

Papua New Guinea

Risk and reward in the land of the unexpected

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Cover photo is of the Collecting Machine chassis, one of three Seafloor Production Tools being built for the Solwara 1 Project, courtesy of Nautilus Minerals.



Papua New Guinea

Mining's Last Frontier

Papua New Guinea, 37 years after independence, retains the alluring veil of mystery that for centuries has attracted a particular mix of missionaries, mercenaries and misfits. Covered by steep, densely forested mountains, the country is home to thousands of different community groups, many of which number only a few hundred in members.

Although it is unlikely that there are any more tribes living in total isolation, there is

little doubt that the country's rugged terrain still holds vast undiscovered mineral deposits. Its position on the collision zone between the continental crust of the Australian Plate and the oceanic crust of the Pacific Plate has led to the development of spectacular geology in almost every province. However, this same characteristic geology makes navigating certain parts of Papua New Guinea almost impossible, and so the country remains

one of the most prospective in the world, and one of the most unknown.

The Old Guard: PNG's producing mines

PNG's economy is highly dependent on the extractive industries. Mining and oil and gas are by far the largest formal sector employers in the country, providing more than 30,000 jobs for Papua New Guineans. They are also the largest contributors to state coffers, accounting for over one third of tax revenues in 2013. Today the country plays host to eight producing gold and copper mines and, since 2011, the Ramu NiCo nickel and cobalt mine, operated by the Chinese MCC. Australian gold miners Newcrest are the country's most prolific operators. Since 2010 they have been running the Lihir gold mine and the Hidden Valley mine, which is a joint venture with South African producers, Harmony. Although the drop in gold prices has affected miners across the world, PNG has perhaps been worse hit than most. Never a cheap country to do business in, the last five years have seen production costs spiral towards unprecedented levels, largely as a result of ExxonMobil's \$20 billion investment in LNG production.

2013 was a difficult year for Ok Tedi, PNG's oldest working mine. After-tax profits were down 80% on 2012 levels thanks to a combination of depressed commodity prices, a major failure at a SAG mill and severe typhoon damage to their largest customer in the Philippines. "On a positive note operating costs were \$70 million below budget, reflecting an increased companywide focus on cost management," said managing director and CEO of Ok Tedi Mining Limited (OTML), Nigel Parker.

Nautilus Minerals: Solwara 1 Project Equipment update



SEAFLOOR PRODUCTION TOOL
Bulk Cutter, final assembly complete H1 2014

BULK CUTTER			
Length	14.2m	Cutting Width	4.2m
Width	4.2m	Cutting Height	+4 -5m
Height	6.8m	Weight	310Te

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Nigel Parker, CEO, Ok Tedi Mining Ltd.



Roger Gunson, executive manager for the regulatory operations division, Mineral Resources Authority.



Ila Temu, country executive, Barrick Gold Corp.

However, more recently OTML has been in the spotlight for other reasons. In September 2013, the national government took over the 52% equity stake in the mine previously held by the PNG Sustainable Development Program (PNG SDP). This move proved to be highly controversial as the PNG SDP is an independent company registered in Singapore to manage the wealth from the mine and feed it back into the local economy. Amid cries of expropriation, the government claims that it was acting to remedy ill-conceived aspects of the previous arrangement. "It was felt that the PNG SDP was applying too great a percentage of

the funds outside of the mine area. Now, the government wants to ensure that the proceeds from the remaining years of the mine's life flow to the Western Province," said the executive manager for the regulatory operations division of the Mineral Resources Authority (MRA), Roger Gunson.

As international arbitration is still pending it is unclear how this situation will play out.

Porgera: Located 680 km from Lae and accessible only via the optimistically-named Highlands Highway, Barrick Gold's Porgera is one of the world's most isolated mines. Since its inception in 1990, the operation has been at the center of a steady stream

of scandals. Aside from the need to reduce costs—2013 saw an all in cash cost of \$1,294/oz—the most pressing issue for Barrick now is the prevalence of illegal mining. "The fame of the mine has continued to grow to the point where we are now dealing with 500 to 800 people breaking into the pit every night. These people are single-minded in their pursuit of gold and do not hesitate to hurt those who get in their way" said country executive, Dr. Ila Temu.

Six people were killed this year in the underground section of the mine after they gained access to a closed-off stope, which collapsed on top of them.



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MINING IN PAPUA NEW GUINEA

The security issues became so acute in April that the central government was forced to declare a state of emergency and send in troops. This heavy-handed response proved to be ineffective and the nightly invasions have continued unabated. The lack of opportunities in neighboring provinces is forcing young people to risk their lives chasing illegal gold. "The central government needs to work together with local authorities to ensure that standards of living improve across the whole country," said Dr. Temu.

