

# Exploration



We invested US\$ 73 million in exploration activities during 2015.

**Mining exploration is the first link of the value chain for our business model and part of the company's strategic plan. This is an essential, ongoing activity that ensures Codelco's position in the copper market.**

Codelco's mining exploration contributed approximately 67 million tonnes of fine copper into the company's resources and reserves inventory between 1991 and 2015. 73% of this was within district limits.

These exploration results position us as one of the best-performing companies in terms of discovery, coupled with the lowest average costs in the world.

Discovered resources corresponding to the ore deposits known as Vicky and Lucy were respectively incorporated into the corporate inventory in 2002 and 2003. These ore deposits located in the vicinity of the Gabriela Mistral Division, which were formerly in the exploration resource records, became important considering the need to provide continuity for this division's service life.

Chairmen's statement

President & CEO's review

Organisation

Corporate profile

Divisions

Highlights

Mineral resources & reserves

Exploration

Investment & projects

Innovation & technology

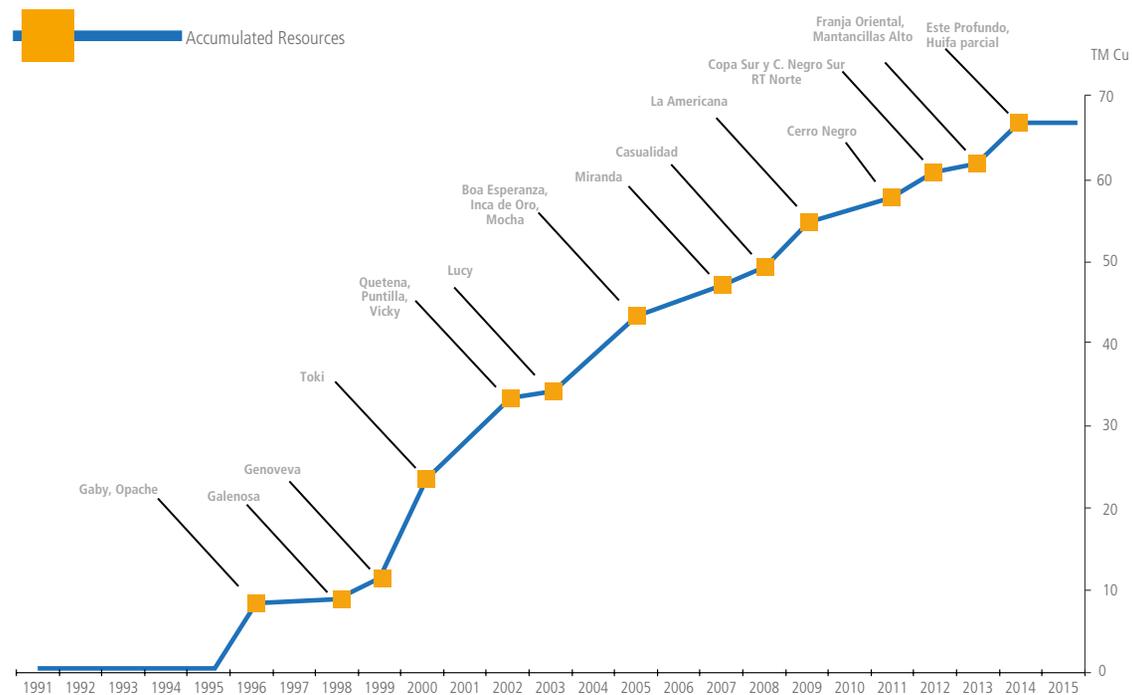
Results & market

People & sustainability

Company network

Financial statements

## Geological resources incorporated into the corporate inventory \*



\*These resources correspond to those originally delivered to the corporate inventory during the advanced studies stage.

## Identified geological resources transferred to the Gabriela Mistral Division inventory

CuT cut-off grade of 0,2%	Ore * millions of tonnes	Average Grade Cu T	Fine Cu millions of tonnes
Lucy oxide	78.9	0.38	0.303
Lucy sulphide	239.0	0.25	0.599
Vicky oxide (exotic)	96.8	0.52	0.503

\*Inferred quality

Chairmen's statement

President & CEO's review

Organisation

Corporate profile

Divisions

Highlights

Mineral resources & reserves

Exploration

Investment & projects

Innovation & technology

Results & market

People & sustainability

Company network

Financial statements

## Investment

The global mining industry started a downward metal price cycle in 2013, which evidences little indication of recovery in the short term. Non-ferrous metal exploration budgets in 2015 amounted to US\$ 8.8 billion, following a historic high of US\$ 20.53 billion in exploration during 2012.

