

# Santa Rita project financing

No. 42 SRK's International Newsletter



**In January** 2008 SRK took on the role of Independent Engineer (IE) for the project financing for Mirabela Nickel's Santa Rita project located in Bahia state, Brazil.

The Santa Rita project is an open pit mine with a conventional nickel sulfide concentrator. Initially, it was based on a proven and probable reserve of 84Mt with a grade of 0.61% Ni, mining 4.6Mt of ore a year and producing 17,000t of Ni concentrate, with a Ni grade of 13% plus Cu and Co by-products.

SRK's initial IE report supported the project but flagged a number of risk issues and recommended subsequent follow-up work. The report was submitted to prospective lenders and in September 2008, SRK made presentations to selected syndicate members in New York and London. Letters of Commitment were due from lenders when the financial crisis hit, as the firm of Lehman Brothers failed. Needless to say, the project financing did not proceed. Despite negative sentiment surrounding the financial crisis and rapidly declining metals prices, Mirabela took the bold step of continuing with project construction, albeit at a slower pace. Using equity funding, they initiated an expansion study to 6.4Mt a year, based on an increased reserve of 120Mt. In January 2009, SRK was engaged again to audit the new reserve and expansion plan. Mirabela successfully raised additional equity funding and procured bridging, offtake and trade finance to support continued construction activities.

SRK signed off on the new scope and cashflow model for the project in April 2009; funding for US\$190M was successfully concluded with the first loan drawdown shortly thereafter.

...continued

## Santa Rita project financing...

(continued)

Throughout the often painful process, SRK kept a close watch on developments at the request of prospective lenders and, while

### NEAL RIGBY

Dr. Neal Rigby, SRK Global Group Chairman, is a Corporate Mining Consultant with 36 years' experience in the mining sector. For the past 20 years, he has served



as a senior participant in dealmaking, supporting the rationalisation, merger, disposal and acquisition of international mining companies and mining finance institutions: his role to define the fundamental value, risks and opportunities of mining projects. Neal has undertaken conceptual through feasibility studies in over 50 countries worldwide, for a wide range of projects. maintaining its independence, performed the role of devil's advocate with the site team during regular site visits. The team's response indicates they found this interaction invaluable.

The stalled financing, expanded scope, and lengthened construction schedule inevitably combined to increase project capital costs. Nevertheless, the project construction was successfully completed in October 2009 and the first concentrate was produced in November 2009. At the time of this writing, commissioning was progressing according to plan.

Neal Rigby: nrigby@srk.com





SRK recently completed a comprehensive Due Diligence (DD) study on a complex mining operation in Southern Africa. The copper mining operation consists of a complex array of surface and underground ore production operations together with primary and secondary beneficiation facilities. SRK's approach to DD studies is to involve professional staff in an integrated multi-discipline approach. The presence of water affects the geotechnical design, both surface and underground, and further complexity is added if several end products require different process routes and different markets. Smelting and refining add more environmental requirements. Particularly on the African continent, the continuous supply of electrical power and the need for emergency power are important for continuous operations.

SRK put together a multi-disciplined team of 18 engineers and scientists

### Due diligence study on a complex mining operation in Southern Africa



to complete the DD in time; the team would have few parallels in mining consultancies worldwide.

As part of the DD a multi-discipline risk assessment workshop was held, with client participation to identify key obstacles in reaching planned production commitments. The geologist and process engineer, the rock engineer and geohydrologist and the tailings and waste disposal engineer were amongst the diverse disciplines represented.

The workshop, a marathon session, covered the operations from exploration through mine design and development to production and transportation of the finished metal products. The client, taking on the residual risks, put together a program for mitigation to be managed on an ongoing basis to reduce the operation's risks.

The size of the Environment and Social team (5) reflects the importance of compliance with the Equator Principles and Performance Standards. Once, converting Mineral Resources to Mineral Reserves was settled between the Geologist and the Mining Engineer but today, compliance with environmental and social requirements is paramount.

Logistics and communication proved to be a challenge. However, the technical team met each evening to discuss issues; this interaction proved invaluable in understanding the interdependencies involved.

Translating the technical issues into a financial model is key. The SRK team put together an interactive model that reflected two business cases - one including Inferred Resources and one excluding them. The model showed how changes at any stage of any of the interlinked processes affect net present value (NPV) and cost per unit of production.

Roger Dixon: rdixon@srk.co.za

### ROGER DIXON

Chairman of SRK's office. He has 37 years' experience engineering, with



projects relating to engineering studies, mineral reserve estimation, due diligence studies on platinum, gold and copper and feasibility studies on open-pit and underground operations.

Roger helped formulate the Mine Health and Safety Act of 1996. He was involved in preparing the South African Code for reporting resources and mineral reserves (SAMREC Code) in 2000, and mineral asset valuation (SAMVAL Code) in 2008. He currently chairs the Committee for Mineral **Reserve International Reporting** Standards (CRIRSCO), which has representatives from the major mining countries around the world.

Roger Dixon: rdixon@srk.co.za

### **GIELSON COUTINHO**

Gielson Coutinho, Principal Mining Engineer, has 14 years' experience in the Brazilian Mining Industry. He works with mining companies to improve their operations.



In 1998, Gielson helped found Gemcom's office in Belo Horizonte; in 2005, he was appointed director of SRK Brazil. With experience in project management, mine planning, feasibility studies and due diligence, his projects involve open pit mining in iron ore.

Gielson Coutinho: gcoutinho@srk.com.br

### ANTONIO GIRODO

Antonio Carlos Girodo, Mining Engineer and Metallurgist, has 40 years' experience working in gold, iron, nickel, copper, cobalt, potash, bauxite and

phosphate mining. He teaches part-time at the Mining Engineering School of the Federal University of Minas Gerais. His industry knowledge is vast; his particular interests are mathematical modelling, geological modelling, geostatistics and resource estimating. Girodo is an SRK Brazil associate.

Antonio Carlos Girodo: girodo@srk.com.br

### Mining Project Evaluation in Brazil



n Brazil mining is energised by a supportive economic and political environment. As South America's leading economy, Brazil is rich in history and culture, with a combination of geography, population and economy that only a few countries such as the USA and China share. Brazil ranks among the world's top-five producers of agricultural goods and mineral commodities. Having controlled inflation, the country has a stable political system, high employment and falling risk ratings. Foreign investments are welcomed and mining will reach US\$25 billion in 2010.

SRK established an office in Brazil in 2005 and presently employs 20 professionals and 10 associates with experience in geology, mining and process engineering, and metallurgy. The fast-growing team of mathematicians and computer scientists, economists, financial analysts, and environmental specialists deals with world-class mining enterprises and with complex, integrated projects involved with iron ore, gold, copper, nickel sulfides and laterites, zinc, asbestos, and limestone for cement.

SRK is participating in several studies including geological prospecting, exploration, feasibility studies, mine planning and design, modelling and resource estimating, and mining infrastructure, including issues concerning power and water supply and the environment.

Mining in Brazil is steadily growing more complex. For example, in the iron ore industry, Brazil produced only highgrade, direct-shipping hematitic ore until the beginning of the '70s. As hematites are frequently accompanied by soft and rich itabirite orebodies, companies started mining this ore based on hydrogravitic methods (mainly spiral concentrators), magnetic concentrators and reverse flotation, because those methods work where all others fail. When demand for iron ore outran supply in 2003, the price rose 71%; and in 2004, 21%. This high value made mining the low-grade ores economic.



However, the concentration of low grade (CPI) ore involves extensive milling that demands great amounts of energy – a significant problem in Brazil. Another problem is the low product yield of the ore and the huge amounts of tailings CPI ores generate. This presents a difficult environmental problem since mine sites lack sufficient places to store these residues.

Many businesses are involved in acquisitions and mergers today, and SRK Brazil is participating in project evaluations and studies that require highly specialised skills in sensitive areas. As this trend continues, bringing more complex problems, SRK professionals will be well prepared to face these challenges.

