

Mining in Brazil

Plenty of room to grow.

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Cover photo courtesy of Votorantim.



Brazil: an Overview

On a slow track but boasting tremendous potential

Brazil is home to roughly 9,000 mining companies and a mineral production which was valued at \$51 billion in 2012, a slight decrease of 3% compared to 2011. Nonetheless, the country's mining industry has had an impressive run in recent years, more than doubling its output since 2009 and recording a positive trade balance of \$29.5 billion last year. A major global exporter of iron, niobium, manganese and bauxite, Brazil is the world's fifth largest country with a surface of 8 million sq km. This implicitly means abundant mineral riches, yet only 35% of the country's geology has been properly mapped so far by the CPRM (the Federal Government's Geological Agency). An indirect consequence of this fact has been the strong geographical concentration of mining activities in Brazil, where the states of Minas Gerais and Para account for a total of 82% of all mining revenues. The mining industry, responsible for 2.2 million direct jobs, attracts average yearly investments of \$15 billion, out of which 63% are absorbed by iron ore, which also accounts for 80% of Brazil's mineral exports. However, with mineral prices falling in 2012, the South American country saw its revenues shrink despite its record production during the year. Furthermore, in light of its natural resources, Brazil still inexplicably lacks self-sufficiency in its fertilizer minerals, importing \$3.5 billion worth of potassium chloride a year. Finally, the uncertainties created by Brazil's new mining code (which will replace its current one that dates back to 1967), along with the global economic crisis, have created a climate of investment reluctance and skepticism in Brazil over the course of the last 18 months. This said, the country has enormous mineral potential and the new mining code's implementation should encourage investors to refocus their attention to the country that occupies 47% of all South America.

New Regulatory Framework – The jury is still out:

On June 18th 2013, a momentous event occurred in Brazil: the long-awaited New Mining Code was released to Congress. Since early 2008, the specter of a new regulatory framework has haunted Brazil's mining industry, causing high levels of consternation throughout the sector as investors shied away from the country, unwilling to put their

money into a jurisdiction that could not offer clear rules of play.

As expected, the code addresses three main issues: royalties, the concessions system, and the establishment of a new independent mining agency, the National Mining Agency (ANM). But it does not offer an instant solution to all the industry's woes. On the contrary, as is often the case in Brazil, the pace of progress is expected to be painfully slow. Now that the bill has lost the constitutional urgency provision with which it was originally released, the forecasted timeline to pass through the political system is anywhere between one and two years. Although opinions differ wildly, the majority of parties involved in the sector actually welcome this development, viewing it as an opportunity for the private sector to have its voice heard and exert a positive influence on those aspects of the code that are unclear or are seen to be potentially damaging to the industry.

Under the current system, royalties' payments, officially known as the Financial Contribution for Mineral Collection (CFEM), are calculated based on a company's net revenue, but this is set to change to a baseline of gross mineral sales, which would equate to an overall increase. Furthermore, the rates themselves will increase across all minerals. While this is understandably an unpopular measure amongst miners, it is far from unexpected and will bring the financial contribution made by miners to local communities closer in line with the world average.

Perhaps the most controversial element of the new code is to be found in the proposed overhaul of the concession system. Today, Brazil's operates a priority system, with the first claimants to produce a plan to develop a piece of land receiving the exploration rights. The new proposal is to introduce an auction system akin to that adopted by the oil and gas sector. However, this is potentially a very risky move; by forcing interested parties to bid on land which, before any exploration work has taken place, is basically worthless, the authorities may actually deter investors.

The third principal element of the new code will be to replace the existing government administration responsible for mining, the National Department of Mineral Production (DNPM), for a new ANM. This has provoked a wide range of reactions amongst experts; while many are skeptical of the level

of independence and autonomy that such an entity would possess, some commentators point to the success of the National Petroleum Agency, set up in 1997 to regulate Brazil's burgeoning oil and gas industry as a positive sign.

One element that is conspicuous by its absence in the new code is any modification to existing environmental laws. Today in Brazil there is a certain degree of tension between miners and environmental authorities, and attaining an environmental license is widely acknowledged to be one of the most difficult and time-consuming stages of developing a project. Barton Stone, director of consultants Runge Pincock Minarco believes this is because the modern mining industry is a fairly recent arrival to Brazil, having only become established in the 1980s. "By this time other mining jurisdictions around the world had already worked out most of the environmental regulations they needed to impose on the industry. Without this head-start ... there is a definite lack of understanding toward the importance of the environment in small companies operating in Brazil," said Stone.

Essentially, the release of the new code to Congress has prompted as many questions as it has answered. While it is certainly a positive step towards establishing a more stable mining jurisdiction and attracting more investment, many of the measures are unpopular in their current form and a lot of work remains to be done before any of the proposals become law.

Vale: To Caesar what is Caesar's

With operations in over 30 countries and revenues of \$46.4 billion in 2012, Vale, the world's third largest mining company, leads global iron ore and pellet production and ranks second in terms of the world's nickel output. In 2012, the Brazilian mining titan accounted for 320 million mt of iron ore (down 0.8% compared to 2011) and 237,000 mt of nickel (down 1.9% compared to 2011), production that engendered 78.2% of Vale's gross operating revenues during the year. China, which accounted for 36% of Vale's overall sales last year, has been the world's main driver for minerals and metals in recent times, and with its economic slowdown to 7.8% in 2012 compared to 9.2% in 2011, Vale inevitably suffered. This development and the unpromising gen-



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The main value is in the mine.

Alumina Rondon is the leading project of Votorantim Metais. Alumina Rondon is an integrated alumina refinery and bauxite mining venture in the state of Pará, in the North of Brazil, with potential to become the largest refinery in the world after the expansion.

With bauxite mineral reserves adding up to 600 million ton, because of the Alumina Rondon project the position of Votorantim Metais as one of the largest Brazilian mining companies is firmly consolidated. Votorantim Metais is part of the Votorantim Group, the Brazilian holding present in more than 20 countries.

Votorantim Metais

- Total headcount of **10 thousand** employees in 17 industrial units: Brazil, USA, China and Peru
- Net revenue **R\$ 9,2 billion** in 2012
- Brazilian aluminum market leader
- Largest electrolytic nickel producer in Latin America
- Ranking among the five largest zinc producers in the world

Alumina Rondon

- Mineral Potential Resources **1,6 billion** tons
- Initial production of bauxite **7,7 million** tons/year
- Initial production of alumina **3 million** tons/year

Votorantim Metais opening new frontiers



An interview with Katsuo Dias Homma, Manager of Integrated Projects Ferrous, Steel and Logistics, Vale



S11D is the largest project in Vale's history. Could you give us an overview of this integrated project and its components?

S11D is Vale's largest project ever and it will help us add 90 million mt/y to our overall iron ore production in Para, which at that point will amount to 230 million mt/y. The Carajás area has several ore bodies that have great promise, but the work we are currently executing at S11D is focused on ore body S11, block D, which has proven reserves of 2.78 billion mt of high grade iron ore content (66.7%). One of the main qualities that S11D has is its very competitive operating expense of \$15/mt; performance that comes from the huge scale of the project itself but also from the synergies that we have in place with our already existent operations in Carajás, and the Northern Logistics Corridor program that we have recently completed. The Northern Logistics Corridor Program, also known as CLN 150, allows Vale to expand the logistics capacity of its Carajás operations to 150 million mt/y, and we have already obtained the operating permit for it earlier on this year, in April. For the purposes of S11D, we are supplementing the CLN 150 project in order to reach a total logistics capacity of 230 million mt/y. This new project, which is currently in the works, is called CLN S11D and it involves new railways, the duplication of most of our existent ones and new onshore and offshore capacity at our Ponta da Madeira port terminal, in Maranhao. Overall, with S11D, we are looking at an integrated project with a total CAPEX of \$ 19.7 billion, out of

which \$ 8.1 billion are accounted for by the construction of the mine and of the beneficiation plant while the other \$ 11.6 billion will go into CLN S11D.

