mineralization and structural measurements, and they ensure that the right information gets into the system. “Using manually or electronically populated upload-templates has made the transition from the field to the data managers and a master database very efficient,” says David Donaldson, Leader of Geoscientific Information Services for the Exploration Technology Group. “We have used them successfully on projects in Mexico, Chile, Peru, Namibia and Canada.”

Ultimately, the company envisions growing its strategy to take full advantage of the huge innovations in technology, for workflow automation and data discovery from online sources, within a live Google Earth type internet interface such as Geosoft Dapple Globe Viewer, which was designed with geoscientists in mind.

Coming up with a roadmap to guide this new vision is a continuing challenge. The near term, especially when it comes to training and implementation, is well established, and with their new, global system in place the company will continue to work with Geosoft on their longer-term strategy.

One of the priorities is to fully populate the DAP servers so that they become the one-stop shop for exploration data they were designed to be. “Data can no longer afford to be shelved after the project. It has to remain live in a network setting on a server and be accessible for regional targeting purposes and evaluation of opportunities,” says Roberts. “That goes beyond going to the library and finding an old CD.”

Holroyd believes the resulting efficiencies and opportunities will stem from having trusted data at everyone's fingertips. “We have no doubt that this global solution will have an impact on our business. It's been said that our next ore body may well come from our own exploration files. The greater our ability to quickly and efficiently find and integrate that data, the better our potential for success.”

The potential benefits of having a global solution that allows data to flow seamlessly throughout the company’s regional offices are limitless. Decisions about whether to invest more in a project or leave it to rest will come much more easily. Projects in one corner of the world will benefit from tapping into data collected on comparable projects elsewhere. Geopolitical boundaries – once an obstacle to file sharing in geologically similar terrains like Chile and Argentina – will dissolve.

What does it all add up to? Much better odds of finding the Holy Grail of mineral exploration: an economic discovery.
Rio Tinto improves effectiveness with one-stop shop for data

It was Kennecott Exploration, a division of Rio Tinto Exploration in Salt Lake City that introduced Rio Tinto PLC to the concept of using a formal data management process to tackle the ballooning terabytes of digital information on the company’s server. Overwhelmed by the burden of organizing, reformatting and distributing geophysical data in the exploration department, it was suggested the company install Geosoft’s DAP middleware technology to boost efficiency.

“We had a big area on the file server that included hundreds of airborne and ground survey grids and no way to organize and store them other than in a file directory with little sticky notes to tell him which one was where,” says Peter Thurston, data administrator for Kennecott Exploration Company, a subsidiary of Rio Tinto.

By introducing Geosoft DAP, Rio Tinto was able to replace the sticky notes with a central server that is readily accessible to everyone in the company. Now, instead of relying on a colleague to retrieve and reformat data for them, geoscientists can access the information directly from their desktops, decreasing the time and cost of interpretation. And they don’t have to know the first thing about DAP to do it.

Thurston says the beauty of delivering information through DAP is that data can be integrated into any client application, for example MapInfo or ESRI’s ArcGIS, making the process of retrieval seamless for the end user.

But from his perspective as a data manager, the simplicity of the software is the main attraction. “It’s an intuitive process and that’s a big plus because you don’t need somebody specifically trained in IT to operate it. Once you’ve got it set up, it pretty much runs itself.”

Rio Tinto has installed DAP servers at its offices in Salt Lake City and in Bristol, England. As the company grows increasingly comfortable with the technology, it is expanding DAP beyond geophysical data to include scanned topographic and geological maps and digital maps from commercial GIS packages such as MapInfo.

“People used to spend a lot of time running around looking for stuff they couldn’t find, but now they can find it right away because it’s all coming from one place,” says Thurston. “That has improved out effectiveness. It’s a one-stop shop.”

As part of its data management strategy, Rio Tinto is evaluating its data repository requirements, and plans to centralize storage of its historical exploration data – including drill hole logs and assay results. Having a central system with a secure server will ensure that data is not lost, corrupted or stolen, regular occurrences when digital information is stored on individual hard drives and CDs. Another advantage is that data semantics and formats can be standardized to ease interpretation.

Implementing these data repositories is a daunting task for one of the world’s oldest and largest mining companies. As middleware, Geosoft’s DAP can help to connect data users with these back-end data repositories, providing access through one single interface.

The DAP web interface was recently implemented to make company data more accessible to users accustomed to accessing and gathering data from the internet. “Our geoscientists frequently visit online government surveys to download data, and we wanted to provide a similar experience through DAP. With the web interface, they can download data from DAP, just like they would from any other online site,” says Thurston.

For a company as big and widespread as Rio Tinto, improved data management is expected to have a significant impact on the value of exploration data. Geologists exploring for diamonds in North America, for instance, will have access – at the click of a mouse – to all the geochemical and geophysical data that Rio Tinto has collected during previous diamond exploration campaigns in other parts of the world. This fresh perspective could be the trigger that leads to new target areas or discoveries.
Deeper, three dimensional insight contributes to higher success rates for Eaglecrest

Sometimes, simply viewing exploration results from a different perspective can highlight hidden details and change the whole direction of a project. That’s what happened when Hans Rasmussen, a former senior geophysicist for Newmont and Rio Tinto, took the helm at Eaglecrest Explorations Ltd. and brought his appreciation for having the right team, approach and technology to explore projects to the fullest.

Rasmussen’s first priority as President of Eaglecrest was to assemble a first-class team, both on the executive and on the ground, to lead and develop the company’s advanced gold exploration projects. And his first observation on the ground was that the company needed to update the archaic software being used on drill projects, and bring in technology that enabled deeper, three dimensional insight.