Gielson Coutinho: gcoutinho@srk.com.br

## Environment and closure due diligence

Over the last 15 years, the importance of environmental, social and closure issues in the evaluation of mineral properties (MPE) has significantly changed. While once these issues were generally considered insignificant, they have evolved into an integral component of most MPEs. Many investors have specific environmental, social and closure standards that are as important as the resources, mine design and technical feasibility, due to their potential to increase the predevelopment costs and slow the return on investment.

With the advent of environmental and social benchmarks, such as World Bank and IFC standards, and the Equator Principles, most new mining developments today are subject to a level of scrutiny previously unheard of. Extended permitting and approval processes are commonplace, often lengthening the predevelopment phase of a project by years. Postapproval delays in project development are occurring more frequently due to lawsuits and protests by citizens and special interest groups. Several projects have even been stopped due to environmental or social concerns. Although rare, global political and environmental trends suggest more frequent occurrences in the future.

Closure and rehabilitation costs are the largest environmental costs associated with mining projects but are often overlooked because they generally occur decades into the future. When discounted as part of the Net Present Value calculation, they may be insignificant compared to development costs. Nonetheless, the mining industry has advanced the practice of mine closure considerably over the past two decades to control future costs and minimise the risks of developing a mine requiring perpetual care. Although the cost of perpetual care would be insignificant in NPV calculations, corporate business practices, and political and social pressures over the long-term management of closed mines is changing the way mining companies evaluate the business risks associated with closure.

Jeff Parshley: jparshley@srk.com

### JEFF PARSHLEY

Jeff Parshley, P.G., C.E.M., Principal with SRK Reno, has over 29 years of project experience throughout North America, Latin America, and Europe. He holds a degree



in geology from Dartmouth College, Hanover, New Hampshire. Jeff's expertise includes mine closure and remediation, mine environmental studies, mine permitting, and environmental geochemistry.

Jeff Parshley: jparshley@srk.com

permitting and approval processes can lengthen the predevelopment phase of a project by years

## Palladon's Iron Mountain project, Utah

The Iron Mountain project is located near Cedar City, Utah. The District was discovered in 1849 by Mormon Pioneers, and the iron deposits were mined almost continuously from 1851 to 1995, producing an estimated 88.2Mt. The new board of Palladon Ventures Ltd, the current owner, commissioned SRK to review the project and comment on its merits.

#### LEAH MACH

Leah Mach is based in SRK's Denver office and is a Principal Resource Geologist with 23 years' experience in geological studies, including resource estimation. She is a Qualified Person



with regard to National Instrument 43-101 and JORC requirements. Leah has international experience in resource estimation, project management, and assay protocols and quality control and has been involved in feasibility studies, due diligence and resource estimation in precious metals, base metals, and iron ore projects.

Leah Mach: Imach@srk.com

In the 1950s and 1960s, former owners drilled on site, but the core samples are no longer available. SRK worked with Palladon to design a drill program for Comstock-Mountain Lion deposit and adjacent stockpiles to verify the historic database and estimate a resource for a Preliminary Economic Assessment; the resource includes 40.35Mt at an average grade of 45% Fe. SRK concluded the high costs of off-mine freight and shipping clearly favored producing higher value products. The iron mineralogy of the orebodies is predominantly magnetite, which has certain value in downstream steelmaking. In addition, the project infrastructure is good.

SRK commissioned an assessment to examine both the US and export market potential. Currently, the US imports over 95% of its alternative iron units, while China's demand continues to be strong. SRK concluded that the Iron Mountain project had merit and that there were opportunities for project optimisation. Meanwhile, Palladon is using SRK's work in discussions with prospective investors and off-take partners.

Leah Mach: Imach@srk.com Joanna Poeck: jpoeck@srk.com





**SRK** was commissioned by a Chinese company to review a copper project located in East Africa. The objectives of the review were to use the data provided to analyse and provide summaries of the results for the client, and comment on any material flaws detected in the project.

The SRK team visited the project site in 2009, reviewed the materials and held discussions with the current owner.

The property holds licences within a substantial mining agreement area. The mineralisation on site is typical of a volcanic massive sulphide deposit comprising a precious metal-rich oxide zone overlying massive sulphide lenses containing copper and zinc. The East African nation has shown strong support for the project, and will participate in a net smelter royalty of 5.0% on precious metals and 3.5% on other metals.

A NI43-101 technical report on the project's feasibility was completed and a South African engineering firm updated the process plant design and estimates for capital and operating costs.

# Technical review of a polymetallic project in East Africa



The deposit has been subdivided and regrouped into 3 zones as oxide, supergene and primary. A threedimensional geological model was prepared to outline the mineralised domains. SRK recalculated the resource and confirmed the company's estimates.

SRK investigated the mining methods, mining phases, processing for three ore types by cyanidation and by flotation, the design of the waste dumps and the disposition of acid-generating rocks to build the interception dyke, and the non-acid generating rocks to build the tailings dam and mine.

SRK concluded preliminarily that additional geological exploration is recommended to upgrade resources to higher categories and to define more resources at depth so as to possibly expand mine life. In terms of the processing aspects, SRK recommends further metallurgical test work be conducted in order to determine feasible grinding size, reagent scheme and related operational parameters. Diesel generators will be rented for two years to supply power; then, heavy fuel oil generators will be purchased. Water will be supplied by fresh water wells. Concentrates will be trucked to the nearest port.

Overall, the project complies with local/national environmental legislative requirements and conforms with World Bank/International Finance Corporation environmental standards.

Yonglian Sun: ysun@srk.cn

### YONGLIAN SUN

Dr Yonglian Sun is a Principal Consultant with over 20 years' experience in rock mechanics, geotechnical and mining engineering across four continents. His international



experience includes site investigation, analysis and geotechnical modelling in open pits, underground mines and tunnels, and evaluating mining projects. Recently, he coordinated and led large due diligence projects, for successful listing on the Stock Exchange of Hong Kong Limited. Yonglian established the SRK China Beijing office in 2005 and opened a second office in 2009; SRK China now has 32 full-time employees providing due diligence and technical reviews, exploration management and audits; mine design, scoping, and feasibility studies.

Yonglian Sun: ysun@srk.cn

### JOANNA POECK

Joanna Poeck is a Mining Engineer in SRK's Denver office with 6 years of project experience throughout USA, Canada, Europe and Australia. Her expertise includes open pit design,



mine scheduling, pit optimisation and truck productivity analysis. She completes pre-feasibility studies, life of mine designs, and optimised schedules for iron ore, gold, coal and diamond deposits using Vulcan software. Before joining SRK, Joanna worked at Maptek, managing the Vulcan technical services team in consulting, training and technical support.

Joanna Poeck: jpoeck@srk.com

# A geological risk approach to valuing early-stage exploration projects

### DEBORAH LORD

With 18 years' experience, Deborah Lord, BSc, MAIG specialises in valuing exploration assets and independent expert reporting to standard for the Australian



Securities Exchange. Her expertise with SRK reaches across a range of commodities through a variety of geological environments. Deborah recognises the broader application of risk and value to the exploration industry and applies valuation principles to asset management in supporting corporate decision-making.

Deborah Lord: dlord@srk.com.au

### ALISON MORLEY

Alison Morley, MSc, BSc, Grad. DipAppFin, MAusIMM, has over 12

years' experience as an Underground Mine Geologist and Superintendent, gaining hands-on experience at Broken Hill and Mount Isa. She has managed a large team of geologists. In 2004, Alison joined



SRK where she participated in valuing exploration prospects and mines. She has completed numerous Independent Geologist's Reports and due diligence and fatal flaw studies of mining company assets.

Alison Morley: amorley@srk.com.au



he valuation of exploration projects that do not contain defined resources is complex, as consideration must be made of both technical and market factors. Technical factors include the level of geological understanding of the project area, the targeted mineralisation style, and the distribution and magnitude of mineralisation indicators defined by previous exploration (e.g. geochemistry or geophysics). Market factors may include recent comparable transactions, geography, infrastructure costs and commodity prices.