S11D is impressive not only in terms of its size, but also when it comes to the technological innovations it employs. Could you detail these processes for us?

Firstly, our operations will not involve trucks, but rather a system composed out of excavators and mobile crushers that will feed the iron ore to the 37 km conveyer belt that will reach the beneficiation plant. This means less workers, less usage of equipment, dramatically less fuel usage and improved worker safety. Vale is even using the iron ore movement on the conveyer belt to generate electricity which then gets recycled and used for the operation of the belt itself. The other technological breakthrough is the dry processing method: by using the humidity of the Amazonian forest, Vale will be able to avoid several electrical and fuel costs related to the beneficiation of the ore and will further mitigate its environmental impact. Dry processing alone will be responsible for saving 18,000 MW of energy per year and overall, Vale is looking at 93% water usage reduction and a 77% fuel consumption decrease once operations will be running at maximum capacity.

What is the current focus for S11D in 2013 and what is your final message regarding the significance of this project to Vale?

In terms of the mining and the beneficiation plant works, our current main focus is on building the modules in the off-site region and on putting the finishing touches on the 42 km road that will allow us to transport them to the mine site; on the logistics front, we are now concentrating on laying down the new branch railway, from S11D to the Carajás line. S11D is a landmark project not only for Vale but for the industry as well: its scale, quality, and technological innovations make it a game changer that will positively impact the market and our clients, who will benefit from high grade ore at very competitive prices.

eral global economic climate drove down steel demand and implicitly the price of iron ore, which plummeted to a record low \$99/mt in September 2012. Meanwhile, worldwide nickel output has been aggressively increased over the last years, with China at the forefront of this development, raising its production by 390,000 mt/y between 2006 and 2012, putting further pressure on nickel prices. Nonetheless, Vale continued to invest strongly last year; with a global capital and R&D budget of \$17.7 billion, it managed to obtain a total of more than 100 environmental licenses for its projects. Now, in 2013, with iron ore prices slowly recovering, Vale is concentrating its efforts on several key projects that are impressive in terms of size, operating costs and quality, allocating a total capital and R&D budget of \$16.3 billion for the year (out of which \$1.58 billion for R&D and \$1.1 billion for CSR initiatives).

The spotlight of the company's investments for 2013 is taken by S11D, the largest single iron-ore project in mining history, which will add 90 million mt/y of capacity to Vale's Carajás operations through the construction of a mine and of a plant that are scheduled to start operating in 2016. Still within the Carajás complex, and with a projected start-up date in the second half of 2013, is the "Additional 40" program, which involves the construction of an iron ore dry processing plant with a capacity of 40 million mt/y. When completed, these two will increase Vale's iron output in Carajás to 230 million mt/y and in order to sustain that, the company has already put into place an impressive logistical expansion. CLN 150 is scheduled for completion in 2014, and will expand the railway and the Ponta da Madeira Port (Maranhao) of Vale's Northern Logistics Corridor to support a nominal capacity of 150 million mt/y; the second stage, named CLN S11D, will allow a further logistics ramp-up that will fully accommodate the final 230 million mt/y regional production. Moving south to Minas Gerais, in Vale's southeastern system, there are four projects that will receive increased attention in 2013: Conceicao Itabiritos will involve the construction of a 12 million mt/y concentration plant (100% pellet feed), scheduled for start-up in late 2013, while Conceicao Itabiritos II, a program projected for completion in late 2014, entails the adaptation of a 19 million mt/y facility (31.6% sinter feed / 68.4% pellet feed) to process low grade itabirites. Finally, Vargem Grande Itabiritos, with its 10 million mt/y concentration plant (100% pellet), scheduled for early 2014, and Caue Itabiritos, with its 24 million mt/y plant (29% sinter feed / 71% pellet feed)

planned for start-up in 2015, constitute the last of Vale's major investments in iron ore in Brazil in 2013. Other domestic investments that are worth noting are the Salobo II expansion which will add 100,000 mt/y of copper capacity to the project by mid-2014 and the construction of Vale's eighth pellet plant (7.5 million mt/y capacity) at its Tubarao Port in the state of Espirito Santo.

Taking the meaning of an integrated project to a whole new level, Vale engaged in 2008 in the acquisition of 35 of the largest Very Large Ore Carriers (VLOC) ever built. Generically called Valemax, these bulk carriers have a capacity of 400,000 mt deadweight each and represent Vale's attempt to further lower its operational costs (with 20% to 25%) and to better compete with Australian exporters, which have a much shorter trade route to China. Generating 35% less CO₂/mt than traditional Capesize ships, the Valemaxes so far have not benefited from smooth sailing however. Pressured by national shipping firms and steel producers worried about the impact these ships would have on iron ore prices and supply, China banned the Valemaxes from docking in its ports in late 2011, a development which led Vale to organizing intermediate ore deployments into traditional Capesize ships in Malaysia over the past years. However, in April 2013, the



Mammoet's first module for Vale's S11D. Photo courtesy of Mammoet.

eastern Chinese port of Lianyungang allowed a Valemax to unload its 220,000 mt cargo on its site, potentially opening the door to a resolution to this controversial issue.

The year 2012 was not without challenges for Vale; the decline in mineral prices impacted profit margins and put future projects in question. Simultaneously, big potential programs such as the potash Rio Colorado in Argentina and the Apolo iron ore mine in Minas Gerais have been put on hold or abandoned. This being said, Vale's strong posi-

tions worldwide have allowed the company to start seeing profits in 2013 based on cost reductions. Furthermore, the bounce-back of commodity prices (iron ore prices have averaged \$137/mt), as well as the Brazilian real's depreciation by more than 10% during the year have already greatly helped Vale. And with strong investments in R&D, such as S11D's truckless system, which could contribute to a meaningful reduction in the project's operating costs, Vale will likely grow stronger in the future.

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Inspection of conveyor belts that will be used in the truckless system at Carajás S11D Iron Project, in the state of Pará, Brazil. Photo credits Paulo Moreira /MMAS /Vale, courtesy of Vale.

Brazil's mining industry remains dominated by iron ore, a mineral which accounts for 80% of the country's exports, and while its top position seems secure, national diversification of mineral production is becoming increasingly apparent. Considering Brazil's enormous agricultural potential and its current dependence on fertilizer imports, it is not surprising that fertilizer mineral projects are gaining ground in the country.

Iron Ore – Brazil's heavyweight champion

Undoubtedly, iron ore reigns supreme in Brazil, and in 2012, the country's iron ore production rose to an estimated 510 million mt/y, up 11% from 2011. However, the world's second largest exporter of iron ore saw the value of its exports decrease by 26% in 2012, down to roughly \$31 billion, due to unfavorable global prices, that hit a

low of \$99/mt in September 2012. Still, iron ore accounts for 80% of all Brazilian mineral exports and the big piece of the pie belongs to Vale, a company that still vastly dominates the market, mainly through its Carajás and Itabirito assets. Nonetheless, Brazil is seeing an increasing number of companies bringing in considerable new capacity on the market thus diversifying the industry's landscape.

Remaining in Vale's sphere of influence we find Samarco, a privately held company founded in 1977, owned in equal parts by Vale and BHP Billiton. One of the leading iron ore producers in Brazil, with an annual capacity of approximately 22 million mt, Samarco is the eighth largest exporter of the country. With mining operations in the historical heart of Minas Gerais, concentrators in Mariana and Ouro Preto (both in Minas Gerais), and three pellet plants in Ubu (Espírito Santo), Samarco exports its pellet production to 25 countries through its own port terminal in Ubu.