Rasmussen immediately revised the drill program to reflect this new understanding of gold distribution and since then, at least a third of the holes on the main ore shoot have hit grades of better than 10 grams gold per tonne. As the company progresses towards establishing an underground resource for San Simon, the original Target model is continuously being updated and used to illustrate drill results to shareholders.

“From a business perspective, this kind of technology is helping tremendously,” says Rasmussen, president and COO of Eaglecrest. “There is no question of the impact a three dimensional presentation makes on the average investor.” And no question that during this period of accelerated worldwide exploration, explorers that can manage different data sets quickly and effectively, then convey the results to investors in a manner that is easy to visualize and understand, will have a competitive advantage over those who can’t.

The record of the past two decades shows that mineral discovery rates have fallen even as the level of investment in exploration has risen to an all-time high. Companies are spending more than ever, but discovering less. To

“Target is very good for cross-sections and it’s good for planned view maps, so we’ve also been able to incorporate satellite images with surface geochemistry as a means of exploring our project outside of where we’re drilling.”

-Hans Rasmussen
President of Eaglecrest

Although Eaglecrest had been exploring the San Simon gold project in northeastern Bolivia for more than a decade, it wasn’t until last year, when Rasmussen’s team used the Geosoft exploration platform, and specifically their Target exploration geology application, to produce a 3-D model of previous drill sections, that Eaglecrest noticed something it hadn’t seen before: the gold was concentrated in vertically-oriented high-grade gold shoots.
improve their hit rates, they need a means to manage their burgeoning data.

Having one platform for working with exploration data and GIS data in three dimensions is where Rasmussen sees greatest advantage. “We can incorporate GIS data and exploration data – from technical information to topographic data – and view it all in three dimensions within our Geosoft platform,” says Rasmussen. “That’s a core strength for our advanced exploration.”

In the earlier phases of exploration, when acquiring prospective ground and selecting targets is important, software like Geosoft Target is able to maximize the value of all available data and enable focused perspective to support drill decisions.

Later, as the company grows and takes on more exploration projects or moves into advanced exploration, their Geosoft platform can grow with them, adapting to larger and more complex datasets as a project or company develops.

As Eaglecrest gathers the information required to produce a resource estimate for San Simon, Target continues to unlock the mysteries of the subsurface to ensure that the drilling is focused and effective. As testament to the value of the 3-D model, Eaglecrest has recently been intersecting some of the highest grades the San Simon property has ever produced.

There is also the opportunity to gather insight beyond their immediate drilling area. “Target is very good for cross-sections and it’s good for planned view maps, so we’ve also been able to incorporate satellite images with surface geochemistry as a means of exploring our project outside of where we’re drilling,” says Rasmussen. “That’s another capability that Target provides.”

“Exploration technology has made huge leaps in how you incorporate data, grid it, and then present it,” says Rasmussen. “The Geosoft platform and Target have worked out really well for us, meeting our technical requirements as well as our business need to effectively present our results to investors.”

Core logging overseen by Walt Odie Edgar.
Innovative techniques help HudBay uncover new potential in old camps

With a tendency to be small, zinc-rich and sometimes difficult to process, Volcanogenic Massive Sulphide (VMS) deposits fell out of favour in the low metal price environment that characterized the late 1990s and early 2000s. But with increasing demand for base metals – including zinc, an early laggard in the metals revival – explorers are returning to some of the old Canadian mining camps known for their VMS production to see if they can find ore deposits missed by their predecessors. This time, they come armed with powerful exploration tools that can see deep into the subsurface, can detect subtle geochemical signatures and/or are capable of integrating multiple historical datasets with more recent information to generate new targets.

From Matagami, Quebec to Flin Flon, Manitoba, they are succeeding. This year alone, several new VMS deposits have been found in mining camps that were thought to have had their day. And in most cases, explorers are crediting improved technology with their success.

VMS deposits are significant sources of copper, zinc and, sometimes, precious metals (e.g. Eskay Creek in British Columbia). The model for VMS deposits, which form on the ocean floor and are one of the few deposit types to have active, modern analogues, is constantly evolving as are the exploration methods to find them.

Take Lalor Lake, a discovery in the Flin Flon – Snow Lake greenstone belt of northwestern Manitoba. The new discovery is showing potential to be a relatively large VMS deposit that could reach production as early as 2010 if ongoing drilling continues to intersect ore-grade mineralization.

Winnipeg-based HudBay Minerals had identified the Chisel Lake Basin where Lalor Lake occurs as prospective, but it was an experimental deep penetrating TDEM (time domain electromagnetic) survey incorporating proprietary “innovative techniques” that identified a large bull’s eye anomaly, according to project geophysicist Alan Vowles.

Using 3-D computer modeling software, HudBay geophysicists defined the conductor as a flat-lying, tabular body within favourable stratigraphy at a depth of 800 m. They plotted it using Geosoft software, and this year, won approval from management to test it with drilling. The company hit 45 m of high-grade zinc and copper in the first hole and sees the potential to develop an 18-20 million tonne deposit grading about 8% zinc and 0.8% copper.

“We believe we have in hand one of the most significant zinc discoveries in Canada in recent years and, of course, we are now fast-tracking that opportunity,” Peter Jones, president and CEO of HudBay told mining analysts in a conference call.

Though relatively deep, Lalor Lake has the advantage of occurring within an established mining belt. The deposit lies within 15 km of the company’s Snow Lake concentrator and just 3 km from a haulage road and power line, so the cost of developing the project would be considerably less than if it were a greenfields discovery.