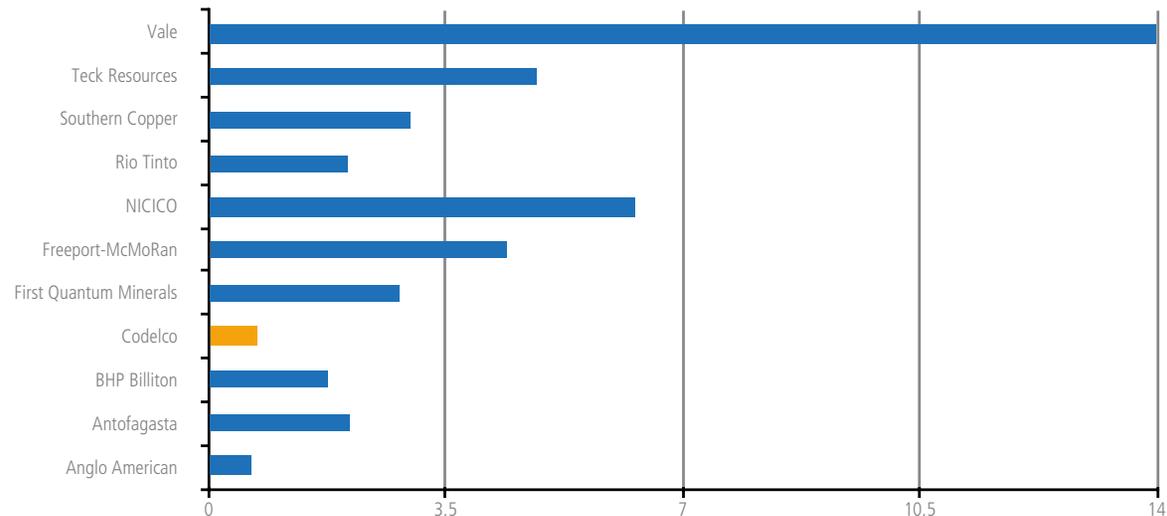
With investment amounting to US\$ 615 million in 2015, Chile climbed to number four in the global ranking of exploration investment and to number one in Latin America, followed by Mexico and Peru. This had not been the case since 2000.

Codelco invested US\$ 73 million in exploration during 2015, up 32% from 2014. 23% of this investment was for

the La Huifa advanced exploration project in El Teniente district. Activity in Chile accounts for 80% of our overall exploration investment. In turn, the remaining 20% was used for international activities, which were focused in Ecuador and Brazil.

Analysis conducted by SNL Metals & Mining 2015 in Strategies for Copper Reserves Replacement for the 2005-2014 period ranked Codelco as one of the companies with the lowest exploration costs in the world. This cost at Codelco came to an overall average of 0.72 US¢/lb for copper discovered, much lower than other important stakeholders that reported an average 2.10 US¢/lb.

## Exploration costs for copper discovery in US¢/lb.



Source: SNL Metals & Mining

Chairmen's statement

President & CEO's review

Organisation

Corporate profile

Divisions

Highlights

Mineral resources & reserves

Exploration

Investment & projects

Innovation & technology

Results & market

People & sustainability

Company network

Financial statements

## Exploration in Chile

In accordance with guidelines provided by the Board of Directors, our focus on exploration activity is mainly centered in Chile, with special emphasis on mining districts (brownfield) where operating deposits are located.

District exploration at Radomiro Tomic, Chuquicamata, Ministro Hales, Gabriela Mistral, Salvador, Andina and El Teniente is conducted in the operational-economic radius of these operating divisions, attempting to discover new mining resources in order to improve and/or develop divisional business plans.

In turn, regional or greenfield exploration seeks to aggregate resources, identifying new copper deposits beyond the limits of our districts. This exploration is executed along strips with the highest geological potential in national territory in order to obtain resources with the right quantity and quality to open opportunities for new Codelco production units.