The most prolific non-Vale asset coming soon into play is the much awaited Minas Rio project, Anglo American's 26.5 million mt/y integrated project. Minas Rio entails mining operations in Minas Gerais, a 525 km slurry pipeline, and a dedicated port terminal in EBX's Acu Superport in Rio de Janeiro. The project, which saw its CAPEX go up \$3 billion to a total of \$ 8.8 billion in late 2012, has certified reserves of 1.45 billion mt of iron ore and a FOOS (First Ore on Ship) date set for late 2014. With 13,000 people working on 120 fronts, Minas Rio is currently around 65% complete overall and will have an operating expense of \$30/mt at the port. Initially, the production will involve 26.5 million mt/y of 68% pellet feed,

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but future ramp-ups could see Minas Rio expand to capacities of 60 million mt/y or even 90 million mt/y.

“Minas-Rio is by far the most significant investment of Anglo American in Brazil and in the world and at a regional state level, Minas-Rio accounts for over 10% of all the investments that have been done in Minas Gerais over the past decade, a proof of our commitment to Brazil and to the project itself. Over the past two years, the project went through a restructuring phase caused mainly by three important issues that we had to overcome. The first main problem that we had to face was related to the heavy rains that we experienced during late 2011. The second issue was represented by the three legal injunctions that were placed on the project; injunctions that came as a result of mismatched timing between Anglo American, state authorities and the public ministry and it took us 10 months to overcome this issue alone. Another troublesome component, which was intertwined with the legal injunctions, was the permitting and licensing required; Minas-Rio had over 300 licenses to acquire and today, we are short on only around 10 of them. The final issue that we had to solve was land access: Minas-Rio crosses 32 municipalities and we have had to deal with over 1,400 land

owners since starting the implementation of the project. Since issuing the new schedule however, we have restructured ourselves, we have become better equipped to solve these issues and so far we have been very much on track,” said Paulo Castellari, CEO of Anglo American Iron Brazil.

In late July, Anglo American CEO Mark Cutifani announced that the company was looking for a partner for Minas Rio but that the project was largely de-risked already. Arguably, after many challenges and CAPEX increases, this fully integrated project seems finally on track.

“Minas-Rio has been criticized severely in the past, but no project as good as this comes easy. Anglo American has implemented systems and pre-warning procedures that allow us to stay ahead of the curve and anticipate problems; we have learned from the past and we are very well prepared to deal with any challenge that might be ahead of us now. Today, we are in a different place and Minas-Rio will be an extremely robust contributor to the group and the mining industry in Brazil,” said Castellari.

Meanwhile, a company that has experienced a lot of turbulence lately has been MMX, Brazilian tycoon Eike Batista’s mining business, part of the EBX group. Batista, who lost over \$30 billion in personal wealth

since March 2012, stepped down as chairman of MPX Energia in July, further increasing worries about the financial health of his EBX Group, which saw its shares dropping 64% in 2013. MMX accounted for 7.4 million mt of iron ore in 2012, which were produced at its Serra Azul mine in Minas Gerais and at its Corumba mine in Mato Grosso do Sul, and future plans were to ramp-up total production to 40 million mt/y through the addition of a processing plant of 29 million mt/y at the Serra Azul site. However, with Batista’s recent financial troubles, in July, operations at Corumba were suspended for at least six months, a fact which has raised doubts about the future of MMX and the company declared in late June that it was in talks to sell a stake or assets to companies like Glencore Xstrata. Another EBX key mining related investment is the Acu Superport, an investment of roughly \$2 billion located in the north of the state of Rio de Janeiro, started by LLX (EBX’s logistics arm) in 2007 and scheduled to be operational in the second half of 2013. At full capacity, the port would be able to handle 350 million mt/y of imports and exports, which would make it the world’s third largest facility of its kind. Capable of accommodating even Valemaxes, the port will have two terminals, TX-1 (offshore) and



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TX-2 (onshore). TX-1 is being developed by an LLX/Anglo American joint venture called LLX Minas Rio and will be Anglo American's Minas Rio's dedicated port terminal. However, the financial troubles experienced by Eike Batista and implicitly, his empire, has cast a long shadow over all of EBX's associated businesses and only time will tell if the market will maintain confidence in EBX's projects.

Several juniors such as TSX-listed Talon Metals (with its Trairao Iron project, in the state of Para) and ASX-listed Centaurus Metals (with its 2 million mt/y Jambreiro project, in the state of Minas Gerais) are moving ahead with significant iron-ore projects in Brazil. Among these, SAFM (South American Ferrous Metals) is a perfect example of a junior looking to make big moves. The only ASX-listed pure-play iron ore producer in Brazil, SAFM currently produces lump, sinter and concentrate at its Ponto Verde project, located in Minas Gerais' Iron Ore Quadrilateral. "We currently have a license for 1.5 million mt/y of iron ore and our processing plant involves a two stage crushing and screening circuit. SAFM has a monthly production of 25,000 mt of sinter, 20,000 mt of small lump per month, and 20,000 mt of concentrate, mainly accounted for by Namisa at the moment. Our sinter feed and



Atlas Copco drill rig operating on a site in the northern region of Brazil. Photo courtesy of SRK.

small lump have a grade of around 60%, with 0.9% phosphorous and our concentrates have a final grade of approximately 64.5%, with a low 0.5% phosphorous level and 2.5% of silica. Until now, we have had two JORC resource statements done and according to the latest one, SAFM's resources amount to 300 million mt of 40.7% iron ore, of which 175 million mt is measured and indicated," said Jose Marcio Paixao, chief development officer of SAFM.

With operational costs at \$15 to \$19 / mt and with a projected mine life of around

20 years, SAFM is aiming high and it plans to achieve a capacity of 8 million mt/y by the end of 2015.

Another ASX listed junior is Crusader Resources, which owns a series of gold, tungsten and iron projects across Brazil. Crusader's Posse iron ore project, located in Minas Gerais, has a mineral resource of 36 million mt at a 43.5% Fe grade. Posse received a license to operate from Brazilian authorities for a trial 300,000 mt/y throughput arrangement in late 2012 and now, Crusader is undergoing a ramp-up of its operations at the site, after it was awarded the environmental approvals necessary for a full mining license in May 2013. It was not all smooth sailing though, as the project saw an injunction being placed on it in late June 2012. "While we were disappointed that the injunction was served in the first place, we were really pleased that we were able to overturn it so quickly, in a matter of days. Now, the ramp-up at Posse is meeting all expectations and we are pushing the application for a full mining license as per our previous guidance," said Robert Smakman, managing director of Crusader Resources.

With sales of 18,000 mt of lump in June going to the likes of Gerdau and ArcelorMittal, Posse seems to have gained traction for future development.

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Lastly, a player worth noting is Sul Americana de Metais, a company that is looking to develop its Vale do Rio Pardo project to a capacity of 25 million mt/y, with production scheduled to start in the second semester of 2015. "We are looking at an integrated project that will have an investment value of \$3 billion and a mine life of 25 years. During the construction phase of the whole project, we estimate we will have roughly 9,000 direct workers while during operation, we will be employing 2,000. Sul Americana de Metais will be investing in a pipeline (1.5 meters average depth) that will connect our mine in Minas Gerais with the port from which we will be exporting our pellet production to China; the port will be built by local authorities in Aritaguá, in the state of Bahia," said Haroldo Fleischfresser, CEO of Sul Americana de Metais.

IBRAM data suggests Brazilian iron ore production will increase its capacity with 451 million mt/y between 2011 and 2016 and that iron investments will equate \$46 billion until 2016. With prices slowly recovering (iron ore has averaged \$137/mt for the first half of 2013), and with China and India continuing their growth and urbanization, demand will still be there but only the best will be able to seize it. "If you look at the global trends right now, it is obvious that China

will continue to dictate demand for iron ore through urbanization and steel consumption per capita. Right now, we see a lot of production for iron ore coming out and while demand has decreased, we are still looking at 2.5% to 3.5% CAGR for the next six years, which is still a good level. The challenge will be for this new capacity, which is often of lower grade material and more expensive to be produced, to actually become viable," said Paulo Castellari of Anglo.

