

Mining Industry

GROUP
coba

ENGINEERING AND ENVIRONMENTAL CONSULTANTS

PRESENTATION

COBA is a multinational and multidisciplinary group of Engineering and Environmental Consultants, founded in 1962.

The Group provides engineering consultancy services ranging from basic and planning studies, technical, environmental and economic feasibility studies, design and construction design as well as project management and works supervision, to operation follow-up and behaviour monitoring.

The Group has offices/subsidiaries in three continents and experience in sixty countries and encompasses several companies in accordance with functional specializations or geographical areas.

The competences acquired along the last six decades, together with the state-of-the-art employee expertise, the stability of its permanent staff and the comprehensive international experience allow to find out the best solutions for the full satisfaction of public and private Clients' needs and expectations.

During its existence, the Group has participated together with public authorities or private developers, in the feasibility of multidimensional projects, some of them being structuring projects and with major impacts on the improvement of peoples' life conditions in the several countries where it worked.

At present, the Group has a wide number of competences and technical areas that allow the composition of multidisciplinary teams who share knowledge and experiences in the execution of projects.

FIELDS OF ACTIVITY

HYDRAULIC UNDERTAKINGS

Concrete, Earth-fill and Rock-fill Dams | Weirs and Reservoirs | Water Conveyance Systems | Hydraulic Structures

POWER GENERATION AND TRANSMISSION

Hydroelectric Power Plants | Small Hydropower Plants | Power Plants Rehabilitation and Modernization | Substations | High Voltage Transmission Lines | Cooling Water Systems for Thermoelectric Plants

WATER SUPPLY AND WASTEWATER SYSTEMS

Catchment, Transport and Distribution of Potable Water | Water Treatment Plants | Drainage Systems | Wastewater Treatment Stations | Pumping Stations

AGRICULTURES AND RURAL DEVELOPMENT

Irrigation and Drainage Systems | Rural Roads | Production Systems Mapping and Basic Information

TRANSPORTATION INFRASTRUCTURES

Roads and highways | Railways | Passenger and Freight Railway Stations Metro and Light Rail | Airports | Bridges and other engineering structures

ENVIRONMENT

Environmental Impact Assessment | Environmental Management, Monitoring and Auditing | Pollution Control | Landscaping | Land Management | Recovery of Degraded Areas | Waste Landfills

GEOTECHNICAL STRUCTURES

Tunnels and Caverns | Slopes in Fill and Cut Section | Special Foundations Breakwaters | Embankment Works

MARITIME AND FLUVIAL WORKS

Wharfs | River Training | Quay Rehabilitation | Flood and Flow Control

MINING INDUSTRY

Environmental Studies | Design of Tailings Dams and Water Management Facilities | Safety Assessment of Tailings Dams | Design Review | Operations Maintenance and Surveillance Manual for Tailings Dams and Water Management Facilities | Emergency Preparedness and Response Plan | Breach Analysis | Risk Management | Mine Closure Plan | Construction Supervision | Training

BUILDINGS

Residential and Services Buildings | Industrial Buildings | Steel and Mixed Industrial Structures | Rehabilitation and Restoration of Ancient Buildings

CARTOGRAPHY AND CADASTRE

Geographic Information Systems (GIS) | Digital Cartography | Thematic Cartography | Thematic Cadastres | Land Acquisition

SAFETY CONTROL AND REHABILITATION

Expertise, Monitoring | Inspection and Reinforcement of Dams and Transportation Infrastructures | Works Instrumentation | Project Maintenance and Operation

PROJECT MANAGEMENT AND CONSTRUCTION SUPERVISION

Project Management | Cost Management | Site Supervision Quality Assurance/Quality Control

MINING INDUSTRY

Dam design dates to the beginning of COBA's activity and represents its genesis. This activity, developed since its foundation, is the oldest in the company and represents the field in which COBA became internationally renowned for, having designed and provided technical assistance to dams, mainly associated with hydropower & agricultural undertakings and water supply networks.

COBA began its activity with the design of concrete dams, having contributed to the progress of knowledge in the science and technique of arch dams. Later, COBA's experience extended to the design and construction of earthfill dams and, posteriorly, to RCC (roller compacted concrete) dams. Also worthy of note is the activity developed in the field of Dam Safety, where COBA has considerable experience in the definition of inspection standards and their interpretation, as well as in the recommendation of remedial measures and in the design aiming at dam rehabilitation and safety.

