

# SAFE DISCOVERY IN ACTION

Working in hostile environments and with an industry-average discovery rate of one find for every thousand drill targets, exploring for resources can be a frustrating mission. But persistence and creative thinking are giving Anglo American an edge. **Andrea Chipman** reports.

**O**vercoming the limits of geology and geography while protecting fragile ecosystems and engaging communities are the key challenges of finding new resources. Over the past decade, Anglo American's exploration unit has recorded considerable success, making 15 significant discoveries containing over 50 million tonnes of base metals. The company's discovery costs are in the lower quartile of the industry benchmark, while its resource quality is in the top quartile.

Along the way, Anglo American has built on its high safety standards. Since March 2008, the team has had no fatalities and experienced an 80 per cent reduction in the lost-time injury frequency rate across global operations.

Such progress is due, in no small part, to having experienced people, says group head of exploration Tracey Kerr. "Successful and safe exploration and discovery is very much a team effort – having the right people in the right place with the right skills. We pride ourselves on having a team who, while they come from different backgrounds and with different levels of expertise, all share a deep passion for the field of geology and are committed to responsible exploration.

"Like others in the industry, we realise that competition for talent is fierce and we need to equip our teams – not just now, but also in years to come – with the skills and opportunities to grow their technical knowledge, as well as their ability to be leaders in their own right. After all, they will be the ones making our future safe discoveries."

Anglo American's exploration team has expanded its operations in both uncharted greenfield territory and brownfield sites on five continents, making discoveries of copper, nickel, platinum group metals and other resources. But making greenfield discoveries is becoming tougher for the whole industry, with access to land restricted by both physical geography and the socio-political context. It is becoming increasingly important for teams to balance geological prospectivity with country risk, focusing on the *what* and *where* of exploration, rather than the *how*.

Graham Brown, group head of geosciences, says: "Years of operating around the world in key frontiers has given the Anglo American exploration team strategic insights that help us identify and assess new geographies, commodities and business development opportunities – and secure our licence to operate. But at the same time, there is no room for complacency. We need to continue to adapt to the world



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Exploration geologist Esmé Tristram examines copper-bearing ore near Los Sulfatos, high in the Chilean Andes

**01**

Project geologist Marc-Antoine Laporte examines a sub-crop rock exposure in the Canadian tundra, one of the more challenging environments for Anglo American's exploration team

around us. In short, the key to future success and sustainable exploration is delivery across multiple areas, including advancing exploration frontiers, maintaining access to land, mineral resources and talent, and providing options for growth through discovery, acquisition and innovation."

**PERSISTENCE AND DETERMINATION**

Anglo American's decade of safe discovery has been driven by three key traits – persistence, innovation and the testing of new frontiers.

Identifying promising deposits in large, remote and inhospitable regions can at times be like looking for a needle in a haystack. On average, Anglo American makes one find for every hundred drill targets it tests – much better than the industry's 'rule of thumb' of more than a thousand to one.

The discovery of the Sakatti nickel deposit, 150 kilometres north of the Arctic Circle in Finland, was a career highlight

for senior project geologist Stephanie Klatt. "It's what every exploration geologist dreams of. On a personal level, it represents the art of what is possible – when a team comes together and is given the belief, space and tools needed to think, explore and try out ideas, no matter how impractical they might appear."

In the Los Sulfatos area of Los Bronces in Chile, helicopter- and mule-supported drilling and movement of supplies were needed to identify potential copper targets in the remote Andean terrain. Their discovery five years ago was complicated by the high altitude and harsh environmental conditions, such as extreme weather and very steep terrain. Furthermore, field activities were limited to the summer months from December through March. It was only after Anglo American had drilled its 10th hole that the size and quality of the deposit became apparent – and this was after a century of mining and exploration activities in the region. The discoveries here have increased the area's Inferred Mineral Resource by 1.2 billion tonnes.

"There is no doubt the conditions can be harsh and tough," says exploration geologist Esmé Tristram, "but you remember the passion you have for geology and making a difference. That's what makes the hours spent studying maps and logging metres and metres of core all worthwhile."

**01**

**INNOVATION AND CREATIVE THINKING**

Creative and scientific thinking is essential for gathering information. It proved key in Anglo American's exploration nickel project in Jacaré, Brazil. Old satellite image data was used to map biodiversity over a 60 km<sup>2</sup> region. A modelling technique normally used to calculate the resource value from a deposit was also used to estimate the biomass and biodiversity of vegetation across the entire deposit.

It was senior geologist Giorgio Sartorato's idea to use data from the airborne radar survey to obtain topographic information. "It gives me great satisfaction to be able to bring something new to the company – an idea or a new application. I'm sure this technique could be used in similar locations all over the world, for instance deposits in forested areas in Oceania or even in Africa."

The process will be hugely beneficial to the mine planners looking to understand the biodiversity impacts in preparing mitigation solutions right through the lifecycle of a potential mine.



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## QUANTUM LEAP

A Low Temperature Superconducting Quantum Interference Device (LT-SQUID) is a sensitive magnetometer that measures extremely sensitive magnetic fields by using superconducting loops. The LT-SQUID technology is considered particularly useful for discriminating between discrete buried metallic deposits, such as nickel sulphides, which can be masked by other rock types that can also hold an electric current – for example, shale. LT-SQUID has been employed by Anglo American field teams to help search for so-called ‘blind’ deposits that have no visible expression on the ground surface.