Legal Framework: Out with the old?

Talk of a new mining code has resonated through PNG politics for several years, but now it seems that change may be just around the corner as politicians draw close to releasing new legislation to Parliament. "Put simply, the 1992 Mining Act currently implemented in PNG has become outdated and there is a need to bring it in line with the reality of today's mining industry," said Philip Samar, managing director of the Mineral Resources Authority (MRA). The MRA is the organization charged with overseeing and implementing all regulation pertaining to the mining sector, and has been instrumental in pushing through the new laws.



Greg Anderson, executive director of the PNG Chamber of Mines and Petroleum.

The current act is a legacy from PNG's colonial past. Drawing heavily on ordinances from Western Australia and Queensland, the regulations have long been seen as fairly solid and have served as a source of competitiveness for the Pacific nation. Nevertheless, there is a lack of clarity on key issues. Stipulations for mine closure procedures are, for example, conspicuous by their absence. On top of this, having issued the world's first lease for undersea mining, which constitutes an entirely new operating environment, it is now necessary to introduce a separate regulatory platform. Other proposed tweaks include the extension of



Frank Kramer, CEO, Kramer Ausenco.

tenement leases from two to five years, and the introduction of a mandatory 60-day turnaround for exploration license requests.

Generally, these changes have been accepted by the industry, however, the exact content of the new act has still not been divulged and speculation is rife that it may contain far more controversial elements. "We do have serious reservations about some of the proposed changes, particularly regarding restrictions on Fly-In-Fly-Out (FIFO) operations and the changes to state equity in mining leases," said Greg Anderson, executive director of the PNG Chamber of Mines and Petroleum, the peak body representing the interests of the private sector.

Under current laws, the state has the right to back into any new mining project and acquire a stake of up to 30%. There are now calls from more nationalistic voices in Parliament to raise this level even higher. They claim that Papua New Guineans are not seeing sufficient benefits from the profits made by the country's extractive industries. However, a simple increase in state equity participation is perhaps overly simplistic. Country executive for Barrick Gold, Dr. Ila Temu, believes that a more systemic solution is needed. "Up to this point the government has not managed its revenues from resource equity in a very effective manner. Putting more money into the pot without resolving the underlying issues of how it is allocated is probably not the best course of action to take," he said.

While most miners are happy to accept the state's participation in new projects, driving up back-in rights at a time when capital is already hard to come by will surely not help to make the country more appealing to investors. "It is the duty of politicians to legislate according to the wishes of their constituents. On the other hand, there is a constant need to measure our fiscal regime against other countries that are competing for global investment in resources, and it is

Papua New Guinea focussed
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Coppermoly Limited's wholly owned PNG subsidiary is Copper Quest (PNG) Ltd.



Flotation tanks at Hidden Valley mine, Morobe province. Photo courtesy of Kramer Ausenco.

important to balance these dual concerns," said Frank Kramer, CEO of homegrown EPCM contractor Kramer Ausenco.

FIFO is an equally emotive issue that has become increasingly politicized as of late. According to Steven Kami, partner at Gadens law firm: "FIFO has never been of any value to locals because it never allowed for the trickle-down benefits in terms of wealth, infrastructure and skills transfer that would have resulted from the construction of townships."

Mr. Kami's views are shared by Minister of Mining, Byron Chan, who has vowed to put a halt to operations relying on personnel flown in from Australia. While it is an appealing idea to bring the labor force close to the pits and retain the expertise in-house, the feasibility of such a strategy, at least in the short term, is uncertain. Details regarding how this transition would be managed have not been forthcoming and Mr. Chan has also failed to make any mention of whether his proposals would affect internal FIFO operations. Almost all of the country's large mines rely to some extent on flying PNG nationals around the country to work on the various sites and an abrupt end to such activity would inevitably lead to an abrupt stop to mining itself.



Steven Kami, partner, Gadens.