Along these same lines, in 2015 we focused on creating an appropriate portfolio between regional and district exploration, together with a balanced proportion between the basic, follow-up and advanced exploration stages in areas located between the regions of Arica and Parinacota and as far south as the Bío Bío Region.

In 2015 we reviewed 166 areas in different exploration stages. Drilling studies were conducted in 88 of these areas, drilling a total 75,000 meters in the sectors with the highest potential. Drilling reached

intersections with mineralogy at three of these objectives that could potentially be of interest. These will be developed in 2016, as indicated in the following table:

Codelco has continued advanced exploration drilling. The original concept for the La Huifa resource, which consisted of a breccia type deposit has evolved from the hypothesis of a mineralized cluster, the Cerro Extravío Cluster, comprised of a type of porphyry geologically related to breccia orebodies, including La Huifa. These results open greater potential for developing the El Teniente Division business plan.

We believe that exploration work executed in 2015 will contribute approximately 1 to 2 Mton of fine copper, mainly associated to district projects, such as high grade orebodies identified in the Andina district and marginal resources in the Colina de Cobre QM deposits in Salvador district. These areas are being evaluated and will be reported and agreed on with the divisions in 2016.

## District and regional exploration in Chile throughout 2015

	Anomalies	Prospects	Targets	Advanced	Total
Nº of areas	78	67	20	1	<b>166</b>
Meters drilled	Studies without	17,000	43,000	15,000	<b>75,000</b>

Chairmen's statement

President & CEO's review

Organisation

Corporate profile

Divisions

Highlights

Mineral resources & reserves

Exploration

Investment & projects

Innovation & technology

Results & market

People & sustainability

Company network

Financial statements

### International exploration

In addition to national exploration and the company's long-term perspective, we also conduct international exploration, mainly in countries in the Andean region with geological affinity, as is the case in Ecuador, or countries with high copper discovery potential, such as Brazil.

In addition, we are constantly monitoring and evaluating mining business opportunities in other countries, in Latin America and around the world, in order to move towards company globalization. In order to address this challenge, geological exploration is an activity located at the start of the business value chain and is essential for this purpose.

### ECUADOR

- **2009:** Exploration Agreement with Enami EP, Ecuador
- **2012:** We operate by means of the EMSA Ecuador subsidiary.
- Over 20 prospects reviewed.
- An environmental licensing stage prospect for follow-up exploration.
- Follow-up exploration project: Llurimagua, 15,000 meters of

### BRASIL

- **2000:** Exploration activity.
- **2001:** We operate through the subsidiary Codelco do Brasil Mineração.
- Two follow-up exploration projects: Tancredo (Copperx with Xstrata) and Liberdade (JV with Pan Brazilian).
- Ten basic exploration prospects.
- Two current associations (Pan Brazilian and Xstrata).
- **2005:** One deposit discovered.



 Codelco exploration offices

Chairmen's statement

President & CEO's review

Organisation

Corporate profile

Divisions

Highlights

Mineral resources & reserves

Exploration

Investment & projects

Innovation & technology

Results & market

People & sustainability

Company network

Financial statements

## Brazil

Our subsidiary Codelco do Brasil seeks high potential opportunities in early exploration stages by means of joint ventures with local and international companies operating in Brazil, while creating points of interest at our mining properties and those purchased at public tenders. Activity is mainly concentrated in Gran Carajás, in Para State, which is the best copper mining district in Brazil where most of the largest mining companies in the world have mining interests or exploration underway.

The Codelco do Brasil property portfolio consists of 168,000 hectares with property deeds and approximately 496,000 hectares in different district lobbying stages.

Mining resources being explored or potential mining resources have been discovered at the Liberdade Project, which makes up part of the association with the local company Pan Brasil, whose preliminary on-site resource estimation amounts to approximately 242 million tonnes, with copper grade amounting to 0.77%. In addition, an iron deposit was discovered at property co-owned with Glencore-Xstrata (the Tancredo project), with potential resources surpassing 1.2 billion tonnes and iron grade amounting to under 32%.

Activities in 2015 focused on lobbying sectorial permits for exploration, which substantially increased the portfolios for these projects. We wish to highlight drilling campaigns at 4 prospects, whose preliminary results show indications of a mineralized Cu-Au system in at least one of these. All related activities are associated to high safety, environmental and community relations standards.