Inspired by HudBay’s success, other companies in the area are using a combination of geophysics and geochemistry to find similar pockets of mineralization within the Flin Flon- Snow Lake belt, which contains 20 known VMS deposits with an average size of five million tonnes. The belt is covered by Paleozoic limestone sediments, making airborne and ground geophysical tools that can see through the cover particularly useful.

Igneous geochemistry of the mafic and felsic rocks associated with VMS deposits has also been refined to better delineate prospective ground for VMS mineralization. The two rock types can be used in tandem to identify key ingredients required to form VMS deposits – rifting and high-temperature
magnetism – according to S.J. Piercey of Laurentian University in a paper presented at Exploration ’07, a once-a-decade event that covers recent advances in exploration technology.

It was geochemistry that led VMS Ventures Inc., the second largest landholder in the Flin Flon-Snow Lake belt, to the Reed Lake project southwest of Snow Lake, though geophysics confirmed its potential.

Past drilling campaigns had identified altered rhyolites with geochemical signatures typical of the alteration halo around VMS deposits in the belt, prompting the junior to acquire Reed Lake. A subsequent airborne VTEM (Versatile Time-Domain Electromagnetic) survey identified an 800-metre-long southwest-trending anomaly and follow-up drilling hit the jackpot – 10.5 m grading 11.2% copper at a depth of 270 m.

VTEM is a leading airborne geophysical survey system capable of providing high definition, deep penetrating magnetic and electro-magnetic measurements of the underlying rock. The system, produced by Geotech Ltd., is particularly good at detecting copper-zinc massive sulphide deposits.

“We’ve primarily relied on geophysics to guide our drilling,” concurs Lynda Bloom, president of Halo Resources, which is also using VTEM technology to identify mineralization within favourable stratigraphy at the contact between felsic and mafic volcanics in the Sherridon camp in northwest Manitoba, about 70 km northeast of HudBay’s mining and metallurgical complex in Flin Flon and just north of Reed Lake.

The Sherridon property, which contains the past-producing Sherritt Gordon mine, has only recently been considered a VMS target. New thinking is that the felsic gneisses on the property may be equivalent to the suite of rocks that hosts the VMS mineralization in the Flin Flon and Snow Lake camps.

Last year, Halo identified 122 new targets with an airborne survey and, in combination with alteration mapping, prioritized new areas of VMS mineralization for drilling.

An ongoing 30,000 m drill program has intersected moderate widths of copper-zinc mineralization including 1.2% copper and 6.3% zinc over 6.5 m and 1.6% copper and 4.9% zinc over 5.1 m.

Because VMS deposits often occur as a series of lenses, down-hole magnetic and EM surveys to detect conductive sulphide bodies near the borehole are also becoming an increasingly powerful tool for VMS exploration as modeling software improves, says Marc Boivin of MB Geosolutions in a paper presented at Exploration ’07.

Partners Alexis Minerals Corporation and Xstrata Zinc Canada, for instance, used a combination of magnetic and EM borehole surveys to detect buried VMS occurrences on the Ansil West property in the Rouyn-Noranda camp of northern Quebec. He team used the magnetic data from a borehole orientation probe to optimise EM interpretation and drilling locations.

Xstrata inherited West Anvil and other properties from its predecessor Noranda, which revived exploration in the Noranda camp five years ago with the objective of finding more ore in the vicinity of its Horne smelter by using new exploration technologies.

The prolific camp is one of the most studied VMS camps in the world and literally hundreds of companies have scoured its ground over the years since the Horne deposit was discovered.
in 1923, leaving behind not only truckloads of data but the impression that there was nothing left to find.

Xstrata’s toolbox included MegaTEM and VTEM, both airborne EM systems, as well as Titan24 for deep penetration from the surface and advanced borehole survey systems. An integral part of the program was the use of 3-D earth modelling technology, particularly 3-D GIS systems, to integrate and interpret the vast amounts of multidisciplinary historical data with new data.

By developing a series of quantitative queries from conceptual geological models (e.g. proximity queries to select cells within 150 m of typical VMS associations, including hydrothermal alteration and exhalites), the partners were able to use a process of elimination to highlight prospective areas.

The resulting West Anvil discovery hole assayed 3.6% copper over a core length of 53 m, representing the first major base metal discovery in the 17 km² central area of the camp in 25 years, according to a paper given to Exploration ’07 by the Xstrata team.

Xstrata, along with partner Donner Metals Ltd., is also using a combination of 3D data integration, advanced technologies, new concepts and diamond drilling to find ore in the Matagami camp about 300 km north of Noranda. Matagami contains 18 known VMS deposits.

The use of advanced technology to find hidden orebodies in the camp has been ongoing since 1999, when a new EM system survey led to the discovery of the Perseverance deposits containing a resource of 5.1 million tonnes grading 15.8% zinc, 1.24% copper, 29 gpt silver and 0.38 gpt gold.

The main productive horizon in the Matagami camp is a “Key Tuffite” at the top of the felsic volcanics, but earlier this year, Donner made a significant discovery in mafic volcanics about 220 m stratigraphically above the Key Tuffite zone. This initial discovery, and subsequent others, demonstrates the potential for stacked mineralization in the Matagami camp.

The drilling success also validates the multidisciplinary approach the partners have used on the project. In recognition, the Québec Mineral Exploration Association (l’Association de l’Exploration Minière du Québec) awarded the 2007 Prospector of the Year Award to the Xstrata/Donner exploration team.

What lies ahead for VMS exploration in Canada after the significant successes of the past couple of years?

Laurentian’s Piercey says future geochemical research will focus on distinguishing productive from non-productive volcanoes within rifts. This will require a combination of field methods, new analytical techniques and thermodynamic modeling to better understand the way tectonic, igneous and hydrothermal processes interact.