Nickel – Good demand ignites overcapacity trouble

With an output of more than 85,000 mt of nickel in 2012, Brazil is currently a global top 10 producer of the base metal. Global excitement surrounding nickel has led to the market supply surpassing global demand growth rates and this development, along with a weak worldwide economic performance in 2012, has pushed nickel prices down.

"Global economic growth is closely tied to the consumption of stainless steel, which is produced using nickel. When the world economy is growing, steel consumption thrives, but when it is doing poorly, consumption of steel and therefore nickel declines alongside it. Although global nickel consumption grew by 6.7% and 3.9% in

2011 and 2012, respectively, and production rose by about 6% in both years, price declines meant that producers were left with year-end surpluses of 51,000 mt in 2011 and 33,000 mt in 2012. Analysts forecast that the demand and supply for nickel will balance out in 2013, leaving a surplus of only about 3,000 mt. Unfortunately, nickel prices have not yet reacted to the increase in demand. The best nickel prices usually occur at the beginning of the year, but we did not see this play out in early 2013. By the end of 2014, analysts expect a deficit of 12,000 mt of nickel, which should put upward pressure on prices. Consumption is also expected to rise by 6.6% in both 2013 and 2014. Most analysts say nickel prices will start to pick up around 2015, reaching a peak at 2020," said Walter De Simoni, CEO of Anglo American Nickel.

Brazil is home to all of Anglo's nickel operations, and recent years have seen major changes occurring in the field for this global mining player. Anglo's Venezuelan site of Loma de Niquel was refused a permit and concession renewals by the Venezuelan government in 2012, a fact which led to the permanent cease of activity at the 13,000 mt/y site. This development left Anglo Nickel with only two major operations, both in Brazil. The first is Codemin, a site in Niquelandia



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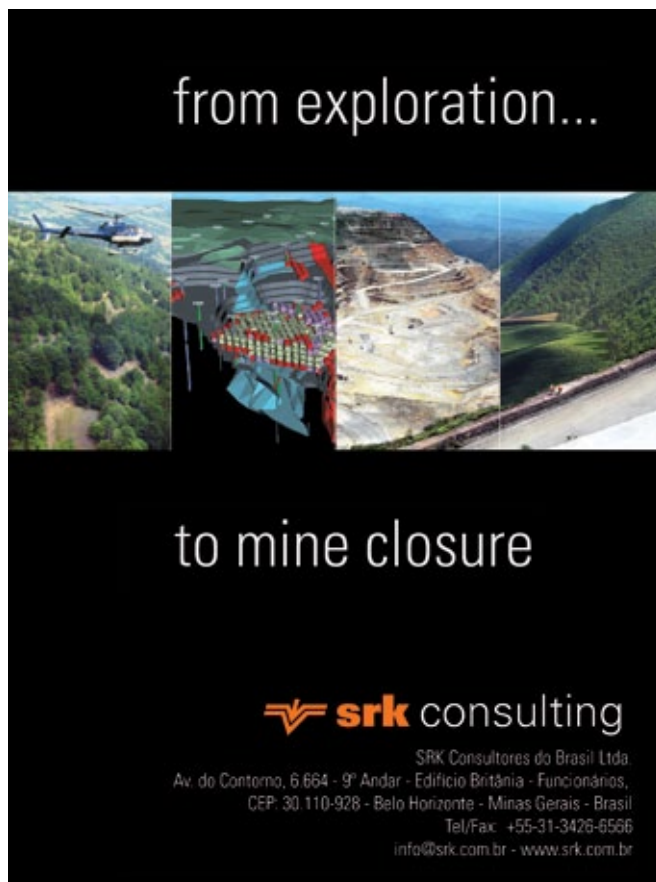
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An interview with Tito Martins, President, Votorantim Metals.



How did Votorantim Metals fare last year and what strategies are you pursuing to take the company forward?

2012 was a tough year for Brazil's mining industry, and we suffered as a result of the poor domestic market conditions, the drop in metal prices and some internal issues that the company was facing. This forced us to cut back on some of our important long-term investments in new projects and interrupt the development of some new processes we were working on. Consequently, production levels across all minerals experienced a slow-down. Today, however, the situation has changed. Although we are still having to deal with low commodity prices, we have made great steps forward in other areas: production of aluminum is back to previous levels, we have implemented several new processes in our zinc transformation plants which has led to a greater level of productivity, and we have increased production of nickel. Looking at Milpo in Peru, we are also doing well, having increased ROM production at the Cerro Lindo mine from 10,000 mt/day to 15,000 mt/day. Thanks to all these developments, I believe that if prices were at their previous high levels, this would be a record year for Votorantim Metals.

Votorantim Metals is investing R\$6.6 billion in a new mine and bauxite processing plant in Rondon do Pará. Could you provide us with some more details on this project?

Rondon do Pará is a key project for Votorantim Metals. Today we are completing the final feasibility study and are

hoping to have this finished by the end of 2013 so that we can begin construction in 2014. The project boasts more than 1 billion mt of high quality bauxite reserves with very low silica content, and we have decided to build an alumina refinery at the mine site itself. As for logistics, our original plan was to transport aluminum from the mine to the port by road, but we have recently heard that the extension of the Norte-Sul railway from Maranhão to the Bacarena port in Pará will pass very close by our site. The plan is for the railroad to be completed by 2016, which fits perfectly with our vision to have the Rondon plant running in early 2017. As for port availability, we are in contact with the state authorities in Pará and have secured a vacant area in the Bacarena port that we can use for our needs. The project is located in a fairly underdeveloped area between three large cities, and it will bring several social and economic advantages to the region, generating 6,000 jobs during construction and 1,600 jobs in operations.

What is your opinion on the contents of Brazil's New Mining Code and the effects that it will have on the industry?

Firstly, the provisions given for the transformation period are very good, and we are thankful for this because there was a fear in the industry that the new measures would be imposed with no time for adjustment. We are concerned about the proposals for the new auction system to grant concessions as we believe it could deter investors away from the country. The royalties were always bound to increase, but the commonly heard assertion that royalties in Brazil are much lower than the world average is misleading because of the plethora of additional taxes that miners have to pay here. There is now discussion in Congress of compensatory measures that would take the form of reductions of other taxes, which is positive, but there was no mention of this in the original draft. The creation of the ANM could be a very positive move for the country, as the DNPM already functions in a similar way to an agency and the formalization of this status will give them more resources to work with.

(Goias), where the company has been producing nickel since 1982, and the site saw 9,600 mt/y of output in 2012. However, delivered on time and on budget, Anglo American's new rising star is its other Goias project, named Barro Alto. With a projected mine life of 26 years and with an expected average production of 36,000 mt/y, the project required investments of \$1.96 billion and produced 26,000 mt in 2012. This year, after solving problems with equipment suppliers for its electric furnaces, Anglo is targeting to ramp-up production to the nominal capacity of 41,000 mt/y. Furthermore, the company has two more long-term projects in sight; Morro Sem Bone and Jacare, which would potentially add another 66,000 mt/y capacity for Anglo American Nickel.

The largest electrolytic nickel producer in Latin America, Votorantim Metals, owns three sites in Brazil that account for a total output of 44,000 mt/y. "Regarding nickel, although we are not a huge producer on the world stage, our production positions us comfortably between the seventh and 10th largest producers in the world. Votorantim was founded by experts in the metallurgical field who viewed the mine as nothing more than a supplier of raw materials to the processing facilities. However, with the exception of some of the finished products that our aluminum unit manufactures, there is much more profit to be found in the mining than in the transformation process and we are planning a shift in this direction," said Tito Martins, CEO of Votorantim Metals.

Operations in Niquelandia (Goias) and in Sao Miguel Paulista (Sao Paulo) commenced in 1981 and these two assets today are responsible for 25,000 mt/y; Fortaleza da Minas is Votorantim Metals' third site, and the 2003-acquired operation accounts for a further 19,000 mt/y of sulfide ore nickel.