Getting on with the Neighbors: Landowner relations in PNG

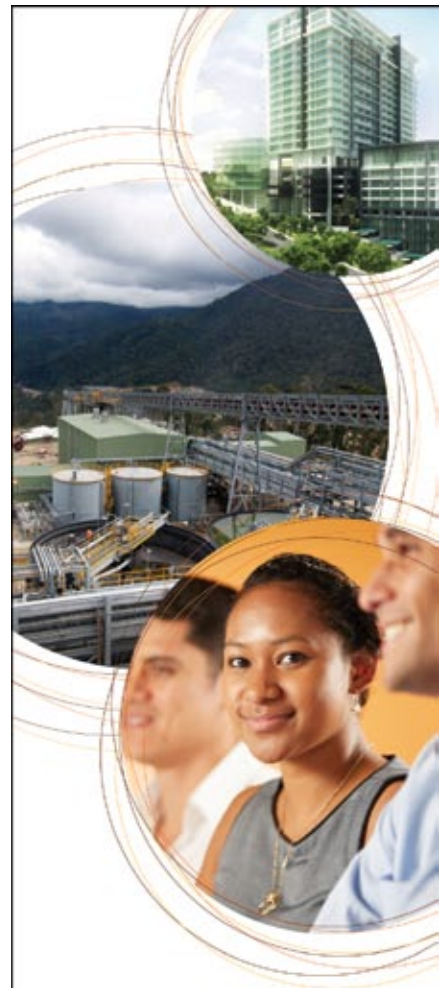
Community relations have become an integral part of the modern mining industry, but in PNG this trend has been amplified 10-fold. Only 12.5% of the population lives in cities, while the vast majority of Papua New Guineans are dedicated to subsistence farming. Over centuries, a complex network of customary ownership has emerged, which often has little to do with official property deeds filed at the central land registry.

This has a direct bearing on miners. Before breaking ground on a particular site, even at the exploration stage, it is necessary to devote significant time and energy to understanding local customs and establishing links with the local people.

A range of highly specialized consultancies cater to these particular needs, including everything from detailed social mapping, health impact assessments (HIAs) or simply an assurance that communications are kept open and that expectations on both sides are well managed.

False claimants often use the country's legal apparatus to try and prove ownership of land that does not really belong to them. In such cases, it may be necessary to deploy a team of anthropologists to draw up a more complete genealogical history of the area and establish the validity of any conflicting claims.

After the genuine landowners have been identified, a benefits package should be drawn up in collaboration with representatives of the local people. Typically, such packages will include a mixture of direct financial contributions, infrastructure construction and a guarantee to award service contracts to landowner companies. The extent of these services depends greatly on the sophistication of the groups within the area. Twenty years ago, most landowner groups offered little more than catering and cleaning, but now their offering is much



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more diverse. Some landowner companies have started to enter into joint ventures with private companies to further boost their capabilities. One example of this arrangement is CorMan Contractors, a joint venture between Coral Seas Mining Services and the Mananda landowner group from the Southern Highlands. "The company offers a very broad range of services within the construction and earth moving area," said CorMan's director, Graeme Paine.

Even after an agreement is reached and the mine is built, it is still extremely important to maintain good communication with the locals: "If they feel that their concerns are being ignored, they are capable of completely shutting down a producing mine," said Kami of Gadens.

The Waste Conundrum

The majority of the PNG's producing operations still make use of Riverine Tailings Disposal (RTD) or Deep Sea Tailings Placement (DSTP) models, both of which are known to have serious environmental consequences.

Although the practice is widely condemned and most international mining houses do not endorse its use, geographical conditions have left operators with very limited options. "PNG's Highlands region is



Len Murray, president of tailings management specialists Klohn Crippen Berger.

generally not well-suited to land-based tailings facilities: in addition to the mountainous terrain, engineers must contend with weak rock, high rainfall and formidable seismicity," said Len Murray, president of tailings management specialists Klohn Crippen Berger.

However, new developments show that alternatives are possible in certain cases. Newcrest and Harmony's Hidden Valley mine makes use of a 5 km overhead conveyor system that transports waste material to a secure storage site. "The HV tailings dam is functioning well and now provides a precedent for future mine developments in the country should they choose to adopt similar techniques," said Murray.

Bridging the Skills Gap

PNG's education system is overloaded and underfunded, which has led to the build up of a substantial skills deficit. This is most apparent in the stark lack of PNG nationals in senior managerial positions. "Unfortunately, many foreign companies in PNG still insist on employing a very high proportion of expatriate workers, so the domestic workforce sometimes misses out on the type of skills and knowledge transfer that they should be receiving," said David Purcell,



Landcruiser with ladder tray reflective tape. Photo courtesy of Ela Motors.



David Purcell, former CEO-Director, Ela Motors.

former CEO-director of Ela Motors, PNG's largest car dealership.

Purcell has sought to buck this trend by introducing a comprehensive management training program to the company. "Those who graduated were sent on a tour of Toyota facilities in Japan," he said.

The scheme proved to be a runaway success and today all of Ela Motor's branches are managed by Papua New Guineans.