SRK's valuation approach considers both technical and market factors. Analysis of the technical aspects of the project form the core of the valuation method as the probability of the realisation of mineralisation potential

Α

 $\mathbf{EV} = \mathbf{P} \mathbf{x} \mathbf{TV} - \mathbf{C}$ 

- EV = Expected Value of Discovery at Stage
- P = Probability of success
- C = Cost of each stage
- TV = Target Value
- (NPV of deposit style)

has to be understood before the project can be sold or developed. The technical understanding is then tempered against market factors.

SRK has developed a probability (risk) based approach to exploration valuation – the Geological Risk Method ("GRM"; Lord et al., 2001; Morley, 2007). This relies on identifying likely target value (TV) outcomes from successful development of a resource of particular target size (TS), and discounting this figure by the cost and probability of success through the five stages of the exploration and development cycle, to arrive at an expected value (EV). The TS is based on the geological understanding of the area, and uses data from previous exploration and nearby operations.

\$





#### Schematic diagram of the geological risk method (after Lord et al., 2001)

Lord D., Etheridge M. A., Willson M, Hall G and Uttley P (2001) 'Measuring Exploration Success: An alternate to the discovery-cost-per-ounce method of quantifying exploration effectiveness' Society of Economic Geologists Newsletter, No 45, April.



The geological risk of each project is quantified by assessing geological features indicative of four key success factors for deposit formation (source, pathway, fluid and trap). Market parameters are considered in the GRM through comparable market transactions for deposits and exploration plays with similar commodities and target sizes, and the expected exploration and infrastructure costs to define a resource at the specified TS. The market data is used in the GRM as a dollar value per tonne of metal as determined by the market at a given time - equivalent to the yardstick method of valuation - and as cost discounts for exploring and developing the project from one stage to the next. The final EV is then benchmarked against traditional valuation approaches.

The GRM represents a science- and market transaction-based valuation approach, which is easily auditable, and accounts for the collective technical knowledge of the project being valued, in concert with market conditions preceding and at the time of the valuation.

Louis Bucci: lbucci@srk.com.au Deb Lord: dlord@srk.com.au Alison Morley: amorley@srk.com.au Peter Williams: pwilliams@srk.com.au

## Trekkopje

Trekkopje is the site of a green fields project, consisting of a very large, lowgrade, shallow uranium resource hosted in calcium carbonate cemented (calcrete) conglomerates. It rests in the arid desert region of western Namibia, in southwestern Africa, situated in gently sloping terrain.

Trekkopje will be an open pit operation, primarily using large hydraulic excavators loading haul trucks. With a planned production rate of 100,000t/d of crushed ore and an average stripping ratio of 0.23:1 (waste to ore), the mine life is expected to last approximately 13 years, based on the current resources. The crushing plant will be designed to crush ore at a rate of 7,000t/h to a product size of 100% passing 38mm. It will consist of two Primary Crushers and two Secondary Crushers running parallel, each with a throughput of 3,500t/h. The ore will then be agglomerated and conveyed to an on-off heap leach pad, sized to contain 300 days of ore. Uranium will be recovered from the heap leach pad using a carbonate/ bicarbonate solution and ion-exchange. Based on the current mine plan, the majority of the spent ore and waste will be placed back into the shallow open pits, allowing for an overall reduced mining footprint and concurrent reclamation.

Beginning in mid-2006, UraMin Inc. (the owner at the time), commissioned SRK to coordinate and lead a multidisciplinary team



of global consultants over a 20-month period to develop the Definitive Feasibility Study (DFS) that was issued in 2008. While South African consultants worked on the process, infrastructure, environmental and permitting aspects of the project. SRK worked closely with the client team to review the exploration program to ensure that all work was 43-101 compliant. SRK developed Resource and Reserve statements and mine plans; provided metallurgical, site geochemistry and hydrogeology assessments; performed site geotechnical evaluation and engineering design, including pit slope and heap leach pad design, and performed economic modelling. Late in the DFS program, UraMin was acquired by the world energy expert AREVA, as part of their global uranium supply strategy.

Terry Mandziak: tmandziak@srk.com Neal Rigby: nrigby@srk.com

### TERRY MANDZIAK

erry Mandziak, a University of Saskatchewan graduate, has over 16 years of diversified professional experience in project coordination and project design, including tailings and



heap leach projects in North America, South America, Turkey, China and Africa.

Since joining SRK's Denver office in 2004, Terry has managed a multidisciplinary team of consultants for several projects, including the Trekkopje Feasibility Study, in addition to performing due diligence on tailings and heap leach projects across the globe.

Prior to joining SRK, Terry spent five years managing heap leach pad construction projects and seven years designing tailings and heap leach pad projects from concept through final development.

Terry Mandziak: tmandziak@srk.com

#### **IESTYN HUMPHREYS**

Dr lestyn Humphreys is Managing Director of SRK (UK) Limited and a Director of the SRK Group. With 20 years' experience in the metals and mining sector, he manages due diligence projects for exploration



companies and financial institutions seeking access to capital markets. Our teams have authored Independent Engineer's and Qualified Persons' Reports on discoveries in Europe, the Americas, Australasia, Asia and Africa. For SRK he helps secure regulatory approvals for IPOs, GDRs, and ADRs on international exchanges. Historically, he has helped write mineral valuation and reporting codes and contributes to the CESR Listing Requirements initiative.

lestyn Humphreys: ihumphreys@srk.co.uk Partnering with Polymetal: from IPOs to Compliance Audits for ongoing reporting



Since 2003 to the present, SRK has partnered with JSC Polymetal in its annual declarations of Mineral Resources and Ore Reserves. The declarations meet the terms and definitions in the 2004 Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore reserves – the JORC Code, an internationally recognised reporting code as defined by the Combined Reserves International Reporting Standards Committee (CRIRSCO).

Today, Polymetal is a public holding company listed on the London Stock Exchange (SRK Mineral Expert's Report 2006), the Russian Trading System Stock Exchange and MICEX. The company operates and manages extensive mineral properties located in the Urals, Siberian and Far Eastern Federal Districts of the Russian Federation. These mineral properties comprise 30+ separate licences with a total area exceeding 7,100km<sup>2</sup> covering the development spectrum from advanced staged exploration, to developing and mature operating mines. In the 9-month period ending 30 September, the company

processed 3.2Mt of ore to produce 12.8Moz of silver and 0.2Moz of gold. By January 2009, the company reported total Ore Reserves of 390Moz silver and 5.2Moz gold contained within 65.5Mt of ore grading 185.5g/t silver and 2.5g/t gold.

On an annual basis, a significant (2009: 80%) portion of the Ore Reserve declaration in Polymetal's Annual report supported by the Compliance Audits were completed by SRK from consulting practices in Europe and the Russian Federation. The process SRK follows combines annual desktop studies and sample site visits completed on a threeyear rolling basis. To ensure material and transparent disclosure, SRK reviews the entire discipline spectrum from exploration through geology, resource estimation, mining, metallurgy and environmental to mineral economics. This process is greatly aided by the company's established twin reporting system, specifically developed for computerised estimation and modern pit optimisation techniques, as well as manual techniques that comply with local regulatory reporting requirements.



SRK recognises that organic development and acquisition continues to fuel the growth of companies operating in the Russian Federation and the broader Commonwealth of Independent States (CIS). This growth coupled with the widespread geographic location of mining and exploration properties within these companies and the continued need for access to global debt and equity capital markets, places increasing demands on inhouse technical resources and external consultants. To meet this demand SRK continues to draw on its global resources and local expertise to:

- Establish further CIS regional practices
- Develop Mineral Resource and Ore Reserve management systems/ protocols tailored to the needs of local and international regulatory requirements
- Play a direct role in the various international initiatives to align state approved reserve reporting systems with the CRIRSCO template

lestyn Humphreys: ihumphreys@srk.co.uk

## Project evaluation course

Wike Warren and Paul Hodkiewicz, Principals at SRK Australia, presented a training course on Project Evaluation in Singapore in May 2009. The course, entitled "Valuation and Financial Assessment of Mining Projects - a complete guide to due diligence in mining," attracted 18 attendees who came from mining and exploration companies, as well as accounting and finance firms.