In the geophysics field, Boivin says further improvements in depth penetration of geophysical tools will be the key to discovering more deep orebodies that can contribute to the next generation of base metal production in Canada.

And finally, 3-D mapping and modeling software and GIS systems continue to evolve. Exploration software companies, like Geosoft, are giving companies more powerful tools to visualize, integrate and interpret both historical and new data. The end result is new techniques and better tools for accessing and working with their data – whether geophysics, geochemistry, drilling or 3D models.

Bring on the old mining camps.

Geotech’s airborne VTEM technology provides high definition, deep penetrating magnetic and electro-magnetic measurements of the underlying rock.
Data integration for discovery: a Sudbury success story

Wallbridge Mining, Xstrata Nickel and Vale Inco created a rare opportunity to generate new targets outside of the Sudbury Basin in northern Ontario when they decided to pool their exploration data for maximum impact on the western margin of the Sudbury Igneous Complex (SIC).

The Trill area covers several square kilometres of the Sudbury Contact footwall, the rocks that host the majority of nickel-copper-gold-PGE deposits in the Sudbury basin. The area presented an opportunity to refine the exploration model outside the boundaries of the basin when the main players shared results from 3-D seismic surveys and detailed aeromagnetic work. Bernd Milkereit of the University of Toronto guided the data integration project with the help of several experts in the fields of impact modelling, seismics and geophysical potential fields.

One component of the project integrated the geophysical potential fields data with rock property measurements from drill core and surface geology to create an improved 3-D model of the SIC and footwall contact over an area of about 100 km².

“It was a unique chance to get data from all three companies, and compile it all. Companies don’t normally exchange information like that, and if they do, it takes time to work with all the data to level and compile it. They normally can’t afford that time.”

-Hernan Ugalde
Research Scientist, McMaster University

The data integration project used new seismic methods to model the sub-crater geological environment and recognize potentially mineralized sub-crater structures, generated algorithms that distinguish between sulphide-rich and oxide-rich seismic reflectors and identified opportunities for future work. Ugalde’s model based on gravity and magnetic data also identified possible new lithologies that have not yet been mapped and may have an impact on future exploration.

Wallbridge is currently drilling targets identified by a deep penetrating Titan-24 IP/MT survey on the Trill property. The survey covered a mineralized offset dyke, similar to the dyke that hosts the Copper Cliff mine, and the surrounding rocks, including a recently-discovered broad, arcuate belt of weakly mineralized Sudbury breccia.

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The survey covered a mineralized offset dyke, similar to the dyke that hosts the Copper Cliff mine, and the surrounding rocks, including a recently-discovered broad, arcuate belt of weakly mineralized Sudbury breccia.
Etruscan develops and shares exploration knowledge for advantage in their developing projects

As the first bars of gold are poured at Etruscan’s Youga deposit in Burkina Faso, project geologist Geoff Day reflects on the company’s progress in bringing Youga from an exploration project to a producing gold mine – and how they plan to replicate that success.

One thing is for sure. Etruscan’s strength in developing and sharing exploration knowledge is an advantage that will continue to play heavily in their developing projects.

From a starting point in Niger 13 years ago, Etruscan is now one of the largest mineral rights holders in Western Africa. With a property portfolio that spans thousands of square kilometres, the new gold producer manages a growing assemblage of exploration programs in Burkina Faso, Côte d’Ivoire, Ghana, Mali, Namibia, Niger, and South Africa.

“Our focus, from the start, has been on developing exploration teams in the countries within which we operate,” said Mr. Day. “Key to this is finding local personnel with experience and knowledge of the country, its administrative policies and local geology. There’s a lot of value in having people on our team who might have walked over the prospective ground we are exploring.”

Based in Etruscan’s head office in Nova Scotia, Mr. Day manages the company’s data hub, a growing corporate map database that stores and provides not only information but knowledge embedded in plan maps, two dimensional exploration maps, drilling plan maps and drill sections for advanced analysis.

While some explorers are content to move from project to project using the tools at hand, Etruscan has taken care to establish simple corporate guidelines, and a common exploration platform to support its project development. This has ensured it can easily capture and share the rich experience and knowledge being developed.

Etruscan adopted Geosoft as their corporate exploration management platform in 1995, and this is the standard that is maintained to date. “We’ve found it easy to use Geosoft as our corporate standard because we’re able to bring in information from any of the main GIS and resource systems used in exploration,” said Mr. Day.

“Geosoft is able to bring in MapInfo files, ArcGIS files, AutoCAD DXF files and a very wide range of remotely sensed data products. It can also bring in files from Surpac and other resource packages. It’s very flexible in that respect.”

Inherently when you are collecting historical data and obtaining data products from local government agencies you will encounter many different formats. Having software that can import the disparate data formats used in the industry has definitely aided in rapid compilation of information and target generation, according to Mr. Day.

As important, it has also made data sharing between the field and managers faster, easier and more productive.

“It’s taken for granted that when someone makes a map at the project site and sends it to one of the local managers or Canada, they’re going be able to open it at the other end and see exactly what the geologist sees in the field,” said Mr. Day. “They quickly understand what is being presented, as opposed to struggling to recreate a map or section using a different platform.”

Etruscan has been exploring for gold and diamonds in Africa for more than 13 years. Now the junior has just made the significant leap from explorer to producer first as a JV partner at the Samira gold mine in Niger and now by opening its Youga gold mine in Burkina Faso in March 2008.

