In May 1985, Dennis Laubscher, a crusty geologist who joined SRK from Zimbabwe as a leading expert in block-cave mining, had a telephone call from Fluor Daniel in South America. The Chilean state-owned mining corporation, Codelco (Corporación Nacional del Cobre de Chile, the national copper corporation of Chile), wanted him to look at the Andina Mine, about 50 kilometres northeast of Santiago. He was soon on a plane to South America.
My first task was to generate as many mass mining methods as I could for the mine,” Laubscher says. “I think I managed 23!” Anyway, having developed the use of 3D physical models carved from Styrofoam in Zimbabwe, I got the two draftswomen to model the Andina Mine ore bodies to show why I thought the underground mine should be turned into an open pit — and they needed Oskar Steffen for that. That wasn’t my area.”

Steffen and his team arrived, and proposed transforming the operation into a humongous open-pit mine with a wall 1,900 metres high — deeper than any in the world. Even if the technical aspects had been in the ordinary range, such a move was a hard sell for political reasons.

“A general was still in charge of mine management in those days, and he told me it snowed too heavily at that elevation in the Andes for an open pit,” Laubscher laughs. “My reply was, ‘Nonsense, I’ve worked at the open pit in Cassiar, northern B.C., where they mine all year round.’”

Regardless, it was SRK’s entrée into South America and the beginning of a lasting and incredibly close relationship between Codelco and Steffen.

The international mining industry aggressively moved into the southern cone in the 1980s, partly because permitting, environmental laws and endless cycles of consultation were making First World projects almost impossible to green-light. Most of South America, with its more laissez-faire regulatory culture, was viewed as fertile ground, albeit politically risky because of the threat of nationalisation. More than a decade after the late President Salvador Allende nationalised Chile’s mining market, it was reopened to international investment in 1982 and the country was again seen as a major opportunity.

Fernando Fuentes, a mining engineer who joined Codelco just after it was formed in 1976, said the dropping of market barriers to international firms also created a need for consultants. Until then, the government employed most of the professional staff involved in mine planning and operations; there was little need for consultants. In 1982, the secretary of Mining, José Piñera, passed the Constitutional Mining Law, which opened up the domestic market. Golder, Knight Piésold, Bechtel Corporation and Fluor Daniel soon arrived.

Fuentes and two of his colleagues saw an opportunity, and in early 1985, they formed NCL Ingeniería y Construcción S.A. in Santiago. That first year, they found themselves working with Steffen and SRK. As a result of Steffen’s initial trip, SRK received a number of contracts from Codelco, and NCL was involved in many of them. Richard Connolly, Dick Stacey, Chris Page, Cam Scott and other SRK specialists soon started arriving in Chile to do one contract after another.

Steffen was then asked to undertake a comprehensive review of what was, at the time, the world’s largest copper mine — Chuquicamata, about 1,650 kilometres north of Santiago, in the Atacama Desert. He led a team of eight to the massive operation that sat on a deposit that had been exploiting for millennia.
PROJECT: Chuquicamata Open Pit

CLIENT: Codelco

SCOPE: The Chuquicamata open-pit mine in Chile’s Atacama Desert started operating in the early 1920s, setting the stage for it to become the world’s biggest open-pit copper mine. The initial waste stripping was carried out by the large shovel used in the earthmoving program for the Panama Canal. The large B-E stripping shovel was used at Chuquicamata to load waste material into train wagons for transport to dumping sites. This shovel is still on display in front of the mine offices. The eminent geotechnical engineer Dr. Bruce Kennedy was a pioneer in monitoring — and setting standards for managing — slope instabilities at Chuquicamata. Laubscher and Dr. Oskar Steffen were invited to visit Chuquicamata in the mid-1980s to give their opinion on the stability of the slopes, having previously participated in the development of Codelco’s Andina operations. Following this visit, SRK worked with mine-planning staff in the early 1990s to develop alternative mining plans. The new procedures brought about a significant reduction in stripping requirements through slope angle increases.

In the mid-1990s, Professor Evert Hoek suggested that a geotechnical review board (GRB) be established in accordance with standard practices in large civil engineering projects. Chuquicamata’s management gave the go-ahead and the mining industry’s first GRB was set up. The original members of the GRB were Professor Hoek, Dr. Steffen, and Dr. John Read. It was agreed that GRB membership span three to five years and that replacements be recruited by GRB members, with mine management approval. This process is now standard practice in the mining industry worldwide.