As a result of contacts made at the course, SRK is now providing geological consulting to one of the mining companies, and supplying Leapfrog<sup>™</sup> software training to assist the mining company to visualise their deposits in 3D.

In December 2009, Mike and Paul ran the course again in Singapore, with an attendance increase to 31. The attendees came from a range of companies based in Asia, with the majority from mining companies; however, the attendees were mainly non-technical staff who worked in roles such as accounting, business analysis, business management and business development.

The course attendees receive a thick volume of documentation from the course, which includes copies of the presentations and a large collection of reference articles and technical papers. The attendees indicated they appreciated being provided with such a comprehensive set of notes and reference material.

Paul and Mike have been asked to present the course twice in 2010. Singapore is the likely venue but there was also some interest in running the course in Jakarta and/or Bali.

Mike Warren: mwarren@srk.com.au

### MIKE WARREN

Mike Warren is a Principal Mining Engineer with 30 years' experience, including on-site and head office roles. He leads the project evaluation team within SRK Australia and has



managed due diligence and valuations on a range of mining projects. Mike provides technical skills to underground and open cut mines. He has added technicaleconomic modelling and evaluation skills to his strong technical background. He has prepared Independent Reports for IPOs on exchanges in Toronto, Hong Kong and New York.



### Due diligence in coal – do SRK clients get good value for their money?

The short answer to this important question is Yes - SRK brings value to clients, licence holders and advisers during the due diligence process, whether it involves an IPO, purchase, sale, or borrowing. We are able to do this because of the experience, breadth of knowledge, and communication skills of our multidisciplined coal teams.

SRK has staff located in all the major coal producing areas of the world and most have worked for many years "at the sharp end" of the industry, as technical specialists and managers, before entering the consultancy business. Team members are able to communicate with the "workforce at the face" as well as

### **KEITH PHILPOTT**

Keith has worked in the coal industry for 35 years, spending the first 17 years with the state-owned coal industry in the UK before becoming a consultant. He joined SRK in 1996 and is a Principal



Geologist and Corporate Consultant. Keith is responsible for the coal group in the UK office and has extensive

the most senior technical specialists, managers and board members.

SRK teams can advise on a spectrum of issues, covering not only mining and geology/reserves, but also geotechnical. hydrogeology, environmental, processing, infrastructure and financial issues. The team is able to carry out associated detailed assessments if they are needed, from scoping to feasibility studies and software modelling using numerous proprietary software packages.

Our due diligence and independent reporting skills have been employed over the past 5 years by major clients, including SUEK, the largest steam coal producer in Russia and a world top-ten producer. The company has over 40 open pits, underground mines, washing plants and associated infrastructure located between western Siberia and Vladivostok. SRK has mobilised up to six multidisciplined teams, including specialist Russian technical translators, to visit the assets. SRK has prepared updated reserve statements and IPO documentation (not yet used!), working closely with SUEK in preparing LoMps and financial budgets for these tasks and, in 2010, is continuing to work with the client.

#### Keith Philpott: kphilpott@srk.co.uk





**SRK** has been evaluating minerals projects in southern West Kalimantan Indonesia for the past four years. This work has been focussed primarily on advising various clients on exploration and development programs for iron ore.

Iron mineralisation in this region is hosted predominantly within shales which have been hydrothermally altered and selectively replaced by massive hematite. SRK established a spatial association between iron mineralisation and porphyritic plutonic rocks early on, and proposed a magmatic-hydrothermal model of formation. This model formed the basis of future exploration programs designed by SRK for the district.

Drilling programs that SRK implemented have confirmed a magmatic-hydrothermal origin for iron formation. However, in addition to intersecting hematite mineralisation,

# Re-evaluation of the base and precious metal potential south of the Kalimantan Arc



SRK also identified geological and alteration features consistent with porphyry- or epithermal-style base and precious metal systems in the drill core. Such features include the extensive development of volcanic and deformation breccia, and the alteration of sulphide - quartz chlorite - epidote - carbonate. These results were somewhat unexpected, as the projects of interest occur significantly south of the currently accepted limits for the Kalimantan Arc - a geological district characterised by gold and precious metals mines with a porphyry or epithermal affinity.

The project's owners recognised the significance of SRK's interpretation and the recent exploration findings, and are working closely with us to develop sophisticated exploration programs to simultaneously target iron ore and base and precious metals systems within the district.

Through this project evaluation work in West Kalimantan, SRK has identified a potentially new base and precious metals district, in an area historically targeted solely for iron ore. Most recent exploration results indicate that the iron mineralisation may represent one phase of an overall evolving multi-element magmatic-hydrothermal system. As such, base and precious metal deposit styles within the Kalimantan Arc should be considered in exploration models for the southern West Kalimantan, and should consider a re-evaluation of the southern margin of the Kalimantan Arc.

SRK thanks the International Commerce Corporation Pte Ltd for their permission to publish this article.

Louis Bucci: lbucci@srk.com.au Kate Bassano: kbassano@srk.com.au

#### LOUIS BUCCI

Dr Louis Bucci is an Economic Geologist with over 13 years' international experience investigating mineralised hydrothermal systems. He has



worked on gold, base metals, nickel, iron ore, manganese and molybdenum across four continents. Louis interprets technical datasets in assisting clients to focus their exploration resources and efforts. He has extensive experience in geological due diligence, fatal flaw and project analysis for Competent Person's Reports for global financial institutions and security exchanges globally, and for feasibility study projects.

Louis Bucci: lbucci@srk.com.au

### KATE BASSANO

Dr Kate Bassano (PhD, BSc, MAIG) is a Geology Consultant with over five years of experience in mineral exploration geology and geochemistry, with exposure to numerous deposit



styles. Kate's expertise is in ore deposit geochemistry and geochronology, and the mapping of regionally deformed metamorphic terrains, with a specific interest in base and precious metals, and iron ore.

Kate Bassano: kbassano@srk.com.au

### **KEN REIPAS**

Ken Reipas, P.Eng., is a Principal Mining Engineer with over 28 years' experience in mine engineering, mine production and consulting. Prior to joining SRK, he worked at several



Canadian open pit and underground mining operations, involved in the bulk mining of iron, coal, gold and base metals. His positions included Chief Engineer and Mine Superintendent. Since 1997, Ken's consulting projects have included technical studies and reports, mine planning and reserves, project economics, and due diligence reviews, involving northern projects, mine rehabilitation, mine reopening and care and maintenance.

Ken Reipas: kreipas@srk.com

### **KELLY SEXSMITH**

Kelly is a Principal Geochemist in SRK's Vancouver office with over 17 years' experience. She holds a B.Sc. in Geological Sciences from the University of British Columbia



and a M.Sc. from the Colorado School of Mines. Kelly specialises in the geochemical characterisation of mine wastes. Her experience includes design and supervision of geochemical test programs, geochemical modelling, development of conceptual waste management plans, and prediction and monitoring of water quality from tailings, waste rock and pit walls.

Kelly Sexsmith: ksexsmith@srk.com

### Red Mountain gold project located in British Columbia, Canada



The Red Mountain Project near Stewart, British Columbia has been the subject of extensive exploration and development activities since 1989.

Seabridge Gold Inc. ("Seabridge") acquired the Red Mountain Project in February 2002 to provide exceptional returns to shareholders by maximising leverage to the gold price that was expected to rise. Seabridge's business plan was to find, evaluate, acquire, explore and develop gold deposits. Management decided that Seabridge would not build or operate mines, but would look to partner or sell assets that were ready for production.