Etruscan used Geosoft Target as the principle exploration platform at its Youga gold mine both during the feasibility stage and currently while developing additional resources outside the mine site, to monitor the progress of drilling
programs. Now Youga is an 88,000 ounce-per-year producer with an expected mine life of six and a half years.

Mr. Day said Target’s most useful features include being able to make clean and informative colour contour images from 2-D geochemical and geophysical data and, by using the map and section modules, visualize deposits during drilling campaigns.

Those features will become increasingly useful as the company continues to expand on African soil. Having just poured its first gold at Youga, Etruscan is working towards mining its Agbaou gold deposit in Côte d’Ivoire, where resources add up to more than one million ounces of gold. A feasibility study is currently underway in preparation for production in 2010.

The company, with JV partner Resolute Mining Limited, is also starting a deep drilling program at the Finkolo gold project in Mali, where resources have increased by 53% to close to 750,000 ounces. And at the Blue Gum diamond project in South Africa, a potential alluvial diamond producer, a prefeasibility study is currently underway.

As Etruscan continues to grow, with the aim of starting a second gold mine in Côte d’Ivoire in 2010, it needs the capability to adapt to the company’s larger and increasingly complex datasets.

“As the company builds it’s portfolio of exploration projects and the scope of our corporate database increases, we will be migrating towards the integration of ArcGIS,” says Mr. Day. “With Target for ArcGIS, we can continue to use Geosoft for drilling data management, 2D interpolation and color contour image visualization in this integrated environment.”
Lonmin combines geophysics and geochemistry to narrow the search for deposits

Geochemical tools that can probe a little deeper are becoming increasingly important complements to geophysics in the search for buried ore deposits, but quality control remains the discipline's biggest bugaboo.

"Exploration managers recognize that this is the way to go in future because just about everything that can be found by walking through the bush has been found already," says Dale Sutherland, Director of Research Activation Laboratories Ltd. (Actlabs). "Now everything we discover is buried."

The demand for new and improved techniques to help find the next generation of ore deposits has not escaped the attention of collaborative research groups such as the Canadian Mining Industry Research Organization (CAMIRO). Several of the projects sponsored by CAMIRO's consortium of private companies are focused on deep exploration, including a 3-phase project investigating soil gas geochemistry and another multi-phase project looking at deep-penetrating geochemistry.

Still, quality control remains the largest barrier to the use of geochemistry in mineral exploration. Many companies are hesitant to rely on geochemical results because there is so much room for error in the sampling and analysis stages, and again, when reporting and presenting results.

"Geochemistry can be very useful, but only if you rigorously follow procedures," says Tom Lane, director of research development for CAMIRO's exploration division. "You have to be careful about variability in the lab as well as in the field."

These challenges are never far from the mind of geochemist Dermot Smyth, Northern Ireland Project Manager for Lonmin Plc, as he sorts through reams of public and private data from a vast, boggy region of Northern Ireland.

His job is to find PGE-bearing deposits associated with the Antrim basalts that underlie the northeast part of the country. As the world's third-largest PGE producer, Lonmin was drawn to the area after the Geological Survey of Northern Ireland (GSNI) released results of the Tellus project, a comprehensive geophysical and geochemical survey over 14,000 sq. km of the country.

Completed in 2007, the Tellus project collected high-resolution airborne magnetic, electromagnetic and radiometric data as well as trace element datasets for soil, sediment and stream water samples. The airborne survey delineated new structures within the Antrim Lava Group, and the ground geochemical surveys identified elevated values of platinum group elements and base metals in the overlying soils and stream sediments.

When the results were released, the area of land licensed for prospecting in Northern Ireland increased from 15% to 70%. Lonmin secured nine separate licenses covering the Antrim basalts, with an additional license over a gravity anomaly in the southwest corner of Northern Ireland for a total of about 2,250 sq. km of prospective ground.

Now Smyth faces the daunting task of narrowing down this area enough to establish drill targets, by integrating the Tellus geochemical and geophysical datasets with incoming data from Lonmin's own exploration program. He has at least one competitive advantage, though: he was geochemistry manager on the Tellus project before joining Lonmin in March 2008.

His first pass re-investigated the Tellus geochemical datasets to define discrete areas for high density soil sampling. Next, Smyth combined the Tellus geochemical and geophysical data to investigate source-anomaly relationships. Now he and his colleagues are inputting Lonmin's own datasets into the exploration model to provide better direction for further exploration.

So far, Lonmin has completed a Full Tensor Gravity Gradiometry (Air-FTG®) survey over 3,579 line km and collected some 2,000 soil samples as part of an ongoing geochemical sampling program.
“We have licensed the Tellus datasets and have spent a lot of time working with them and finding the anomalies within them,” he says. “There are many lifetimes of interpretation in those datasets, particularly when they are combined with the datasets that we have collected as part of our exploration strategy.”

Though he was initially doing most of the data plotting and analysis himself, Smyth now shares the datasets with the junior geologists in his office, who can contribute to the gridding using Geosoft’s Geochemistry for ArcGIS extension.

“Now that we have the geochemical module, the junior geologists are involved in making preliminary maps to confirm that we are working in the right area and are on the right path in terms of our exploration strategy,” says Smyth. “At the moment, we are plotting up data to produce grids; then we add the topography and geology to produce maps that scale from 1:250,000 to 1:10,000. Part of the ethos of the office and Lonmin has been to train the junior geologists in new exploration techniques. This includes both in-the-field sampling methods and office tasks such as target generation.”

He is less prepared to abdicate the intricate task of quality control, even though Geosoft’s module comes with built-in QC standards.

He says the QC feature is useful for geoscientists who don’t have in-depth knowledge of geochemistry because it allows quick plotting of duplicates and replicates and produces plots of standards, showing how they vary over time.