OUTCOME: SRK has been actively involved with the Chuquicamata operations. Technologies within the Chuquicamata and Codelco group have been continually updated, with external consultants participating as required. During the current conversion from open-pit to underground mining of the ore body, extensive investigations have been conducted to ensure a smooth production profile for the long-term underground operation.
The modern Chuquicamata Mine was enormous. Heap leach pads extended to the horizon and the huge rock dumps grew to heights of 100 metres and more. Scarred by desiccation cracks 100 millimetres wide and 1 metre deep, the tailings impoundments seemed equally boundless. A fine dust covered everything. The mine was a mammoth conventional truck-and-shovel operation, with much of the crushed ore shunted by underground conveyors to the mill that produced both copper and molybdenum concentrates. For years, Chuquicamata had been the most prolific copper producer in Chile, until the Escondida Mine overtook it. The open-pit mine’s productivity was declining, and Codelco was looking for ways of extending its life. One option was to go underground, and Jarek Jakubec was later brought in to consult on that issue as well.

Meanwhile, Stacey and Dave Ortlepp, “Mr. Rockburst,” who had joined SRK from Anglo American, continued investigating the problems at El Teniente. Legend has it that mining began in the 18th century. Everything suggested that SRK should have directed the field exploration, engineering design, operations planning, construction technical oversight and quality assurance for a new copper heap leach facility. The design criteria included an ore loading rate of approximately 53,000 tonnes per day and a leaching rate of 15 litres per hour per square metre. This project was the first large-scale oxide leach project at a site that would become one of the world’s biggest copper producers. SRK reviewed metallurgical, geotechnical and related data to assess the technical and economic viability of different design options for a 90-metre-high heap leach facility. Given the significant seismic risk, SRK analysed heap stability and the potential for earthquake-induced deformation. To minimise solution collection disruptions caused by slope displacements, SRK designed an internal inter-lift solution collection process. SRK conducted site investigations to identify construction materials and characterise the foundation conditions for the leach pad, 50/EV plant; crushers and points. The company devised laboratory- and field-scale testing to evaluate the performance of components for the proposed liner and solution collection system.

SRK produced detailed engineering design plans for the four-phase construction of a 4-square-kilometre pad. It also prepared technical specifications and quality assurance procedures for construction, and monitored quality assurance during construction.

OUTCOME: The heap leach facilities operated successfully. The heap leach concentrate is processed by electrowinning – an electrolysis process that deposits the copper on large sheet cathodes, ready for re-manufacturing.
PROJECT: Los Sulfatos Exploration Tunnel
Near Los Bronces Mine, Andes Mountains, Chile

CLIENT: Anglo American Sur Exploration Division (Chile)

SCOPE: Upon exploring the area around the existing open pit, Anglo American Sur Exploration Division (Chile) identified a promising new deposit with underground mining potential. SRK was appointed to design a 4.5-metre-diameter, 8-kilometre-long tunnel to provide access to the potential ore body so that an exploration campaign could be initiated.

The deposit’s 3,500-metre elevation in the Andes presented significant construction challenges. Ventilation and health and safety issues had to be addressed during the excavation process. There was a risk of rockbursts in zones with more than 1,000 metres of rock overhead.

On top of the harsh terrain and extreme winter conditions, the mining boom had caused a shortage of key people and other logistical difficulties.

After conducting geological and geotechnical site investigations, and a thorough assessment of tunnel-design options, SRK recommended excavation with a double-shield tunnel boring machine (TBM). This was approved by Anglo American Sur Exploration Division (Chile), and SRK produced all the technical designs and specifications for the tunnel, evaluated bid documents from tunneling contractors, and provided management and site supervision services during construction.

OUTCOME: The tunnel was successfully completed on time — with a record 47 metres excavated in one day — and with an outstanding safety record. It was the first time a double-shield TBM had been used in the Chilean Andes.

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“Establishing Santiago office was Oskar’s brainchild in about 1993.” Allan Haines says. “Oskar and I were traveling there every few months and he said, ‘It makes sense to be here.’ It also made sense to partner with NCL, as the two companies had grown increasingly close while working together over the previous seven years. They had complementary skill sets in mining, and Steffen, who had been a professional and business mentor to the firm and its principals, hardly needed NCL to become part of SRK.