## Ecuador

We have investigated and evaluated over 20 prospects in the framework of a mining exploration agreement between the state-owned Empresa Nacional Minera de Ecuador (ENAMI EP) and our company. The portfolio presently has a follow-up exploration target (Llurimagua) and a prospect currently in the environmental licensing stage for follow-up exploration (Mina Real or Nanguipa).

The agreement specifies that if a project qualifies as being of interest for our company after basic exploration work has been completed, a corporation comprised of a 51% stake owned by Enami EP and 49% stake owned by Codelco will be created. This company will be responsible for development, construction and operation of the mining project.

The most important project is Llurimagua, which corresponds to copper porphyry located in the Province of Imbabura, in northern Ecuador. Geological studies including over 15,000 meters of drilling were executed in 2015 and results confirm the existence of a mineralized copper and molybdenum system. Exploration has been executed with high safety, environmental and community relations standards through our subsidiary Exploraciones Mineras Ecuador (EMSAEC) created for this purpose in 2013.

## Exploration models

Exploration is an activity that requires high levels of pre-existing knowledge. The management of large information volumes requires systems that enable the classification, maintenance and updating

Chairmen's statement

President & CEO's review

Organisation

Corporate profile

Divisions

Highlights

Mineral resources & reserves

Exploration

Investment & projects

Innovation & technology

Results & market

People & sustainability

Company network

Financial statements



We explore in Chile and abroad in order to move towards becoming a globalized company.

of information with swift access and processing. This accumulated information and conceptual models allow for the spatial recognition of critical factors and basic variables that control geological processes involved in the formation, movement and location of mineral deposits, in order to select areas and generate exploration plans.

The fundamental focus of this activity has been centered on applying technologies that enable the detection of hidden and generally deep orebodies, which currently pose the greatest exploration challenge. This is because exposed or easily accessible orebodies have already been discovered. Development of expert capacity aims to further materialize a technological breakthrough that could optimize this type of exploration.

We participated in investigation and technology development projects throughout 2015, which include the following:

- **Collaborative programs sponsored by AMIRA**, which focus on the identification of ore diagnosis in mineralized system halos. Results of the first study phases allowed us to conclude that the methodology has high application potential for outcrops at a remote distance from mineralized centers and thus indicate vectorization. A third phase of this project will conduct a blind test in a pilot area proposed by Codelco.
- **Seismic test in a high resolution reflection**, a technique commonly used in the oil industry that could be used for metal ore exploration. These studies require corrections and new calibrations, which are being executed by means of an agreement with a specialized center at Curtin University, Australia.

Chairmen's statement

President & CEO's review

Organisation

Corporate profile

Divisions

Highlights

Mineral resources & reserves

Exploration

Investment & projects

Innovation & technology

Results & market

People & sustainability

Company network

Financial statements

## Associations

Associations with third parties are a complementary mechanism for accelerating reconnaissance in certain sectors. These enable the development of business options for projects located in the following cases, among others:

**Mining property owned by third parties:** world-class geological resources or which feature profitability believed to be attractive for our company (i.e. potentially Llurimagua in Ecuador).

**Mining property owned by Codelco:** Geological resources whose metal content, volume and/or location may not be included in our production scale and may consequently be lower priority for reconnaissance campaigns (i.e., Inca de Oro, Puntilla-Galenosa, Boa Esperanza in Brazil). The objective is to capture value from assets generated by exploration that are not of corporate interest by means of associations; sharing exploration risk and participating in development in accordance with current legislation while maintaining a stake in the ownership of any eventual discovery.

At the end of 2015, exploration activities in Chile under this category were limited to five projects: Queen Elizabeth with Río Tinto, Puntilla Galenosa with Pucobre; Anillo with Fortune Valley Resources Inc.; Plazuela with Hot Chili and Roberto with Anglo American Norte. In 2015 these companies jointly conducted geology and geophysics work, while drilling approximately 4,000 meters with investment amounting to US\$ 4 million.

### Exploration associations

Projects in Chile	Partner	Type
Queen Elizabeth	Río Tinto	Copper
Anillo	Fortune Valley	Gold
Puntilla – Galenosa	Pucobre	Copper
Plazuela	Hot Chili	Copper
Roberto	Anglo American Norte	Copper
Projects abroad		
Liberdade	Pan Brasil	Copper
Tancredo y otros	Xstrata Brasil	Copper
Grupo Propiedades	(ENAMI EP) de Ecuador	Copper