In 2003 Seabridge commissioned SRK Toronto to prepare an Independent Engineering Study on the Project.

SRK evaluated previous studies and recommended the best development alternatives for various aspects of the project, including:

 Method of access to the site location in challenging mountainous terrain. Options included road access, aerial tramway, and tunnel and shaft. Road access was selected

- Power supply. Overland BC Hydro power line was selected over on-site diesel generation.
- Operating schedule, considering the mountain location and avalanche hazards. Seasonal operation from May to October was selected over year-round operations for safety and reliability
- Mill location and basic process. An on-site mill using a grinding and cyanidation leaching (CIP) circuit was selected over the alternative of using flotation to produce a sulphide concentrate for offshore marketing
- A conventional type of mill was selected over a portable type, due to the tonnage required (1000tpd) and the very fine grind needed
- The full use of backfill was selected to maximise the mining recovery of the resources. Minimising backfill was considered to reduce costs, but the potential savings did not justify a lower recovery of the mineral resource



Having selected the optimum development plan for the project, SRK prepared a life-of-mine production plan and cash flow model.

In late 2007, Seabridge commissioned SRK to update the costs and economics of our 2003 Technical Report. Results were reported in an updated Preliminary Economic Assessment in January 2008.

Throughout this period, SRK Vancouver provided ongoing environmental management services to Seabridge, including annual site inspections, water quality monitoring, annual regulatory reporting, and closure planning to ensure the site is in compliance and no outstanding regulatory concerns could delay future development activities.

Seabridge is now seeking a joint venture partner or acquirer for the Red Mountain Project.

Ken Reipas: kreipas@srk.com Kelly Sexsmith: ksexsmith@srk.com

# El Chanate gold project, Mexico

With the significant increase in the gold price over the last several years, some smaller mines have had the opportunity to become bigger mines. Capital Gold Corporation's El Chanate heap leach gold mine, located in the Sonoran desert of Mexico is one such operation.

Subsequent to completion of SRK's Independent Engineer role for the lending banks, SRK was retained by and worked closely with Capital Gold personnel to help define potential corporate and operational strategies to maximise shareholder value and the growth of the company. Specific work has included revised geologic modelling and resource estimation, pit optimisation, preparation of phased mine plans and production schedules, mine equipment fleet modelling and estimation, development of a disturbance schedule, compilation of an NI 43-101 technical report and scoping and targeting of in-fill/ exploration drilling programs.

The culmination of a series of "whatif" scenarios and recommended work plans has given management and site personnel a much better understanding of the true potential at El Chanate and what work is required to realise its potential. SRK has also been involved in providing technical analysis for potential mergers and acquisitions that Capital Gold may or may not execute. Using a combination of public domain and/or site specific data, SRK has acted as technical advisor and independent engineer to evaluate potential orebodies, mine plans and economic models.

SRK will continue to provide Capital Gold Corporation with the technical expertise needed to make informed investment and operational decisions in order to meet the company's corporate strategy in the years ahead.

Bret Swanson: bswanson@srk.com

### BRET SWANSON

Bret C Swanson (BE Mining) MAusIMM is a Principal Mining Engineer with 15 years of global mining experience. His recent work has involved contributions to



numerous feasibility, pre-feasibility, preliminary assessment, independent engineer, Competent Person's Reports and mine site support while employed with SRK Denver.

Bret Swanson: bswanson@srk.com

The El Chanate Mine, Sonora Desert, Mexico

### Independent review of worldwide exploration portfolio

n connection with the acquisition of Falconbridge Ltd., the integration planning team of Xstrata plc commissioned SRK to provide technical guidance for the evaluation of Falconbridge's exploration assets.

SRK's assignment was to complete a desktop review of Falconbridge's greenfield exploration assets with a view towards summarising the characteristics of the portfolio, providing an independent assessment of their realisable value and commenting on the capabilities of the exploration team.

### J E A N - F R A N Ç O I S C O U T U R E

Dr. Jean-François Couture, P. Geo, is a Principal Geologist based in Toronto and Director of SRK North America. He is a Qualified Person within the definition of several international



regulatory requirements (National Instrument 43-101, JORC). His expertise lies in geological and structural modelling, ore deposit modelling, digital data integration, exploration project review, due diligence and resource evaluation. He has authored and co-authored independent technical reports for precious and base metals, uranium exploration and mining projects in Canada, Argentina, Burkina Faso, Chile, China, Finland, Guyana, Ghana, Kazakhstan, Mexico, Niger, Sweden, South Africa and the United States.

Jean-François Couture: jfcouture@srk.com

The challenge of this unique assignment was to mobilise an experienced and credible team capable of reviewing a worldwide portfolio containing early- to development-stage exploration assets and prepare a timely technical overview.

SRK's unique worldwide presence was instrumental in mobilising five teams to visit six regional exploration offices in five countries on three continents. Within six weeks, a team of 14 SRK geologists had reviewed over 60 active exploration projects in 14 countries to assess their merit, rank the portfolio on the basis of qualitative metrics – essentially the perceived potential of yielding a positive discovery – and provide a "fair market value" opinion, based on a market approach and comparative transaction analysis.

Although subjective, the ranking proposed by SRK based on a very limited review, aimed at providing a first-order independent overview of the portfolio, to guide Xstrata in realising the value of the exploration assets as part of integrating Falconbridge into Xstrata. Critical to this assignment was SRK's capacity to mobilise quickly a credible review team and deliver a timely technical review.

Jean-François Couture: jfcouture@srk.com





**PT** Indo Rak Resources (RAK), a subsidiary of Middle East Coal and a joint owner of the Marwa Wahau deposit along with PT TOP, commissioned SRK to undertake a feasibility study of the property. The thermal coal greenfield project, sitting over a large resource, is poised to be one of the biggest open-cast projects in Kalimantan.

It is located in the District of Marwa Wahau, Kutai Timur, East Kalimantan, Indonesia. Of the two blocks, North and South, the North block is thoroughly explored. The workable S2 seam has a reported JORC resource of around 500Mt; the coal is known to extend into the South Block.

Beginning in 2008, SRK assisted RAK in evaluating the deposit with an independent audit of its exploration data and reported resources. Following that study, SRK joined SMGC, a geological consultant from Jakarta, in advising RAK.

In March 2009, SRK started a scoping study of the North block using the geological models and resources Marwa Wahau coal projectpreliminary feasibility study



prepared by SMGC. The study used comparative methods of scope definition and cost estimating.

The current 2009 report estimates the total geological resource to be 937Mt within the North block. Only measured and indicated resource categories were applied to estimate potentially mineable coal, forming the basis of mine planning and economic evaluation. An early interpretation of slope stability and a basic understanding of groundwater conditions was completed by others.

The pre-feasibility study defines an open-cut strip mining operation utilising conventional truck and shovel equipment for overburden removal, Continuous Surface Miner for coal mining and waste backfilling to maximise in-pit dumping thereby ensuring minimal environmental disturbance. The method divides the coal block into longitudinal strips of similar width from one end of the block to the other. Once coal is removed from one strip, it is backfilled with the waste rock generated from the next strip. This method is most apt for areas with flat terrain and low dipping coal seams with long strike length. It facilitates early backfilling, reduces the need for external dumps, improves environmental outcomes and promotes progressive rehabilitation.

The mine is planned for 21Mt per annum with a project life of 19 years. The quantity of open-pit mineable coal from the North block is estimated at 388Mt at a life-of-mine stripping ratio of 1.42:1. No inferred category resources were included in the calculation. SRK evaluated different mining technologies and selected the preferred option. SRK has also planned for the mine and support infrastructure for the target capacity.

Based on this work, SRK recommended that the project proceed to a definitive feasibility study.