Vale, the world's second largest nickel producer with a total output of 237,000 mt in 2012, only has one operation of the kind in Brazil: Onca Puma, located in the state Para. A lateritic project using a pyrometallurgical process, Onca Puma is intended to have a final nominal capacity of 53,000 mt/y but problems with its furnaces led Vale to put the ramp-up of the project on hold in June 2012. Nonetheless, Onca Puma produced 6,000 mt of nickel in 2012 and the company plans to have the asset back on track in late 2013.

Furthermore, Brazil also hosts a number of juniors trying to develop nickel assets and one good example is represented by Horizonte Minerals, an AIM and TSX listed company focused on the Araguaia Nickel project

in Carajás. The asset, which was acquired in 2010 from Teck Resources and consolidated with the integration of the Vila Oito and Floresta nickel laterite projects (bought from Lara Exploration), is in its prefeasibility study stage. "We will take 12 to 18 months to complete our bankable feasible study, and there will then be another 12 to 18 month construction period. Ideally Araguaia would enter production in mid-to-late 2017. Brazil has two or three nickel projects being developed, and there will be a period of two or three years of oversupply as they reach capacity, but from 2016 or 2017 underlying demand will outstrip supply here, as not many new projects will be developed after the current wave," said Jeremy Martin, CEO of Horizonte Minerals.

Fertilizer Minerals – A large gap to fill:

As has been widely reported in the international press, Brazil's agribusiness has gone from strength to strength in recent years: in addition to being the world's largest producer of soya, coffee, orange pulp and sugar cane, the country is now also the world's fourth largest grains producer. The sector directly employs some 15% of the population and accounts for over 25% of GDP. Between 2001 and 2011 Brazil's agricultural exports increased from \$16 billion to approximately \$80 billion, which constitutes an increase of over 400%. By comparison, in the same period the USA's agricultural exports increased by just 175%.

Aside from the increases in production volume, Brazil's agricultural industry has also become much more efficient. In 1970, across the 16 main arable crops grown in the country, the average yield a farmer could expect was 1.44 mt per hectare, while today this figure stands at 5 mt per hectare. This improvement in efficiency has been made possible to a great degree by increased usage of mineral fertilizers, for although Brazil is blessed with a vast amount of arable land, ample sunshine, and abundant fresh water, in many areas its soil suffers from a relatively low nutrient content. Today the country uses some 300 million mt/y of fertilizers, making it the fourth largest consumer in the world after China, the USA, and India. However, domestic production is nowhere near sufficient to meet the ever-increasing demand, and today Brazil imports more than 70% of its fertilizers. In an effort to remedy this situation, the government has set itself the ambitious goal of becoming entirely self-sufficient in fertilizers by the year 2020. To meet this target on time Brazil will have to act fast, particularly in developing its potash production capacity, as 92% of the potash used in the country today is imported. The remaining 8% is produced by the only operational domestic potash concern; Vale's Taquari-Vassouras mine in Sergipe. However, this project is widely believed to be in the last stages of its life cycle and, to compound matters, Vale's Rio Colorado project in Argentina, which was supposed to replace production of the Sergipe mine, has been on hold since January. This development could have very serious consequences for Brazil. "Where problems might arise is if another investor takes over the project and decides not to uphold Vale's commitment to export 90% of output directly to Brazil, choosing instead to sell to other markets. This would disrupt the equilibrium that has been established and would have negative repercussions for the entire industry," said David Roquetti of the Brazilian National Fertilizer Association (ANDA).

Brazil's potash deposits are fiendishly difficult to extract and process compared to the more straightforward reserves found in Russia and Canada, and many juniors struggle to develop a cost effective beneficiation process. Nevertheless, this has not acted as a deterrent to the several companies currently investing in bringing the next big potash concern to production. Indeed, according to data from IBRAM, potassium will see the second highest amount

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MINING IN BRAZIL

of investment out of all minerals in the 2012 to 2016 period, totaling some \$7.6 billion. One of these companies is TSX-listed Verde Potash, which is seeking to develop a \$2.3 billion potash project in Minas Gerais. The Cerrado Verde mine will eventually produce 3 million mt/y of potash for the domestic market. That being said, delays with the bankable feasibility study have slowed the project down and could push back production by up to a year. The Forbes and Manhattan group is also involved in potash through its Potassio do Brasil company. "The resource is located in a basin that could theoretically provide for all of Brazil's potash needs. We have a resource of half a billion tons and are currently raising funds to carry out a final feasibility study," said Hélio Deniz, VP Brazil Operations at Forbes and Manhattan.

If all goes well, then it is eminently possible that these projects will be able to fill the gap left when Taquari-Vassouras is eventually decommissioned, but it remains to be seen whether or not they will manage to deliver sufficient quantities to totally eliminate the reliance on imports.

The odds of Brazil reaching its self-sufficiency targets in phosphates are rather more favorable; the country already produces 50% of its total consumption and there are a number of on-going developments that

should see this percentage rise even further.

One of the most important new players in this field is B&A Mineração, a new venture set up by Vale's former CEO, Roger Agnelli, which will be investing approximately \$550 million over the next two to three years on developing projects in fertilizer minerals, iron ore and copper. "Since our foundation in August 2012, we have been consolidating our portfolio and looking outside for new potential. Looking specifically at phosphates and potash, we are currently finalizing our acquisition of Rio Verde Minerals and are pushing to establish a new phosphates target in the northeast as growth in this region is set to increase national demand for fertilizers by some 5% to 6%," said Eduardo Ledsham, CEO, B&A Mineração.

B&A also owns a 12% stake in MBAC, an integrated fertilizer producer that was established in Brazil in 2008 by several former directors from Yamana Gold. "The philosophy behind MBAC is to grow strong on agricultural fundamentals, and Brazil's agribusiness is booming today. Our two most advanced projects are based in the country's new agricultural heartland around the states of Maranhão, Tocantins, Piauí, and Bahia, where demand for fertilizers has seen double-digit growth for the last few years," said Carlos Braga, VP Technical Services, MBAC.



Eduardo Ledsham, CEO, B&A Mineração.

By 2016, both these phosphate projects should be operating at full capacity and delivering a total of 1 million mt/y of SSP to fertilizer blenders in the agricultural states of Brazil's savannah region.



While the new players are concentrating on developing greenfield projects, Anglo American is currently in the pre-feasibility stage of an expansion of their existing Ovidor phosphate mine in Goiás. "We hope to see this study completed by the end of 2013, a final feasibility study finished by 2014, and we will be ready to submit to the board for final approval by 2015. The eventual aim is to double total production from 1.4 million mt/y to 2.8 million mt/y," said Ruben Fernandes, CEO, Anglo American Phosphates and Niobium.

Gold – Less shiny than usual

Brazil has a long gold mining history: the late 17th century saw the first gold rush in Brazilian history that attracted almost 1 million Portuguese and their African slaves to the region. Today, gold is Brazil's second most exported mineral after iron ore, and in 2012, the South American country was responsible for \$2.4 billion worth of gold sales. Brazil, which is the 12th largest global gold producer, also holds the 9th position in terms of worldwide reserves. However, the last 18 months have seen the price of gold plummet to a recent record low of less than \$1,200/oz in June 2013. This depreciation has led to producers and juniors experiencing difficulties lately, hardships that were also augmented by the uncertainties regarding the new Brazilian mining code and its impact on the industry.


While the Brazilian gold mining environment is dominated by Canadian companies, major South African player AngloGold Ashanti leads the way with two operations in Brazil. The first is the Córrego do Sítio Mineração project in Minas Gerais, a project that has a total of five mines and three

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plants, one of which was acquired from Eldorado Gold in late 2008, refurbished and brought into operation in January 2012. The second asset, located in the state of Goiás, is called Serra Grande and AngloGold Ashanti obtained 100% ownership of the site in late May 2012, after acquiring Kinross Gold's 50% stake in the project for \$220 million. Employing a total of 5,300 people at these sites, AngloGold Ashanti produced a total of 486,000 oz of gold in Brazil in 2012.