The shortage of highly skilled locals has been exacerbated by the tendency for the most qualified professionals to venture overseas in search of better salaries and a higher quality of life. There are now Papua New Guinean engineers and geologists working in mines from Australia to Canada.

All the major mines in PNG run training facilities, but according to Grant Wechsel, managing director of One Key Resources: "While every major resource company claims to be carrying out comprehensive training programs, not all of these are entirely successful."

One Key Resources produces a web-based learning management system to demonstrate the correct usage of a wide range of mining equipment. In Australia they have developed a methodology for delivering these courses to students with no formal education, which they believe could be of immense value to PNG. "This is not simply a case of teaching a student to use a given piece of equipment, it is actually more about instilling a new set of values so that they understand the importance of responsibility, accountability, and even punctuality," said Wechsel.

The Next Wave:

PNG has never built up a fully mature exploration community. The release of a major geological survey at the 2010 PDAC conference served to stimulate interest amongst the junior sector. However, this flurry of activity was short-lived as the optimistic cli-



Grant Wechsel, managing director, One Key Resources.

mate of the global mining boom gave way to the current downturn. To make matters worse, Barrick, BHP Billiton and Vale have all abandoned their exploration programs in the country, leaving some concern about the short-term potential for smaller companies to find development partners.

However, not everyone has viewed their departure as an entirely negative occurrence. New Britain-based junior, Coppermoly has taken advantage of Barrick's divestment from copper exploration to reacquire management control over several projects that it had been proving up in collaboration with the major. This is not the



Maurice Gannon, former managing director, Coppermoly.

only positive outcome for the company: "As a result of the general drop off in exploration activity, drilling prices have reached fairly low levels," said former managing director, Maurice Gannon.

Lower prices have allowed for extensive drilling campaigns on their Nakru 2 prospect in New Britain, which have yielded positive results. "Our work and Barrick's exploration work has us now positioned with exploration assets that are really rich with exciting targets most notably, in my opinion, a prospect called Nakru 2. This is an outstanding geochemical and geophysical anomaly with great potential that has only

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Mike Johnston, CEO, Nautilus Minerals.



Control room. Photo courtesy of Nautilus Minerals.

been tested by three, relatively short drill holes in the past, all of which had excellent mineralized intersections. From the most recent surface sampling program comprising over 120 samples, which was virtually the first thing we did when we regained management of the assets, we found four rock chips ranging from 1.88% to 24% and five float samples ranging from 2.31% to 20.6% copper content. We also obtained quite extensive elevated gold in many of the assays," said Gannon.

At this point, PNG boasts a healthy pipeline of advanced exploration projects now approaching the feasibility stage. There are

the perennial issues of power supply and waste management to contend with but it is estimated that by 2020, major greenfield mining projects could contribute \$15 billion to the economy. The majority will focus on the characteristic copper/gold porphyry deposits that have so far typified PNG's mining industry but there is great potential for diversification.

Mayur Resources has eschewed traditional exploration paths in favor of proving up their high-grade iron sands precinct, which surrounds the Gulf of Papua. The company is also involved in early stage exploration for coal and preliminary results

suggest that the quality and scale of these deposits could rival those of neighboring Indonesia.

"We are currently in the process of defining a 2012 JORC Resource as quickly as possible as we believe the location and style of mineralisation lend themselves to a low capital intensity, 'fast track to market' type of project development," said Mayur's head of exploration, Tom Charlton.

No mining project in recent years has captured public attention quite so dramatically as Nautilus Minerals' Solwara 1. Development of the world's first Seafloor Massive Sulphide (SMS) project has been stalled since 2011 following a dispute with the government over equity rights. However, as of April 2014, the issues have been resolved and the venture will go ahead with the state exercising its right to assume 30% equity in the project.

The technology required to mine copper 1,500 m under the ocean surface had to be designed from scratch. "Deep water is very unforgiving and concerns that can be brushed over on land must be fully addressed for submarine operations," said CEO Mike Johnston.

At this point, the seafloor production tools are almost ready for deployment and a preliminary design for the support vessel has been approved. The craft will have capacity for 150 people and 45,000 mt of ore and will house a 32 MW power plant, delivering approximately three times the total generation capacity of Port Moresby.

Although the investment in front-end engineering has been substantial, the economics behind the operation are extremely attractive. Total investment to date amounts to approximately \$300 million but the construction of a similar scale mine on land would incur costs of around \$2 billion. Production costs will also be relatively low, with the most recent estimate suggesting approximately \$85/mt.

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