Marajul Haque: mhaque@srk.co.in Arunabha Duari: aduari@srk.co.in Kousik Bose: kbose@srk.co.in Barendra Nath Paul: bpaul@srk.co.in

### MARAJUL HAQUE

Marajul Haque is a Mining Engineer, specialising in mine planning, equipment selection, optimising production

. sequencing and economic modelling. He has worked with international mining



equipment manufacturers, planning and implementing coal mining projects. Marajul recently developed an application based on MS-Excel that helps determine equipment requirements, mining fleet composition and size, and cost estimates. He is presently involved with a coal project in South Kalimantan, Indonesia, while he completes his MBA degree in finance.

Marajul Haque: mhaque@srk.co.in

### KOUSIK BOSE

Kousik is a Mining Engineer working in open-cast coal mines, with mining companies and mining consulting firms. With projects in mine operations, planning, and



consulting, he uses software, such as Whittle Optimisers, extensively. His special interest is in mine modelling, optimisation studies and design. Kousik started with SRK's UK office in Cardiff, with coal his specialty. He is presently working on the feasibility study for a major coal project in South Kalimantan, Indonesia.

Kousik Bose: kbose@srk.co.in

### DAVID PATTINSON

#### Dr David

Pattinson, Principal Metallurgical Engineer, joined SRK in 2005 and specialises in metallurgy and mineral processing aspects of



technical studies, due diligence and project execution. David has over 28 years of experience in the non-ferrous mining industry. During his career he has been involved in plant design, construction and commissioning with an international engineering company and has experience in consultancy for reimbursable, EPCM and lump-sum contract work. David is SRK's Project Manager for the Talvivaara project.

David Pattinson: dpattinson@srk.co.uk

### JAMES GILBERTSON

J ames Gilbertson is a Senior Exploration Geologist with SRK Exploration Services. He has 10 year's experience in the mining and exploration industry, including



three as a Resource Geologist with SRK (UK). James conducts exploration logistics, planning and reviews, resource estimates and audits, and QA/QC management. He reviewed the geology and resource estimation for the Talvivaara project and helped compile JORC-compliant Mineral Resource and Ore Reserve statements.

James Gilbertson: jgilbertson@srkexploration.com

### Talvivaara



Talvivaara is a Greenfield mine development, located in eastern Finland. It is the first application of the bio-heap leaching process for the economic exploitation of lowgrade, nickel-zinc sulphide ore bodies. Although not yet in full production, Talvivaara already stands out for using new, innovative technology and for the speed at which the project has been implemented.

Pekka Pera, the CEO of Talvivaara Mining Company Plc, initiated the project after acquiring the mining rights and historical research from Outokumpu in 2004. A handpicked team of specialists completed a Pre-Feasibility Study in 2005 and a Bankable Feasibility Study in December 2006. A 17,000 tonne bioheap leach was built in mid-2005 to demonstrate that the leaching process could operate effectively during the cold Finnish winters at temperatures below -20°C. Metals were recovered as precipitated sulphides in a hydrometallurgical pilot plant. The project follows Equator Principles and received its Environmental Permit in 2008. At present throughput is being ramped up and full scale production should be achieved during 2010.

There are a number of interesting aspects of the Talvivaara project due to the application of bio-heap leaching. Non selective bulk open pit mining will be used to develop the two ore bodies and ore blending will not be required. In pilot testing, relatively high metal extractions were achieved by crushing the ore to only minus 8mm. The crushed ore is stacked 8 to 10 metres high on large HDPE-lined leach pads, and bacterial leaching takes place in two stages over four years. The bacteria used were found naturally within the surrounding environment and the temperature within the heap can reach 80°C. Metals precipitated from the pregnant solution include NiCoS, ZnS and CuS.



The development includes all on-site reagent systems and infrastructure, including a fresh water supply system, a new power line, a rail spur and large lined waste storage ponds. It is recognised that the Talvivaara operation may well have set the standard for a new generation of low grade open pit mining operations.

The mine should produce 15 million tonnes of ore a year, over a 22-year mine life. Annual metal production is estimated at 33,000 tonnes Ni, 61,000 tonnes Zn, 10,000 tonnes Cu and 1,300 tonnes Co. To date, approximately €700 million has been invested in the project.

David Pattinson: dpattinson@srk.co.uk

Sabine Anderson: sanderson@srk.co.uk

James Gilbertson: jgilbertson@srkexploration.com

# SRK involvement

SRK has been involved with the Talvivaara project since 2006. SRK was appointed by Talvivaara to prepare a Mineral Experts Report for listing on the London Stock Exchange, and subsequently by Standard Bank Plc to prepare a Technical Audit Report for debt finance. Additionally SRK has prepared a revised JORC compliant resource estimate and has provided assistance during additional financing. For project implementation, SRK was appointed to undertake the role of Independent Engineer on behalf of the banks and report quarterly on all aspects of the development.

SRK's role as Independent Engineer will gradually change to operational monitoring and it is likely that this will continue until the end of 2010.

### SABINE ANDERSON

Sabine, Senior Mining Engineer, joined SRK in 2005, performing technical assessment of exploration and mining projects, in support of acquisitions, debt and equity finance.



Her experience includes project evaluation and valuation, economic analysis, multi-disciplinary due diligence, project managing numerous commissions, and preparing scoping and pre-feasibility studies. Sabine is responsible for SRK's Financial Evaluation of the Talvivaara project.

Sabine Anderson: sanderson@srk.co.uk

## Capstone Mining Corp's Minto Mine

**SRK** began its relationship with Minto Exploration Ltd. (a 100%-owned subsidiary of Capstone Mining Corp.) in 2006, when it conducted a due diligence review of the Minto copper-gold-silver mine project for a major bank. At that time, the company had just completed a feasibility study and was fast-tracking construction at the mine. SRK's favorable review assisted the bank in making a decision to invest in the project

### **GORDON DOERKSEN**

**G**ordon Doerksen, P.Eng., PE, is a Principal Consultant, Mining, in SRK's Vancouver office. His technical strengths are built on 20 years' experience at operating mines



in production, management and engineering roles. He has worked with coal, trona, aggregates, gold, copper and poly-metallic, in both underground and open-pit mines. Gordon's expertise is in mine design, scheduling, equipment selection, costing, project management and practical solutions to operational problems. He manages due diligence audits, technical reports, economic assessments, and feasibility studies. and, with funding in place, Minto was constructed and commissioned within a very aggressive timeline and budget.

Upon startup, SRK assisted the mine with operational support and has continued to provide on-going technical assistance ever since. SRK performs geochemistry, rock mechanics, hydrogeology and resource/reserve estimation for the operation and has provided mine planning services on an as-needed basis. Exploration success at Minto has led to SRK's involvement in estimating new mineral resources and reserves and providing 43-101 compliant technical reports and preliminary feasibility studies for new resource areas.

Minto's aggressive "can-do" attitude has led to significant improvements in copper production since start-up, and more opportunities are still available. SRK is currently reviewing the underground mining potential of the deeper and highgrade zones, where extraction using open pits is not economical.

As the Yukon's only copper mine continues to expand and evolve, SRK is fully committed to provide technical and operational support to help mine personnel make informed decisions and continue to exceed expectations.

Gordon Doerksen: gdoersken@srk.com





During 2009, SRK took on several compliance audits for project funders. Through this work, SRK witnessed mines move from merely aiming for compliance with in-country environmental legislation to adopting good practice as outlined in the Equator Principles and other guidelines. Mining companies and financial organisations are working to achieve international best practices. Several projects have focussed on refurbishing mining and processing activities in Zambia and the DRC, where new players address complex environmental and social legacy issues.