Kinross Gold leads the wave of Canadians producing gold in Brazil and the company's landmark project in the country is Paracatu, an asset with proven and probable reserves of 17.9 million oz at 0.40 g/mt Au, which is located in the state of Minas Gerais. Kinross Gold achieved 100% ownership of the open-pit project in 2004, and in 2012, the company produced 466,709 oz of gold in Paracatu, an asset that saw its mine life being extended to 2042 in recent times.

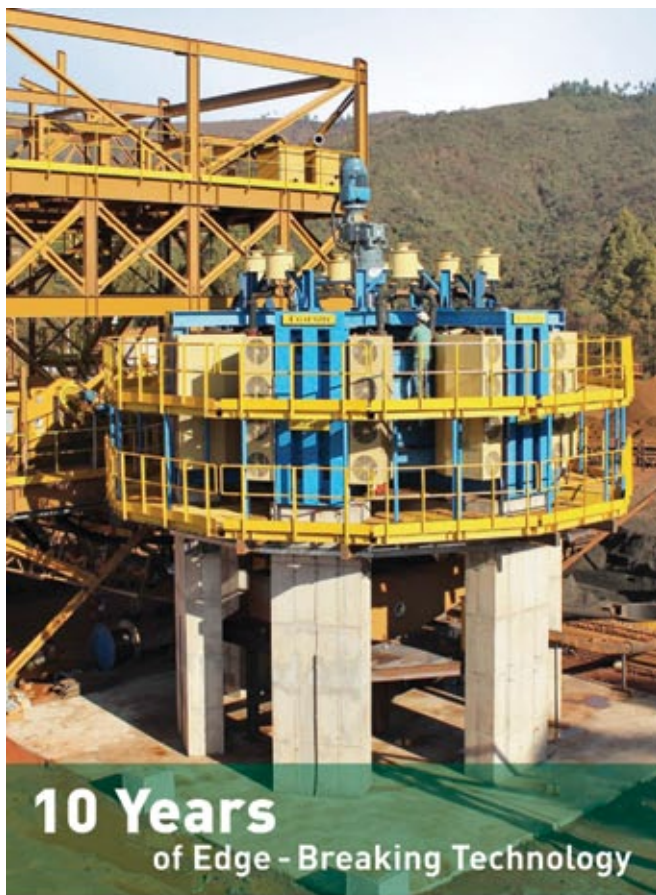
Yamana Gold owns and operates three projects in Brazil: Chapada (18 year mine-life with 3.37 million oz at 0.27 g/mt Au proven and probable), Fazenda Brasileiro (five year mine-life with 306,000 oz at 2.30 g/mt Au proven and probable), and Jacobina (13 year mine-life with 2.4 million oz at 3.02 g/mt Au proven and probable). Located in Goiás and Bahia, these assets accounted for a total of 311,000 oz of gold produced during 2012. Yamana Gold, which also has assets in Mexico, Argentina, Chile, is currently developing three other projects in Brazil, with its underground Pilar Project (Goiás) being expected to complete commissioning in 2013.

Jaguar Mining maintains its status as an important gold producer in Brazil with its Turmalina, Paciencia, and Caete projects, all located in the state of Minas Gerais, accounting for a total of 102,823 oz of gold in 2012. Turmalina has measured and indicated resources of 1.17 million oz of gold at 4.22 g/mt of Au and had a production of 37,840 oz in 2012. Paciencia, which boasts 921,000 oz of gold measured and indicated at 3.76 g/mt Au, accounted for 9,987 oz last year. Finally, Caete, which encompasses 1.93 million oz of gold at 3.31 g/mt Au, had a total output of 54,996 oz in 2012.

Finally, Eldorado Gold, which has operations and projects in development scattered across four continents, is focusing its Brazilian efforts on the Tocantinzinho asset, located in the state of Pará, which has proven and probable reserves of 1.98 million oz at 1.25 g/mt Au. The company plans to produce 159,000 oz/y at the site at a total cost of \$559 /mt. Tocantinzinho received a preliminary environmental license in September 2012 and is expected to come into production in 2016.

Gold juniors were particularly hit by the unfavorable gold prices and a climate of global investment slowdown. These trends have pushed juniors to put projects on hold or to develop subsistence low-scale productions meant to generate cash flow for the further development of their main gold targets (in the case of companies such as Rio Novo).

Amarillo Gold Corp. has four gold projects in Brazil, but its current focus is on its Mara Rosa deposit, located in the state of Goiás, which has measured and indicated resources of 1.17 million oz of gold at 1.75g/mt Au. Currently preparing for a bankable feasibility study, Amarillo Gold hopes to see its Mara Rosa project producing in late 2014. Meanwhile, Colossus Minerals stands out in the landscape as the only company that has engaged in a partnership with a garimpero cooperative. Approximately 40,000 m of drilling was done in 200 holes at the site by Vale, Serra Pelada's previous owner, and the Colossus Coomigasp joint venture added another 11,000 m in 40 holes to that already since they acquired the asset in 2007. Serra Pelada is 87% ready and gold production is



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scheduled to start in the fourth quarter of 2013. In late August 2013, a group vying for control of Coomigasp organized a protest at Serra Pelada, but action was quickly taken by state authorities who prevented the protesters to reach the gates of the mine.

Despite the harsh global environment, the year 2012 saw a gold demand that was 15% higher than the average for the previous five years, largely led by central bank purchases of emerging countries. Meanwhile, the supply of gold contracted 1.4% in 2012 and China's imports of the precious metal reached a record level during the year. Looking forward, these developments, combined with an unstable global environment that will continue to create currency volatilities, could lead to a healthy gold price comeback. "As demand is being driven by the macroeconomic factors, with countries competing against one another to devalue their currencies, gold will be more and more in demand. Supply has been diminishing over the past years, mostly due to low grade production that is technically challenging, with projects not reaching their objectives. This is a very favorable context for gold price appreciation, and \$2,000/oz gold should be achievable in the next 12 to 18 months," said Claudio Mancuso, CEO, Colossus Minerals.

Diamonds – Yes, they exist

Brazil currently boasts an impressive portfolio of minerals but it cannot pride itself with being a significant diamond producer. Nonetheless, the country has a long history of diamond mining that started with the royal monopoly imposed by the Portuguese Crown in 1725. This monopoly lasted until roughly 1860 and during this timeframe Brazil accounted for 50,000 to 250,000 carats of rough diamond output per year, including a 254 carat stone discovered in 1854, named the "Star of the South." Mining was largely carried out by African slaves through labor-intensive alluvial mining in the states of Mato Grosso, Minas Gerais but also in Bahia. In more recent times, discoveries of kimberlite pipes have been made across Brazil, and in 1999, several thousand garimpeiros invaded the Cinta Larga reservation, which is located close to Brazil's Bolivian border, to mine for diamonds. Eventually, the Federal Police solved the issue but it is believed that diamonds worth more than \$40 million were smuggled before this occurred. This event and others prompted Brazil to become a participant of the Kimberley Process Certification Scheme in October 2003.

One of the companies trying to invigorate the way that the world perceives Brazil's dia-



Ken Johnson, general director of Lipari.

mond potential is Lipari Mineracao, a junior that owns the Braúna project in Bahia, a former property of Vaaldiam Resources and De Beers. Braúna encompasses 22 kimberlite occurrences, with the B3 deposit currently being the largest and the best developed. In January 2013, Coffey Mining's mineral resource estimate revealed indicated resources of 1.78 million carats and inferred resources of 926,000 carats. "In 2013 we saw our resource increase significantly and consequently, we have reworked our mine plan, and are now predicting an open pit mine with a lifespan of seven years and the potential to go underground after this. We expect an average sales value in excess of \$280 per carat, which I believe would rank as the fourth or fifth highest dollar per carat value for rough diamond production in the world. By world standards the output will be fairly small, at 230,000 to 250,000 carats per year, but this is compensated for by the excellent margins the project will be running at. Right now we are finalizing the engineering work in terms of mine design, geotechnical studies, and infrastructure, and we aim to break ground on the actual construction in the first quarter of 2014," said Ken Johnson, general director of Lipari.