**02** At the Sakatti nickel project in northern Finland, project geoscientist Circé Malo-Lalande uses LT-SQUID (Low Temperature Superconducting Quantum Interference Device) technology to measure magnetic fields in the search for new deposits

Anglo American has developed new technologies on its own or in partnership with other companies in order to break new ground. Specialised Low Temperature Superconducting Quantum Interference Device (LT-SQUID) technology, for example, has been exclusively licensed to the exploration unit, while advances in tunnel-boring machine (TBM) technology have enabled the team to explore where previously they would not have been able to go.

LT-SQUID has been used in the discovery of three deposits by the exploration team and is a key technology for Anglo American field teams.

TBM technology was used to provide future exploration and resource drilling access for exploration teams seeking new copper deposits at Los Sulfatos. The technology allows for significant improvements in terms of development timeframes, safety and overall project risk in comparison with the more traditional drill and blast approach.

### WORKING ON ‘THE FRONTIER’

Working in far-flung, less familiar regions represents a microcosm of all aspects of exploration – from science and technology to people and safety. The biggest initial challenge is physical geography, be it the arctic tundra of northern Canada and Finland, the high altitudes of Chile

and Peru or the often-impenetrable jungle terrain of the Democratic Republic of Congo.

Travelling to and communicating with field work areas and keeping staff safe requires careful planning by field teams so they can identify risks and manage them. Anglo American’s exploration unit has produced a Safety, Health, Environment and Community guidance document, *The Exploration SHEC Way*, which helps its teams go through a detailed risk assessment and to plan field programmes.

The numerous transport options that are needed for exploring hostile environments and underdeveloped areas, including helicopters, mules, 4x4 vehicles and snowmobiles, have their own specific risks. And the monitoring of air safety procedures has been an essential part of exploration in areas of South America, where measures have ranged from audits of airline safety, hazard identification and risk assessment and mitigation to ensuring that helicopters, pilots and engineers are compliant with safety standards.

Yet, as well as navigating the complicated logistics of a ‘frontier’ project, exploration teams must manage the expectations and concerns of multiple stakeholders, balance their different interests and communicate how and when field work will be carried out.



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Understanding the strong bonds local people have with their land can also have a key impact on the way exploration teams operate within a frontier region. In the Nunavik region of northern Quebec in Canada, Anglo American's project team holds formal meetings with community leaders twice a year to give them an overview of work carried out and plans for the upcoming programme.

Gaining the approval of local indigenous communities is also crucial to maintaining a licence to operate – and the trust that goes with it. It's a long process, with few shortcuts.

In Colombia, Anglo American's local community relations team worked with the indigenous communities in the Putumayo and Antioquia regions for two years to understand their laws and traditions and to build trust and understanding, thereby helping to resolve concerns and dispel myths about the company's copper-exploration project there.

Country community relations coordinator Laura Garcia and her team are in charge of drawing up procedures, social tools and engagement plans for each project across the country, which often requires previous consultation with the communities involved before Anglo American's

**01** Anglo American's Laura Garcia talks to community members in Colombia, where residents are seeking more opportunities to contribute to local developments



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03

**02** Vast expanses of jungle terrain, as at Jacaré in Brazil's Amazonian region, present a challenging working environment for geologists

**03** At the Musgraves project in Australia, a helicopter survey allowed tribal elders to identify within hours 'dreaming' and hunting trails and other ceremonial sites which needed to be protected

exploration team can bring in any equipment. It pays to invest the time in building relationships, says Laura. "Nowadays in Colombia, communities are more informed, more aware of their rights and better prepared to face the demands of the modern world. They are changing their minds, and that poses an important challenge to our company – to help them make clear decisions by demonstrating what value we can bring.

"And that's what we are doing in Colombia, adapting to this new reality and implementing the best social practices, working closely with communities and encouraging them to participate in the projects, so that they become *their* projects – and eventually *our* projects. This way, we are ensuring the

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sustainability of our business and supporting the social development for the country."

In the Musgraves region of central Australia, traditional landowners had closed the area to all mineral exploration between the 1960s and the mid-1990s because many large ranges and outcrops in the region were important religious sites and 'dreaming' trails for the indigenous population. Anglo American's exploration team established the trust of the local communities, on one occasion taking elders from three communities on a 10-day helicopter survey. The survey helped identify sensitive sites and expedite the process of locating dreaming trails and other ceremonial sites that would then be designated as no-go zones, while ultimately opening up other areas for low-impact work. By also voluntarily reporting some sites of significance that had been missed during the helicopter survey, Anglo American further improved the level of trust between the company and the community.

Senior geologist Paul Polito says he won't forget his experience in the region: "From a purely exploration point of view, it can be frustrating working in an area with many cultural restrictions, but from a social aspect and at a personal level, it has been very rewarding. Some of these staff members have been gifted the stories of that dreaming trail first hand. That's a rare privilege even for some of the district anthropologists who have worked in the areas for many years."

## FUTURE EXPLORATION

Clearly, successful exploration and discovery is a major differentiator in terms of leadership, expertise and value creation. In the past, the priority was finding and building mines, whereas today the focus remains not only on creating value but also building partnerships with host communities.

Future deposits are likely to be harder to uncover, especially in harsher physical and socio-political environments. But with the industry dependent on viable finds, the determination of exploration teams is not diminishing. And investment remains high, with Anglo American and De Beers' combined exploration expenditure likely to be in the region of \$150 million in 2012. Determination, technical expertise, innovation and a richer understanding of local issues may well ensure the next decade is as promising as the last. 