More recently, following the Brumadinho accident in Brazil, in 2019, and the increased legal and regulatory requirements for the safe management of tailings storage facilities (Global Industry Standard on Tailings Management, August 2020), COBA extended its field of activity to tailings dams in mining undertakings. In this context, COBA has carried out numerous projects in Brazil, including design reviews and safety analysis studies of tailings dams, with periodic assessments of the general conditions of these structures and proposals for the correction of anomalies encountered.

In another geography, COBA recently completed the Operations Manual and Monitoring System for the Sierra Rutile mine in Sierra Leone, which includes more than 40 tailings ponds.

COBA is currently supervising the expansion of the Cerro do Lobo tailings dam at Neves Corvo Mine in Portugal, as well as the design of the dam's expansion.

Within the scope of COBA's activity in the Mining Sector, it is also relevant to highlight the preparation of the Closure Plan for the Neves Corvo Mine, as well as the performance of several environmental studies in mining areas.

Within the scope of its activity, COBA conducts training activities related to its several areas of expertise, for public and private, national and international entities. In this context, a course on Safety of Tailings Dams was recently held at the largest Angolan open-pit mine, the Catoca mine.

TINOCA MINES - Portugal

Environmental recovery

Client/Owner: Instituto de Hidráulica, Engenharia Rural e Ambiente (IHERA)

Preliminary Study and Detailed Design: 1993/1994

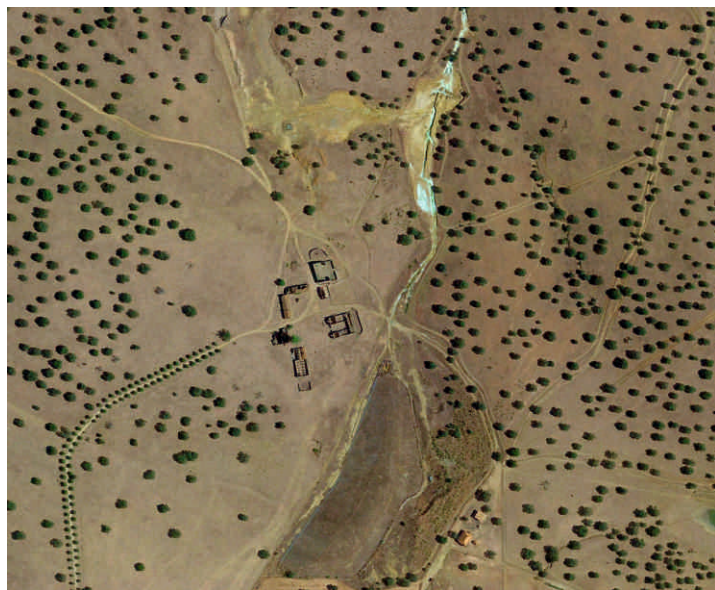


The Tinoca mines subject to environmental recovery comprised a significant source of pollution in the Abrilongo Dam reservoir inflows, jeopardizing the future quality of water stored, which was intended to irrigate a vast area in the transborder area of Portugal and Spain.

The aim of the Project was to **eliminate** this **source of water pollution caused by the Tinoca Mines** but still **preserve several**

testimonial structures of the mining activities of high industrial archaeological value.

It also involved the **implementation of a monitoring programme**, which included a set of wells and structures for monitoring of groundwater, in order to perceive the extent of contaminated area that should be subject to treatment and environmental recovery.



SÃO DOMINGOS MINING AREA - Portugal

Environmental control measures

Client/Owner: Instituto Geológico e Mineiro

Environmental Control Measures: 1999/2002



The recovery strategy advocated for the São Domingos AMA promoted the phased implementation of environmental control measures, taking into account the benefits and the feasibility associated with each one of these.