While the scope of the Braúna project is relatively small, its potential success could have a large-scale symbolic impact on the way diamond mining is regarded in Brazil and in South America: "By the end of 2013 we should have finished all the detailed engineering and the mine design, ready to begin construction in 2014 and production in 2015. We will stay focused on Brazil, because in spite of its many difficulties, the geological potential of the country is almost unbeatable; there have been over 1,000 kimberlites discovered in the country, but only three or four have been properly sampled. We are hoping that Lipari's mine will put Brazil back on the map for diamonds," said Johnson.



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Lipari Mineração Ltda. is a private Brazilian mining company focused on the development of its 100% owned Braúna Diamond Project, State of Bahia, Brazil. The Braúna Project is a feasibility-stage project which is expected to become South America's first diamond mine developed in kimberlite rock, the primary source-rock of diamond. Lipari's goal is to become South America's largest rough diamond producer.

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As Brazil's reputation as a serious mining jurisdiction becomes more entrenched, the ranks of service companies are swelling. A more equitable relationship is taking shape between domestic companies, which now have to work increasingly in alignment with international quality and safety standards, and multinationals, which are now competing to gain contracts from the powerful Brazilian mining houses.

Engineering and Consulting – How best to become Brazilian

2012 was not an easy year for Brazil's mining service providers. "The main reasons for this were the rising levels of uncertainty provoked by rumors about the New Mining Code, and the very real hold on exploration permits that the DNPM introduced last year. As a result of these factors, many important contracts were either postponed or

put on hold for an undetermined period of time," said Cauê Pauli de Araújo, interim manager at SRK Brazil.

However, now that the new regulatory framework has been released, and requests for exploration licenses are being processed once again, work on several important projects is recommencing, and the increased certainty brought to the industry by the new code should serve to restart the flow of foreign investment. Today, Brazil's EPCM and consultancy sector enjoys a good balance between foreign and domestic firms, but this has not always been the case. "For many years, almost all project development in the country was carried out by American or European firms, who in turn were working on behalf of yet more foreign companies. It was not until the 1970s that Brazilian engineering and consulting firms really started to make an impact on the market," said Jackson Oliveira Bragança, director of Belo Horizonte based engineering and consultancy firm, Tecnomin.

After this period, for many years the tables were turned definitively in favor of the domestic service providers. Historically, Brazil has always been a cost-driven country, and this can make it a hard market to penetrate for multinational companies, as they struggle to compete with the low



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Brent Thompson, president of Tetra Tech's mining division.

costs offered by smaller, local service providers. "The general mentality of Brazilian companies is usually to opt for the cheapest product or service in the market, omitting the long-term gains of engaging with a high quality solution provider," said Michel Booden, general manager of specialist lifting contractors, Mammoet. That being said, the Dutch firm has carved itself an ample niche in the market, and last year they made history by setting "a new world record for the heaviest load lifted at the highest altitude while lifting the P55 Petrobras Offshore Deck. The deck with a weight of 17,000 metric tons was lifted to an elevation of 47 meters" said Booden.

As well as the cost issue, some commentators point to another key factor that previously held back multinationals from establishing a firm foothold in Brazil. According to José Ricardo Barella, founder and chairman of home-grown engineering firm Progen: "International firms that came to Brazil in the past often made little effort to integrate with the Brazilian way of doing business. They were generally managed by foreigners, often with key decision makers located outside the country, and this made it difficult for locals to build constructive relationships with them."

Now, however, several foreign companies are establishing, or re-establishing themselves in the country and are making a concerted effort to adapt better to the particularities of the Brazilian industry. Broadly speaking, there seem to be two main approaches to achieving this integration: the first involves building a purely Brazilian team from the ground up; while the second is to follow a course of mergers and acquisitions, taking over local firms and establishing an immediate presence in the market.

DRA Mining's entrance provides a good illustration of the former strategy. Already well-established in Africa, and with a notable presence in Australia and Canada, the South African engineers opened their Brazil-



João Carlos Ronchel Soares, head of global mining and metals business units at Pöyry.

ian office in January 2013 in response to requests from their international clients. "It is our clear intent to become 100% culturally Brazilian. In other countries we have seen many companies try and impose their own external systems on an alien culture, and we have seen these companies fail. Our aim is to blend our expertise with Brazilian talent to ensure that we gain the best of both worlds," said Paul Carlin, director, DRA Brazil.

As a first step towards forging this Brazilian identity, the company intends to employ 70 Brazilian staff over the next six to eight months who will be based out of its new office in Belo Horizonte.

American based Tetra-Tech Wardrop, on the other hand, opted to expand into the country through a series of local acquisitions. "Tetra Tech uses its mining arm to gain footprints into new markets and then engages into further expansions based on that. That is precisely what has been happening over the course of the last few years in Brazil, where in June 2012 we acquired CRA Engenharia, a local mining engineering company, established in 2005 in Belo Horizonte," said Brent Thompson, president of Tetra Tech's mining division.

This one move added over 300 staff to the company's engineering and consulting division as well as a wealth of local knowledge. That being said, the successful acquisition of a totally new company is by no means an easy option. "The process of properly integrating a company is complex and takes a long time – this is one of the reasons why we look out for good firms, whose core values are solid; we do not try to change their essence but rather we work around the edges," said Thompson.

Finnish EPCM specialist Pöyry has followed a different trajectory altogether. After first coming to Brazil in the early 1970s, the company then withdrew from the industry completely in the late 1990s. Today, they see fresh opportunities as the sector

develops and they are now aggressively re-entering the market. The combination of local DNA and foreign infrastructure gives them a unique perspective to assess the challenges still faced by the sector. "Brazil's mining industry is not performing as well as it has in the past—in particular in terms of meeting deadlines and minimizing investment costs—and the main reason for this is the failure to adopt a holistic perspective on project implementation... There needs to be a lot more planning, working beforehand with the communities, preparing feed engineering, and taking into consideration all the aspects of project implementation," said João Ronchel Soares, head of global mining and metals business units at Pöyry.

Nevertheless, the main challenge facing Brazil's engineering and consultancy firms, and indeed most companies involved in any sector in Brazil, is the country's lack of skilled labor, which has become something of a chronic affliction. While the 2012 mining slowdown has led to a slightly larger pool of skilled workers to choose from, there are still not enough qualified personnel to fill vacancies, particularly in remote areas. In the absence of sufficient labor, some companies are taking matters into their own hands. "Martin Engineering is investing in a strong internal training program to be able



Javier Schmal, managing director for Latin America at Martin Engineering.

to develop our people and ensure that we have a good supply of new technicians in the pipeline for times of especially high demand.," said Javier Schmal, managing director for Latin America at the USA based engineers and manufacturers of specialized conveyor belts Martin Engineering.

Sotreq, South America's largest Caterpillar equipment dealer has also recently invested in a new 2,000m² training center to instruct its clients' mechanics in how to repair Caterpillar products. "We are currently training a group of 120 of our client's employees to be mechanics. When they came here they had absolutely no

mechanical knowledge, but when they return to their employer in six months' time they will be well versed in repairing Caterpillar machines and will even have acquired a working knowledge of English," said Paulo Brasil, account manager for Vale at Sotreq.

Technological Advances – the value of innovation

Mining in Brazil has typically been viewed as a fairly conservative domain, in which technological innovation has often been dismissed as nothing more than an attempt to disrupt the status quo, but today there are signs that this old fashioned outlook may be undergoing a transformation. Australian slope stability radar developer Ground Probe offers a variety of solutions to deliver increased pit wall stability in open pit mines, and they are feeling the effects of this change as it happens. The company opened its first Latin American office in Chile in 2006 and came to Brazil in 2012. "Although most engineers we speak to are very enthusiastic about our products, they have some difficulty upselling them to management. On the other hand, we have visited 90% of the major mines operating here and we have definitely caused a stir. The market may be slow to get moving but many experts outside of Ground

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Damian McKay, president of CAE Mining.