Financial and legislative drivers are advocating environmental and social management over the life of an operation. However, while many mines are simultaneously in the development, operations and closure stages, attention is largely focussed on new development projects. Attention to legislative compliance is imperative, but the development stage cannot be considered in isolation from other stages. The ramifications of this neglect include:

# Taking a holistic view in mining reviews and audits



- Limited attention to existing liabilities. By focussing resources only on new developments, existing liabilities often increase and opportunities for progressive rehabilitation and clean up are missed, even though they would reduce the final costs at closure.
  Particularly for refurbishment projects, neglect or poor practice can significantly degrade the environment
- Management systems focus on new developments. When existing operations at a site are not included, serious pollution incidents can result in significant non-compliance, jeopardising project funding and licence to operate
- Social uncertainties around possible closure. In one case several operations were geographically dispersed and at different stages in the life of mine. With the focus on new development, limited closure planning was evident at the site of the possible closure resulting in socio-economic uncertainty which manifested in community threats, action, and dissatisfaction. Lack of attention to these issues can damage reputations and perpetuate poor

community relations and difficulty in obtaining funding

 Turnover of difficult assets. As assets become less financially viable to one company, others may see an opportunity to invest. Affected communities can be exposed to several mining companies over a few years that should manage the assets, but the turnover often results in delayed or incomplete implementation of commitments. Unrealistic commitments made in the past can result in strained community relationships and a difficult operational environment

In many of these reviews, SRK has the opportunity to consider the operations in their entirety. SRK concludes that operations simultaneously meet legislative requirements in some areas of the operations yet are non-compliant in other areas. The former areas of compliance tend to correspond with new developments.

The holistic review allows SRK to assist clients in identifying areas that need attention, to bring the full spectrum of the operations to compliance level, minimising or avoiding risks.

### BRIONY LIBER

Briony Liber is a Senior Environmental Scientist in SRK's Johannesburg office. Briony has over 11 years' experience in environmental impact assessment, public involvement,



environmental management and implementation of management plans. In the last year, Briony has developed knowledge of the Equator Principles and IFC guidelines, having worked on an ESIA for a mine in the Democratic Republic of Congo and on several environmental auditing projects at Zambian and South African mines.

Briony Liber: bliber@srk.co.za

### HENRIETTA SALTER

Dr. Henrietta Salter is a Principal Scientist in SRK's Johannesburg office She has over 17 years' experience in environmental impact assessment, water and waste



management and environmental auditing and due diligences. She managed the preparation of an Equator Principles-compliant ESIA/ ESMP for a project in the Democratic Republic of Congo, as well as auditing compliance with the Principles and due diligence work on copper, coal, zinc, gold, platinum group metals and uranium mines.

Henrietta Salter: hsalter@srk.co.za

Briony Liber: bliber@srk.co.za Dr Henrietta Salter: hsalter@srk.co.za James Lake: jlake@srk.co.za

### JAY PENNINGTON

Jay Pennington is a Certified Professional Geologist and Principal Mining Geologist in SRK's Elko, Nevada office. He is a Qualified Person for NI43-101 reporting under CIM



regulatory guidelines. He has over 24 years of international experience in precious and base metals exploration, resource geology, mine feasibility and due diligence. His expertise is interpreting mineralising systems, integrating digital data and resource evaluation. With 12 years' industry experience in Australia and Southeast Asia, he was Chief Geologist at the Grasberg Deposit in Indonesia. Jay's recent consulting work consists of domestic and international mine development and due diligence for mine financing.

Jay Pennington: jpennington@srk.com

# Growing up with a gold mine – SRK's multi-level project support at Hycroft



Allied Nevada Gold Corp. was formed in 2006 after purchasing a portfolio of over 100 precious metal prospects in Nevada (NV). Their flagship property, Hycroft, located 60 miles west of Winnemucca, NV, was reactivated after a 10-year dormancy period to establish cash flow to fund on-site exploration and to develop advanced projects in other parts of the State. Since 2006, as the price of gold has risen from US\$700 to US\$1,100 per ounce, interest in historic Nevada mines has been rekindled and some sites are coming back on line with new development strategies. Though the Carlin Trend is Nevada's "headliner" mining district, the state's "supporting cast" of gold producers over the last two decades have been shallow, openpit oxide operations receptive to bulk mining and low-cost heap leaching. The underlying sulfide zones of these deposits that are not heap-leachable have been largely ignored and often undrilled.

In 2007, Allied, who subcontracts most of their technical work, selected SRK for due diligence of a Hycroft restart that would involve production of both oxide and sulfide ores. Following a favorable outcome, they approached SRK to prepare permitting documents and engineering designs to expand the historic leach pad. In less than 18 months the company was mining and leaching oxide ore and pouring gold offsite. The company, however, had set its sights on a much larger sulfide resource beneath the mined-out oxide pits.

During the production ramp-up period, SRK teamed with Allied and independent specialists to build the geologic base from which a 2.0Moz gold equivalent mineral resource was generated. Initial work included digitising and verifying data from nearly 4,000 historic drill holes. SRK then took responsibility for storing and managing the drill database. Geologic support involved probabilistic modelling of lithology, alteration and merging interpretations of logged oxide and cyanide soluble gold to produce a "leachable ore" horizon. The scale of the property would have made the cost/time investment prohibitive, for this type of modelling, using a conventional sectional approach. Next, the team produced a



comprehensive structural framework to serve as domain boundaries for the ensuing round of resource estimation. In parallel, Allied/SRK prepared an intensive infill-drilling program that, once completed, added 6.1Moz gold equivalent to the company's resource base, upgraded many of these resources to reserves, and more than doubled Allied's share price. Geologic modelling is currently being refined, and as new drilling data arrives, SRK is shifting from probabilistic to deterministic modelling using an extensive 3D toolkit.

SRK has leveraged the relationship at Hycroft to support Allied in promoting its other properties. SRK's capability for rapid assessment and 3D manipulation of exploration data has allowed it to host project demonstrations, gaining valuable exposure to prospective new clients and showcasing SRK software and talent, while advancing Allied's marketing objectives.

Jay Pennington: jpennington@srk.com

# Site visit could be critical for identifying the potential fatal flaws

he picturesque Serra da Canastra Kimberlite Province in southwest Minas Gerais is one of several diamondiferous locations in Brazil. The kimberlite bodies are mostly buried along the extensive valley floors and beneath scree deposits. The region has produced approximately 2 million carats of diamonds since the mid-1930s.

SRK and Mineral Services jointly completed a technical audit of the Canastra 1 kimberlite pipe. A small team of diamond mining specialists flew in to value the Canastra project in preparation for a possible bid.

With both time and cost constraints for this assessment, it was critical to concentrate on "big picture" issues material to the outcome.

Auditing diamond properties is one of the most challenging due diligence assignments, because the resource cannot be re-sampled or the grade/value verified within the audit time frame. However, identifying other issues and potential fatal flaws could provide critical information for the project acquisition.

The Canastra 1 pipe is located near the beautiful Casca d'Anta waterfall, on the steep valley floor, where regional rainfall is estimated between 1,300 – 1,700mm per year.



Although the stream running through the kimberlite at the bottom of the steep valley was identified as a potential problem during the desktop study, only the site visit revealed the magnitude of the problem. In the early morning hours, fifty minutes of hard tropical rain produced a flash flood that converted a peaceful crystal-clear stream into a raging current with flows estimated at 20-50m<sup>3</sup> per second.

This event would certainly materially affect the mining approach and the capital to be spent upfront to manage surface water. Without the site visit, this flaw could not have been identified from the data provided.

Jarek Jakubec: jjakubec@srk.com

### JAREK JAKUBEC

J arek Jakubec, C. Eng has over 25 years of operating and consulting experience in mining, geology and rock mechanics, including technical and managerial



positions in operating mines in Canada, Botswana and the Czech Republic. As an SRK Engineer based in Vancouver, Jarek has worked on 70 projects on all continents, completing technical or operational audits, and due diligence studies, publishing technical papers and speaking at conferences. Jarek is a Qualified Person for 43-101 reporting.

Jarek Jakubec: jjakubec@srk.com

General view of Serra da Canastra k

# **Evaluating CIS projects**



David is the Managing Director of SRK Russia and is based in Moscow. He has over 20 years' experience, 11 of which were on mine sites. With SRK he has led several large



multi-disciplinary audits for financing and stock exchange listings including the listing of ENRC (2007) and Vedanta (2003) on the London Stock Exchange.