“The Geosoft module is great for quickly evaluating if the laboratory data is within set limits, and by having quality control built into the module, it becomes a standard procedure,” he says. “But as a geochemist, I need more detail and more control over the integrity of the data.”

Smyth brought to Lonmin his own set of exploration standards that he developed as part of his PhD in exploration geochemistry and then refined during his time as geochemistry manager for the Geological Survey of Northern Ireland. The standards include methods of sampling, systems of recording samples, systems of quality control, and best practices for exploration.

The thick layer of glacial till and peat in Northern Ireland, for instance, creates challenges at the sampling stage. Boulder layers in the till can make collecting samples by auger difficult, and the high organic content of the peat promotes preferential absorption of specific trace elements (e.g., copper and palladium) to the organic matter. Smyth’s rigorous sampling and interpretation protocols prevent misleading information from distorting results.

At the gridding stage, Smyth is working to establish a set of parameters that can be modified as data is added.

“The interaction with Geosoft has been very beneficial in understanding the intricate aspects of menus such as gridding in Geochemistry for ArcGIS,” says Smyth. “I’ve also suggested new features that I’d like to see implemented in future releases, such as interactive real-time visualization of geochemical data to aid geologists in target definition.”

Although the Lonmin exploration program is not yet advanced enough to justify using the powerful visualization tools that come with the geochemistry extension, Smyth is looking forward to producing 3-D maps and sections that can be used to illustrate the latest results in a meaningful way as data accumulates.

In the meantime, his team is producing preliminary maps quickly and easily. “You might have a call from headquarters about what the data looks like and within a few minutes you can produce a basic plot that shows the major trends in the data with overlays such as geology added.”

He is also keen to make more use of the geochemistry extension’s statistical tools such as the interactive histogram that can display selected field data and update data values whenever a value in the corresponding database changes.

And if and when Lonmin reaches the drilling stage, Smyth will be integrating his surface geochemical results with assay results from drill holes using the same tools in Target for ArcGIS, Geosoft’s subsurface geology extension, to produce 3-D maps that can lead to a better understanding of the results.

The combination of comprehensive geophysical and geochemical datasets, the technology to integrate them, and a quality control program that prevents errors and distortions will give Lonmin the best chance of finding buried PGE deposits underneath Northern Ireland.
Vale increases efficiency with better integration of their GIS and exploration software

Exploration software and Geographic Information Systems (GIS) are essential for geologists searching for petroleum and mineral deposits. With discoveries harder to find, geoscientists are collecting more data than ever before and examining their findings with greater scrutiny.

The key to keeping the whole process efficient and focused is technology.

GIS and exploration software has come a long way in the past 10 years, especially visualization and 3-D modeling. But, until recently, the inability to work and share data between earth mapping software like Geosoft and ESRI’s ArcGIS application environments has left a gap for explorers.

As software developers on both sides of the gap begin to collaborate, technology and solutions are now evolving to allow geoscientists to share data easily between their mapping and GIS environments.

“As we become more global, being able to share information and expertise with other regions is increasingly important.”

- Ana Maria Goncalves
  Information Manager
  Exploration and Project Development Division

Geographic information systems have been used for 2-D mapping for decades; however, the limited ability of GIS to visualize below the earth’s surface means exploration companies have had to resort to work-arounds. As a result, geoscientists tend to store their geological, geophysical and geochemical information in one database, and their surface spatial (GIS) data in another, with no efficient way of merging the two.

Although geoscientific data can be moved in and out of a GIS environment, doing so is time-consuming and can result in lost, changed or corrupted data.

For consulting geophysicists like Michal Ruder, whose livelihood depends on delivering accurate, up-to-date maps to clients in the oil and gas sector, recent advances in integrated GIS exploration tools mean smoother workflow and higher productivity in both 2D and 3D environments.

“Most of the time I work with gridded data, and I can manipulate it with ease using Geosoft exploration software, Oasis montaj and Target,” says Ruder, who is principal of Denver-based Wintermoon Geotechnologies. “That’s not the whole solution, though, because after I’ve processed the gridded data, I need to integrate it with vector data. That means putting my magnetic and gravity data into the geographic context of my exploration problem.”

After moving the data into ESRI’s ArcGIS, Ruder uses Geosoft extension software, Target for ArcGIS, to see geographic and other associations. She then searches for patterns in the Geosoft grids and ArcGIS vector data.

Geosoft is working to close the exploration GIS gap entirely with its recent introduction of earth mapping software that has ArcGIS Engine technologies built in. The new generation of Geosoft Target and Oasis montaj software allows geoscientists to work seamlessly between their Geosoft and ESRI environments using ESRI technology to display Arc.mxd and .lyr files without leaving the Geosoft environment.

The breakthrough is expected to boost productivity and result in smoother workflows for geoscientists in both the
private and public sectors. It will also prevent data from being changed or lost.

"With this software, geoscientists have greater flexibility and control in achieving the results they need," says Louis Racic, Director of Product Management for Geosoft Inc.

Closing the gap between GIS and geoscience also benefits large companies with multiple users and data sets. The more integrated their exploration software is, the less likelihood of costly mistakes or missed opportunities for discovery.

Ana Maria Gonçalves is information manager for the exploration and project development division of Brazil-based Companhia Vale do Rio Doce (Vale), one of the largest mining companies in the world with 14 regional exploration offices. "As we become more global, being able to share information and expertise with other regions is increasingly important," says Gonçalves. "In the past, our exploration applications didn’t connect with our GIS. We had to make all sorts of conversions, and with data sets such as geophysical grids, you can lose important information when you try to convert the data to other formats."