Guilherme Bastos Alvarenga, CEO, Devex.

Probe have predicted that within five years our products will be more popular here than in Chile," said David Ogan, general manager for the Americas.

Felix Torres, VP Diversified Customers at explosives and blasting services provider Orica Mining, sees this movement towards a more technologically intensive environment as part of a wider trend that is affecting the whole region. "Throughout Latin America, mining houses have begun to recognize the value of adopting new technologies, even though the initial cost may be higher than that of more traditional methods. That being said, some segments within the industry

seem to be more open to innovation than others: in particular gold, coal, and copper mines are quicker to turn to new developments than producers of bulk commodities such as iron ore," said Torres. This goes some way to explaining why Brazil, with its predominant focus on iron ore, has been somewhat slower to embrace technological advances in the mining chain than other Latin American jurisdictions such as Chile and Peru.

In recent years the industry has seen an ever-greater focus on safety, and Brazil is no exception to this trend. Canadian CAE Mining is seeing increased demand for its simu-

lation and training services, which allow heavy machinery operators to gain valuable experience and better prepare them to deal with the challenges they will face in the field. The company's president, Damian McKay, considers this to be indicative of a systemic change in the industry: "A few years ago, the decisions on whether or not to adopt our solutions were left to specific engineers or geologists whereas nowadays we are witnessing more corporate, strategic decisions being made by companies as a whole."

Nevertheless McKay believes that there is still room for improvement. "The industry would benefit from governmental top-down legislation that makes certain standards (for example, a minimum of 100 hours of simulator training for a truck driver) mandatory."

In addition to the clear gains in worker safety that technological developments bring to the mine site, adopting the latest innovations can lead to a profound impact on operational efficiency, which ultimately translates into lower costs and higher profits for the operators. From its first forays into fleet management applications, Brazilian software house Devex has now positioned itself at the forefront of the wave of automation that is sweeping the industry, and has managed to capture 85% of the market share in their home country. The company has recently launched two comprehensive software suites, Extreme and SmartMine UG, which provide automation solutions for every step of the mining chain for both open pit and underground projects. "Devex is just starting to optimize the whole process, but already we usually report 7% to 10% gains from optimization of the mining operations. These gains can come from unexpected places; for example, our underground system incorporates a simple device which can switch the ventilation on and off and move its position around easily," said CEO and founder, Guilherme Bastos Alvarenga.



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Minas Gerais

The Undisputed King of Brazil's Mining Industry



Small mines account for tens of millions of tons of iron ore in Brazil. Photo above shows one of these mines near Belo Horizonte, courtesy of Inmecco.

Situated in the southeast of the country, above São Paulo and Rio de Janeiro, Minas Gerais has played host to several generations of miners over the centuries: from the Portuguese pioneers in the 1600s, to the English gold prospectors 200 years later, to the rather more sophisticated international crowd that calls the area home today. In the state capital of Belo Horizonte it is possible to find all of the services necessary to develop a mine from initial exploration through to production as well as a wealth of high quality educational establishments in which the next generation of geologists and engineers are trained.

In some instances, the physical conditions of working in the state have led to a tangible effect on how a company is formed. Specialist truck body constructor Inmecco “developed around the explosion in production of iron ore in the region, and as this is such a tough material to deal with, it has necessarily made our products stronger than those of our competitors. This in turn has driven mining companies in distant

states to turn to us rather than to local producers because they know that our buckets and bodies are sufficiently robust to put up with the harshest of conditions” said company director, Leonardo Parreiras.

Another local manufacturer with a basis in iron ore is that of Gaustec, the Belo Horizonte based producer of Wet High Intensity Magnetic Separators (WHIMS). Over the last 10 years, the company has evolved from a father-and-son team designing their products in an improvised laboratory, into an international equipment supplier with 50% of domestic market share, whose clients include all the major Brazilian producers, as well as mines in India, Venezuela and Australia. While many companies involved in processing iron ore are feeling the negative impact of China's economic slowdown, Gaustec is turning the situation into an opportunity: as several new iron ore projects around the world are being scaled back, many producers are seeking to optimize the processing plants in their existing projects and are turning to Gaustec's

separators to recover ever-lower grades of ore. “In the past, producers were reluctant to look at anything that was below 30%, but we are now seeing them considering processing tailings with as little as 6% ore” said founder and director, José Pancrácio Ribeiro.

Two of the most frequently voiced complaints about Brazil are that it suffers from a severe shortage of skilled labor, and that the infrastructure is ill-suited to support heavy industry. The fact that mining exploration often takes place in particularly remote areas of the country means that it feels the effects of these problems even more keenly than most industries. Drill manufacturer Trado was founded in 1978 with the express goal of designing lightweight, easy to use pieces of equipment that it would be possible to transport to the most remote locations in the country. “To date, we have sold over 1,000 rigs around the world and still keep to our original philosophy that Trado drills should be mobile enough to be transported by a small helicopter, pick-ups or even on a horse to reach the most remote locations in the world” said president Alexandre Guimarães Misk. Although the rigs were originally developed with the Brazilian customer in mind, they have found a market in far flung locations across the globe such as DRC and Laos that suffer from the same logistical issues as Brazil.

Pará – The Young Pretender

Although Minas Gerais has historically been the main mining state in Brazil, and the country's southern region has always been the driving force for the Brazilian economy, most commentators are in agreement that the winds of change are beginning to



Leonardo Parreiras, director, Inmecco.



Alexandre Guimarães Misk, president, Trado.



Marcelo Stenzel, managing director at SGS.

blow over this scene. "The NE region of the country is developing at very fast rates and its evolution over the past 10 years is truly impressive, with shipyards, refineries and petrochemical complexes being constructed there. Many people talk about the importance of the World Cup and the Olympics but if you take a step back to analyze things, the investments related to these events are not nearly as important as the overall evolution of the North and Northeast" said Marcelo Stenzel, managing director at SGS. With regards to the mining industry, nowhere is this shift in focus to the North more apparent than in the state of Pará.

Many of the country's largest new mining projects, including Vale's S11D expansion, Votorantim's Rondon do Pará and Hydro's Alunorte expansion are all taking place in this state. While it may not yet boast the same level of high quality service providers that can be found in Minas Gerais, many international names are setting up offices in the area to cater to the growing number of juniors and majors developing projects in the region. In a matter of years it may even overtake Brazil's established mining capital of 400 years.

Progress is being made, but we should not hope for rapid change.

No matter how hackneyed the sentiment has become, the old cliché of Brazil being the country of the future remains frustratingly accurate today. It is impossible to ignore the sheer raw potential that Brazil offers in terms of mineral resources. Although less than 35% of the surface geology has been mapped to a useful level the country presents unparalleled opportunities across a broad range of minerals, and developments such as Vale's Carajás Complex are proof that Brazil is capable of developing world class, cutting edge projects. Nevertheless, in several respects the sector still fails to live up to expectations.

Nevertheless, in several respects the sector still fails to live up to expectations. The acute shortage of skilled labor remains as problematic as ever and infrastructure coverage in many areas is sorely lacking, particularly in terms of public railroads and ports. The bewildering array of taxes levied on domestic producers makes it difficult for the local industry to remain competitive, and the astonishingly slow speed with which mining and environmental permits are awarded is still a major stumbling block to the development of new projects.

It is not only within the mining sector that this sense of frustration is apparent: the recent unprecedented outburst of public demonstrations across the country acts as a clear barometer of the prevailing national sentiment.

The population believes that Brazil can do better, and if the right political moves are made then there is little doubt that the situation will improve. Legislative measures such as the New Ports Law, which will open up the country's ports to private investment, are a sure step in the right direction, and whilst the release of the long-awaited New Mining Framework is far from a panacea, it is at least a definitive action that should serve to attract investment to the industry.



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