David Pearce: dpearce@srk.ru.com

When evaluating projects in Russia, Kazakhstan and other CIS countries, a key challenge is that their data and technical studies have been developed following resource reporting guidelines that differ from the standards many international investors or consultants use. SRK has been involved in CIS projects for many years and has developed approaches to help clients evaluate and optimise projects.

SRK has made these key observations:

- While the quality assurance and control systems often did not involve duplicates or standards, independent laboratory checks involving 5-10% of all samples provide sufficient insight into the accuracy of the samples. However, a key challenge can come when the core recovery is poor, due to the extensive use of single-tube core barrels
- Often, far more geological data, including underground exploration, is available with CIS projects than with international projects, providing a greater appreciation of the geology
- Soviet exploration programs were typically better controlled and guided

than comparable international projects at the time, with data spacing guided by the assessment of deposit complexity. Where the assessment was appropriate, the data spacing often matched that required to meet geostatistical requirements. Also, while the drill core is often no longer available, the drillhole "passports" are stored in either corporate or state archives

- Resource estimates are typically derived using standardised polygonal methods, which generally produce comparable global results to more sophisticated methods but which can in some cases produce less reliable local estimates
- There are often multiple technical studies available, though data required internationally (e.g. the Bond Work Index) may not be available. It is important to understand what studies exist to help plan future work and to explain differences if new studies give different results.
- As the technical studies are rarely based on computerised models, the effort involved in updating life-of-mine plans or evaluating alternative cut-off grades can result in mines operating sub-optimally



SRK's approach aims to:

- Use existing data as much as possible
- Advise and supervise verification drilling to check historic data and infill studies to collect missing data
- Computerise the data to evaluate alternatives quickly
- Develop international style scoping, prefeasibility and feasibility studies in conjunction with Russian studies
- Benchmark the projects against comparable international projects
- Help the client implement the changes needed to realise the planned performance targets
- Help CIS clients raise international debt and equity finance through advising on how the studies can meet the levels of confidence and accuracy required

By combining SRK's local knowledge with international experience, SRK has been able to help clients optimise projects and meet local regulatory requirements in the most efficient way.

David Pearce: dpearce@srk.ru.com

## Sino Gold

In 2006, Sino Gold Limited commissioned SRK to provide an Independent Expert Report on the mines and exploration assets of the company, with the report intended to be submitted to the Stock Exchange of Hong Kong Limited (HKEx). Sino Gold was already listed on the Australian Stock Exchange but wanted to have a dual listing in Hong Kong. The SRK team inspected and reported on the Jinfeng gold mine and exploration tenements in China, which were owned by the company or were in Joint Venture (JV) with Chinese partners.

The Jinfeng gold mine is located in Guizhou Province, as shown in the map below. Jinfeng had a reserve grade averaging 5.4g/t gold and was to be mined by both open-pit and underground mining methods. The metallurgy of the Jinfeng ore was not straightforward, requiring processing by the bio-oxidation method to achieve good recovery of gold.

The exploration assets included the White Mountain project in Jilin Province, three JVs in Shandong Province and four JVs in the "Golden Triangle," which is located in the border area of Guizhou and Guangxi Provinces. The SRK report was tailored to meet the Listing Rule requirements of HKEx and was included by Sino Gold in their prospectus. The listing was successful and Sino Gold became the first mining company jointly listed in Australia and Hong Kong. The White Mountain mine was successfully commissioned in late 2008.

Peter Smith is an Environmental Scientist who previously worked for Sino Gold and SRK China was happy to attract Peter to work for SRK in our Beijing office. Two SRK staff joined Sino Gold in their Sydney office and were part of the exciting period of exploration and operation of both Jinfeng and White Mountain. In 2009, Eldorado Gold of Canada completed a merger and took over management of Sino Gold to create a company with almost 19 million ounces of gold in measured and indicated resources.

Mike Warren: mwarren@srk.com.au



# Geology beyond the resource

A fundamental part of SRK's approach to project evaluation is the recognition that many of the risk areas associated with mining projects are driven by lack of understanding of the geology of the deposit in question. Typically, there is significant focus on the impact of geology on the resource. This is justifiable, since the resource is the key asset of a mining project and a long list of project failures can be attributed to poor resource estimates. However, from a number of project reviews over recent years, it is apparent that the key geological

### RICHARD CLAYTON

Richard Clayton is a Resource Geologist whose primary expertise is in the production and critical evaluation of mineral resource estimates and management of multi-disciplinary,



due-diligence projects. He is a member of SRK Australia's project evaluation team based in Sydney, and his experience covers a broad range of commodities and geographic locations. Richard's involvement with multi-disciplinary teams provides the background and experience to assess the impact of geology on other disciplines –metallurgy, mining and environment, in particular. risks are often associated with other aspects, such as geo-metallurgy and environmental impact. In these specific examples, key assumptions are dependent on mineralogy and the representivity of sampling campaigns, which are often limited in scope and breadth. Assessing the geological representivity of the data, which underpin downstream assumptions for other disciplines, is therefore a key part of the geologist's role in any project evaluation.

Recognising these factors, the geologist has a responsibility to communicate with other team members, especially those with an engineering rather than geological background, to assess the key geological assumptions impacting these other disciplines. The geologist can then assess the level of geological understanding supporting these assumptions and help identify any risk areas and/or opportunities for improvement.

In summary, the geologist must look beyond the resource and assess the impact of geology on the project as a whole. Recognising this fact is a key strength for SRK's holistic approach to project evaluation and assessing geological risk in particular.

Richard Clayton: rclayton@srk.com.au



Copper oxide mineralisation - Peru



Anvil Mining Limited, a public company listed on the Toronto and Australian Stock Exchanges, is engaged in exploring and developing base metals mineral properties in Southern Africa. Anvil's principal development asset, the Kinsevere Copper Project, is located in the Democratic Republic of Congo and is managed via its 95% interest in a local joint venture. Relying on input from various technical teams located on three continents, the company completed a Feasibility Study in 2007. Additional exploration drilling and technical updates led to a further update following which, the company sought access to the debt capital markets to fund construction and commissioning of an SX-EW plant with rated capacity of 60ktpa of LME grade A quality electrolytic copper cathode.

In 2008, as the independent engineer, SRK completed a full technical due diligence of the project and authored an Independent Engineer's Report (IER).

26

### Kinsevere Copper Project: due diligence in the DRC



Since local knowledge and specialist input for review of milling-in-raffinate technology was key, SRK established a multi-disciplinary team from its European and Southern African practices supplemented by expert associate metallurgists. The process did not identify any fatal flaws but presented specific recommendations, which were incorporated in a detailed action plan.

During the second half of 2008, as turmoil mounted in the financial markets and copper prices declined, the company was unable to secure funding and in November 2008 all construction activities were placed on hold. At this stage the plant construction was 35% complete with detailed engineering 77% complete. In the ensuing six months, sustaining dry conditions in the open-pits while completing technical optimisation studies and the detailed action plan were critical to maintain the momentum and identify alternative sources of funding should market conditions change. In 2009, SRK again worked with Anvil, maintaining the original team of consultants. Following the development of updated mining plans and construction/ commissioning schedules, Anvil announced that it had reached an agreement for US\$200m of debt and equity financing with Trafigura Beheer B.V., the second largest independent commodity trader in the global nonferrous market. The updated IER was made available to all parties.

Following recent (December 2009) shareholder approvals, syndication of the Trafigura project finance remains a possibility. The intellectual capital vested in the process to date is significant, and the updated action plans and the IER remain the principal independent technical due diligence reference documents. The ability to retain a core team of consultants with local and specific experience, through a global network of practices, to support access to the international debt capital markets is crucial. lestyn Humphreys: ihumphreys@srk.co.uk



Every type of mining project in all environments everywhere in the world.

To learn more about SRK and how we might help you with your next mining challenge, please visit:

# www.srk.com