Adopting Geosoft Target for ArcGIS has done away with the need for data conversion, says Gonçalves. "Using Target for ArcGIS, our geoscientists can work with their geophysical, geochemical and geological data within the ArcGIS environment much more quickly and effectively."

On a broader scale, trends in mineral exploration show there’s a need for better integration of GIS and geosciences. Most ore deposits with a surface expression have already been found, so 3-D information from the subsurface – particularly geophysical data – is becoming the main pathfinder to discoveries.

Taking a tool known for excellent spatial analysis on a 2-D plane and integrating it with software that can handle multiple 3-D data sets from the subsurface makes the search for these deposits a whole lot easier. It’s a development whose time has come."

BACK TO GIS WORKFLOWS
Hunsaker adopts exploration software and GIS as a critical part of his tool kit

As a well-established consulting geologist working in the middle of the Nevada goldfields, Buster Hunsaker has adopted software and GIS as a critical part of his exploration tool kit – both in the field and in the office.

Being faster and more efficient in using technology for geological insight and project management has given him an edge in what can be a competitive business, especially during cyclical downturns in the mining industry like the one we are experiencing today. More important, it’s enabled him to produce better results for his customers.

“Our expertise in GIS has opened a lot of doors for us,” says Hunsaker, who specializes in early stage gold exploration projects. “As a consultant, bringing both our experience and technology to bear on projects is a tremendous advantage. We see a real gap in the application of technology to exploration. There are not as many senior people applying it as there should be.”

The Carlin gold belt in north-central Nevada is one of the richest in the world. Hunsaker estimates that about 8% of global gold production comes from deposits within a 100 km of his headquarters in Elko. Because the state has been so intensively mined and explored over the years, there is a rich store of available data, including a comprehensive subsurface database.

That’s where the application of digital technology comes in handy. Without the tools to process and make sense of it, all that data would be mindboggling at best and virtually useless at worst.

Using ESRI’s ArcView to visualize geographic data in combination with Geosoft’s Target for ArcGIS to mange drill projects, Hunsaker is able to integrate volumes of old and new data, both public and private, to highlight areas with mineral potential, work within different scales, and generate 3-D renderings of the information.

“There are a lot of new geological concepts coming out in Nevada,” he says. “We can take the new geologic maps and apply existing data to them and it gives us new ways to interpret the existing data.”

Though Hunsaker has been using GIS for years, many mining companies are just beginning to see the value of integrating geological, geochemical and geophysical data from government geological surveys – which are increasingly publishing data in ESRI formats – with their own exploration data as part of their workflow.

The most obvious advantages are efficiencies in project and data management, time savings, increased productivity and better decision making.

The introduction of extensions for GIS systems such as Geosoft’s Target for ArcGIS has made the suite of spatial analysis tools even more powerful by providing the ability to visualize subsurface geological data within a GIS environment.

“We wouldn’t consider doing something without the third dimension, if we have drill data available,” says Hunsaker, “and Target provides the ability to handle that third dimension quickly and easily. That’s both the geophysics as well as the drillhole data.”

“Having the 3D perspective also means we’re quite comfortable bringing in a lot of data because we’re confident we can handle it and it won’t overwhelm us.” says Hunsaker.

Hunsaker’s adoption of GIS for mineral exploration began 12 years ago when he was looking for an efficient way to track federal mining claims. A colleague directed him to ArcView and there has been no looking back.

“ArcView’s ability to handle large amounts of data led us to expand from land title data to all kinds of geologic data,” he says.

As Hunsaker’s experience with GIS grew, he was able to
take the mostly raster data available in Nevada and convert it into GIS format. That gives him another edge over the competition. “From a business viewpoint it has become a good income stream for us.”

Another unique aspect of Hunsaker’s approach to exploration is his use of ESRI’s ArcPad, a software program that allows data capture in the field on ultra-rugged field computers or hand-held devices. The software is commonly used in urban areas where there is easy access to cell phone networks, but is just beginning to penetrate the mineral exploration industry.

Using ArcPad has allowed Hunsaker to generate data in GIS format while he is in the field, resulting in an instant compatibility between field and office that would not be possible were he still using a notebook to scribble observations about outcrops and other geological information.

In the historic gold mining district of Wonder, Nevada, for instance, Hunsaker used ESRI’s ArcMap to convert 34 years of data generated by his client and a century of archival data into a standard GIS coordinate system. He then took the subsurface data – including results from more than 100 boreholes – and applied Geosoft’s Target for ArcGIS to generate cross sections.

He is adding even more value to the historic data by using ArcPad to complete additional surface mapping in the field, creating another layer of digital information that can be used to explore the district.

“The ArcMap model and the Geosoft extension allowed me to generate sections that have the latest mapping from ArcPad windowed in the plan portion, straight out of the field,” he says.

As important as it is today, adapting technology to exploration will be even more essential in the future.

“We are generating massive amounts of data, all of it digital and most in GIS format. You need technology to effectively explore all this new data and fit it in to your projects,” says Hunsaker. “The new technology that’s coming on stream, like Geosoft DAP and Dapple is phenomenal. You can take an AirCard even in an area where you have limited coverage, and you can take a cell connection with your tablet computer and access these data sets.”

“Don’t even think about the old tools,” he advises other explorationists. “Think about the new tools that are coming on board. You need to become really efficient with data.”
Gold Fields applies technology to get the best value out of its data

Industry usage of drillhole and mapping software is growing day-by-day. This is largely due to speed and efficiency advantages when dealing with greater volumes and diversity of data. Exploration projects can have upwards of five hundred drillholes. As exploration projects get bigger and the number of drillholes and other datasets increase, effective software has become essential for managing and visualizing these large datasets.