“We gained a lot of experience working with Oskar,” says Fuentes. “It was great, and we grew a lot over those years. So by the time we were talking about a partnership, we were about 25 or 30 people in Santiago, and my partners and I wanted to retain our identity. We were proud of what we did and what we had achieved, so we didn’t want to give up NCL.

Although SRK wanted to merge with NCL and grow its own brand in South America, Fuentes and Kirsten (South America) S.A. My Spanish was limited to what I knew from Western movies: ‘Dos cervezas, por favor.’

Choosing Chile

In July 1997, Haines hired Dermot Ross-Brown from Denver, ostensibly to run the geotechnical division. Born in Jamaica to British parents who returned with him to the U.K. when he was five, Ross-Brown was an old Africa hand. After completing a master’s degree in soils and geotechnics at the University of Goldsmiths in London, he worked at Ashanti Goldfields in Ghana, the richest mine in the world at the time and rumoured to be the legendary source of the ancient Egyptian pharaohs’ wealth. Located at Obuasi, just south of Kumasi, it was one of the world’s 10 largest major deposits — alluvial gold has been mined in the area for more than 2,500 years, and underground mining started in 1897.

Ross-Brown bumped into SRK regularly during his time in Africa. He valued the technical papers written by Steffen and others from the firm, and he respected their work. Four years after moving to Santiago to help with management and co-ordination, Scott from the Vancouver office moved down to Lima, “Soldi says. “They preferred to have office space in Peru, and work on a project-by-project basis with us.”

Ross-Brown had work on the go across the continent. Cam Scott from the Vancouver office moved down to Santiago for a few years to work on tailings; starting in 1996, Andy Barrett began making quarterly trips to visit Santiago to help with management and co-ordination. By late 1997, Haines had grown the South American practice to roughly 45 people. Deb Lord, who had been working in Santiago for EHYF of Australia, joined for a two- and-a-half-year stint before her husband got a job back home.

“They were not very keen on setting up a new unit in Lima,” Soldi says. “They preferred to have office space and work on a project-by-project basis with us.”

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By the time Ross-Brown arrived in Santiago, though, in September 1997, Haines had returned to South Africa. Fuentes was again doing double-duty as general manager, but the moment it was tough. International firms were at least one-third, perhaps half, of the world's copper mining operations. Fuentes was again doing double-duty as general manager, but this did not happen. SRK hired a specialist from SVS Ingenieros in Lima, Aldo Brigneti, to lead the practice. He had worked with Dorey and was familiar with SRK.

About six months after he arrived, Ross-Brown was officially appointed the general manager. It was a very difficult period. "There was no money in the bank one month," says Sergio Orellana, the firm's accountant. "That was exacerbated by the fact that the copper price was very low... 85 cents a pound anybody had any chargeable work, and so we struggled." Still, all of the major consulting companies wanted an office in Peru by then. There were at least one-third, perhaps half, of the world's copper and nickel operations. Fuentes was again doing double-duty as general manager, but this did not happen. SRK hired a specialist from SVS Ingenieros in Lima, Aldo Brigneti, to lead the practice. He had worked with Dorey and was familiar with SRK.

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through a lot of his time was spent mentoring. Reports and lead project teams. He was qualified to report for banks, author technical models for mining companies, and couldn’t live on their own. I was 63, I thought it was good to retire early and I could afford to do it. But the main consideration was to look after my parents. I was with them for seven years before they went. My dad was 100 and my mother was 93, so I’m very pleased that I did that.

Before he left, Ross-Brown prepared Alejandro Palma as his successor. Palma grew up in Chile and earned his master’s in civil engineering in Germany. He worked for a handful of companies doing geotechnical work, and joined SRK in November 2001. In April 2003, he took over as general manager, there were 22 people. Our big project was a tailings dam facility and I was part of the geotechnical investigation work. He returned to Santiago in 1989 to work as a technical consultant with a South American prospector. "I still liked to get out in the field a lot," Even says, "but I took a cut in pay to start at SRK, " he says, "but we had doubled in size and had grown a great deal in the relationship, but we did not want to be part of SRK, and we did not want to do a broad range of work — we realised that we wanted to just do mining. We liked to work with SRK. We had a very good relationship with many of them — Neal Rigby, Chris Page, Cam Scott, Allan McCracken, Dick Stacey ... and of course, Oskar Steffen. But the partnership was no longer a good fit. We sold out so they could carry on with their strategic development and we could focus on our practice."