Major and junior exploration companies each bring their own unique and diverse perspective to the business of exploration, however, when it comes to mapping software there is a common view on essential requirements, and emerging priorities. With so many options available, focusing on the software functionality that you require from your exploration mapping software is considered a good strategy for maximizing efficiency and your exploration investment dollars.

POWER MAPPING FOR EXPLORATION

Mark Parker, Managing Director of African Eagle Resources plc, a London AIM-listed junior exploration company operating in East Africa had a clear view of his needs when looking for mapping software, “We knew that what we needed was a good, computer-based means of archiving and visualizing our drillhole data.”

Parker has been using Geosoft’s mapping system for geophysics and geochemistry since 1990 and this past year African Eagle added Geosoft’s Target drillhole software to their system. The ability to work efficiently with all their data in one integrated environment was a key consideration.

“Our Oasis montaj system provides a powerful way of viewing and visualizing the data,” explains Parker “and it allows you to combine different data sets, in different ways, to make the best use of all the data you have available.”

Visualization has played a critical role in African Eagle’s exploration projects. “In a situation where you don’t have any outcrop, which is typical in Tanzania, you’re relying very much on your drillholes to do basic geological mapping, as well as actual mineralization interpretation,” says Parker. “In this case, it’s quite important that you have powerful tools for visualization which allow you to make the best use of the data you have and to interpret the data to the maximum.”

Integration with their Geographic Information System (GIS) environment has become a greater priority for African Eagle. In addition to meeting internal needs, GIS integration allows data to be shared effectively with African Eagle’s major exploration partners.

Exploration projects often involve two or more companies working together within joint ventures, option agreements and other partnership arrangements. “As an example the partner on one of African Eagles’ Tanzania projects uses ArcView,” explains Parker. “In working with them, we need to supply formats that can be viewed in ArcGIS. If we can supply things in native ArcGIS so much the better.”

Parker sees the market introduction of Geosoft’s Target for ArcGIS, a drillhole and mapping extension for ESRI’s ArcGIS, as a positive step towards meeting their integration needs. “Target for ArcGIS will allow us to exchange our data, and particularly our visualizations, as freely as possible with ArcGIS users.”

EXPLORING IN GIS

Julian Misiewicz, Consulting Geologist for Africa and Europe with Gold Fields International, a South Africa-based major global gold producer makes a distinction between essential and specialist-use mapping functionality.

“In exploration, you need three basics: database software, a GIS package, and, definitely, a drillhole processing package,”
says Misiewicz. “All three are essential.” Having met those needs, if cost is not a factor, specialized three dimensional modeling packages are also very beneficial.

Gold Fields uses ArcGIS as its GIS platform for exploration. Recently, they purchased Geosoft’s Target for ArcGIS for its ability to provide integrated drillhole plotting and surface mapping capabilities in ArcGIS. “ArcGIS is an outstanding package”, says Misiewicz, “and Target provides the facility to plot drillholes within ArcGIS.”

Using Target for ArcGIS drillhole mapping software is quick and easy. It provides the facility for drillhole plotting, as well as surface mapping, contouring, plotting and treatment of geochemical and geophysical data in ArcGIS. One doesn’t have to be a specialist or geophysicist to process the data, and a geologist working with multiple data sets can do it easily using Target within ArcView.

Efficiency in data processing is important, but ultimately the proof, and the power, is in seeing your data. “The better you can see and plot your data,” says Misiewicz, “the better you are able to understand it, firstly, and the better you are able to get the best value out of that data, and to use it effectively throughout the business environment.”

For many years, specialized exploration software, such as Geosoft’s Oasis montaj has provided the ability to expertly visualize geophysical, geochemical and geological data within an integrated environment. “One of the things that Geosoft has been very good at, is visualization,” says Misiewicz. “Oasis montaj is an excellent package for creating beautiful images of geophysical and geochemical data.”

Visualization technology has come a long way. Advanced rendering techniques together with three dimensional modeling applications have added a lot of power to the way you can view and interpret your data.

Until recently, however, visualization tools for exploration data in the GIS environment have been very limited. This is rapidly changing, as integration of exploration software with broad-based GIS systems takes greater priority in the industry. Target, as an extension to ArcView, is seen as providing a necessary solution.

Using Target, geologists are able to bring in a borehole, and plot the trace of that borehole directly on their map. They can also plot sections straight out of their ArcGIS package, and are able to incorporate all the information they have in their GIS package, the geological mapping, the geophysics images and the geochemistry in particular, in their interpretations.

New exploration software is tasked with meeting the growing need for seamless integration of exploration datasets within the broad-based GIS environment, while continuing to meet the rigorous mapping and processing requirements of geological users.

At the end of the day, explorationists use computerized methods because it’s quicker and better than doing it by hand. The key advantage that exploration drillhole and mapping software, such as Target and Target for ArcGIS, bring is the capability to handle large volumes of data and visualize a thousand or more drillholes at a time, allowing geologists to create and revise maps and sections quickly and easily, while formulating and fine-tuning their understanding of their targets.
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Founded by geoscientists in 1986, Geosoft is a world leader in software and solutions for earth exploration. Harnessing the power of information for exploration, Geosoft helps to accelerate knowledge development and unlock opportunities within exploration industries and the geosciences. The company ranks among the top 150 software companies in Canada, with more than 5,000 customers in over 100 countries worldwide. Geosoft customers are among the most successful explorers in the world. Our mission is to make your earth data experience work, so you are free to explore.

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