The move allowed SRK Chile to market SRK’s mining services and helped transform the office. The culture change that occurred under Palma’s leadership was also significant — he persuaded people to invest in themselves and successfully promoted the employee-ownership plan. It made all the difference. By the end of 2008, SRC Chile had 80 employees, 144 projects and more than 60 clients. It’s not SRK that makes it work. Yes, the name is there and the reputation facilitates and adds support, but it’s really the people and their attitude that produces success,” Palma says. “You have to have the confidence to say, ‘This is my company, and I can make the difference and invest in it.’ We had a good name, but we hadn’t really marketed SRK’s full range of skills in Chile. Once that changed, the office took off.

“Our performance was going up and down in South America, but we had to prove that being a ‘company’ was good enough,” Ross-Brown says. “We had a good name, but it’s really the people and their attitude that produces success,” Palma says. “You have to have the confidence to say, ‘This is my company, and I can make the difference and invest in it.’ We had a good name, but we hadn’t really marketed SRK’s full range of skills in Chile. Once that changed, the office took off.

“Marco Auréliao Perez do Nascimento started his career in the 1970s, working as a mining technician in mine planning for large iron ore projects. During the 1980s, he worked as an engineer in Paulo Abbi Engenharia, a leading consulting company in the mineral industry, continuing with mine planning but beginning to work with geostatistical techniques and developing computerized routines. During the 1990s, he created Geopit, a set of computational routines for use in mine planning, with an emphasis on blending control. In 2000, he joined Gemcom Software to work as a consultant in mine planning. In 2005, he became a founder of SRK Brazil; in 2006, he became the chairman of SRK Brazil; in 2006, he became the president of SRK Brazil, which quickly grew to more than a dozen people. However, in 2009, Palma decided to move to the Fortescue Metals Group in Australia to gain international experience and work in developing Geopit for strip mining. “I was very sorry to leave SRK,” he says. “I very much liked the environment and the corporate culture.” After he became an Australian citizen, Nascimento returned to Brazil in 2012 to continue his dedicated work with Geopit and act as a consultant on projects in both countries. He is working with SRK Brazil as technical director, and continues to work on the development of Geopit.
A civil engineering graduate from the University of Buenos Aires, Alejo Sfriso has 20 years of geotechnical experience in the construction and mining industries. He has participated in over three thousand geotechnical investigations for civil and infrastructure projects, including conducting and interpreting geotechnical surface investigations.

Sfriso has worked in tunneling and underground projects since 1998 and is an expert in underground construction procedures and the application of numerical methods to geotechnical design and analysis. He has published more than 40 papers and continues to impart his knowledge through professional roles in soil mechanics, geology and geotechnical engineering at the universities of Buenos Aires and La Plata.

Having co-founded the SRK Argentina practice, Sfriso is now a principal engineer in the Buenos Aires office. He attributes the success of the practice to the SRK philosophy. "People see themselves not just as employees but as business partners," he says. "and the 'we're all in it together' concept has really taken hold."

"We had always believed strongly in investing in local experts who embraced the corporate values and added to the international skill set," says Barrett. "Adding local leadership gave us access to networks and facilitated communication in a profound way. We have applied those lessons elsewhere."

SRK Chile was building tailings impoundments for Antofagasta Minerals, conducting construction inspections for Anglo American Tunnel Set, overseeing the design and construction of a major TBM Chilean mining company aggressively moved into the Amazon. A huge asset."

With continued support and work from SRK Chile, the office has become successful, though the Argentine mining industry remains small. In 2011, SRK also finally established a formal relationship with Perú's SVS Ingenieros — Rigby's old pals Antonio Samaniego and Carlos Soldi. The Peruvian mining company aggressively moved into the Amazon. "We used to be a small company for 10 years with two partners, three employees," Sfriso says. "We are now 40 — most of our employees are partners or shareholders and most are under 27 — very young people who embrace SRK's philosophy. That augurs well for the future."

"Both of us continue to work at the university — it's a funny connection we have with the founders of SRK, who also maintained their academic connection we have with the university — it's a funny future."