The measures proposed focused primarily on the control of water pollution. The proposed solutions included:

- Recovery of the surrounding canal system;
- Treatment of the acidic waters stored in weirs;

- Landscape recovery of marginal areas;
- Filling of the cutting cavity with tailings material;
- Reuse of tailings material; rehabilitation of the existing railway line;
- Landscape recovery of the remaining degraded areas;
- Recovery and promotion of built cultural heritage elements; Assessment and safeguarding of dam stability and safety conditions;
- Sealing of the landfill; monitoring of water quality



JALES MINE - Portugal

Rehabilitation of mine waste dump area

Client/Owner: EDM – Empresa de Desenvolvimento Mineiro, S.A.
Detailed Design and Technical Assistance: 2001/2003



The primary objective of the studies included the rehabilitation of the Jales Mine Waste Dump Area, which contemplated mitigating and corrective solutions that enabled:

- to guarantee slope stability and control surface runoff, thus avoiding erosion;
- to control geochemical and hydrochemical dispersal of heavy metals in the zones surrounding the spoils area, provoked by runoff of storm water;
- to control resurgence of eventual leaching in the interface between the rock substratum and the base of the spoils area, as well as in the slopes themselves;
- to control geochemical dispersion of pollutants provoked by wind activity.

From the four solutions studies, it was considered wise to adopt the solution that foresees the isolation and confinement of the Jales Mine Spoils area.



TERRAMONTE MINING AREA - Portugal

Environmental rehabilitation

Client/Owner: EDM – Empresa de Desenvolvimento Mineiro, S.A.
Basic Design and Final Design: 2004/2005



The Terramonte Mining area is constituted by the old Terramonte and Ribeiro da Castanheiro Mines, which were part of a mining complex that integrated 7 concessions, totalling approximately 352 ha of concessionaired area. It explored lead, zinc e silver from the Terramonte / Sterra de Montalto mineral seam.

A **Geological and Geotechnical Study** and an **Environmental Impact Assessment** were undertaken for Rehabilitation of the spoils area in order to assess the most significant **environmental impacts** associated to the implementation of the project, as well as to **propose mitigating measures** in order to contribute to a an environmentally more favorable enterprise.

- Cleansing and revegetation of slopes.
- Cleansing of existing residues existing along the Terramonte river.
- Confinement and reshaping/modelling.
- Sealing/waterproofing, construction of perimeter ditches, of surface and sub-surface drainage system.
- Landscaping.



SANTO ANTÓNIO DE PENEDONO MINING AREA - Portugal

Environmental rehabilitation

Client/Owner: EDM – Empresa de Desenvolvimento Mineiro, S.A

Master Plan and Detailed Design: 2006/2007



The recovery of the mining area included two principal areas, two secondary areas, the industrial zone and a dam for water supply. In general, all built-up areas are damaged.

The remedial measures taken aimed at the environmental recovery of the mining areas, eliminating the risks for populations, including hygiene, public health and safety as well as those impacts arising out of the exposition and proliferation of contaminating materials from the spoil areas. Objectives:

- Stabilization of the spoiled areas E1 and E2.

- Surface runoff prevention and the erosion associated with pluvial waters and the geochemical and hydromechanical dispersion of the polluting elements generated in the surrounding area of the spoiled zone.
- Pollutants dispersion control generated by the wind action.
- To promote the landscaping and the urban upgrading of the surrounding area.
- Heritage conservation.



CUNHA BAIXA MINING AREA - Portugal

Environmental recovery

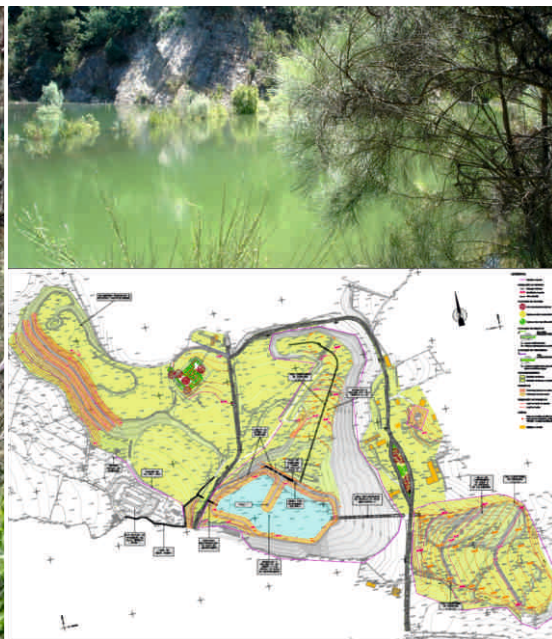
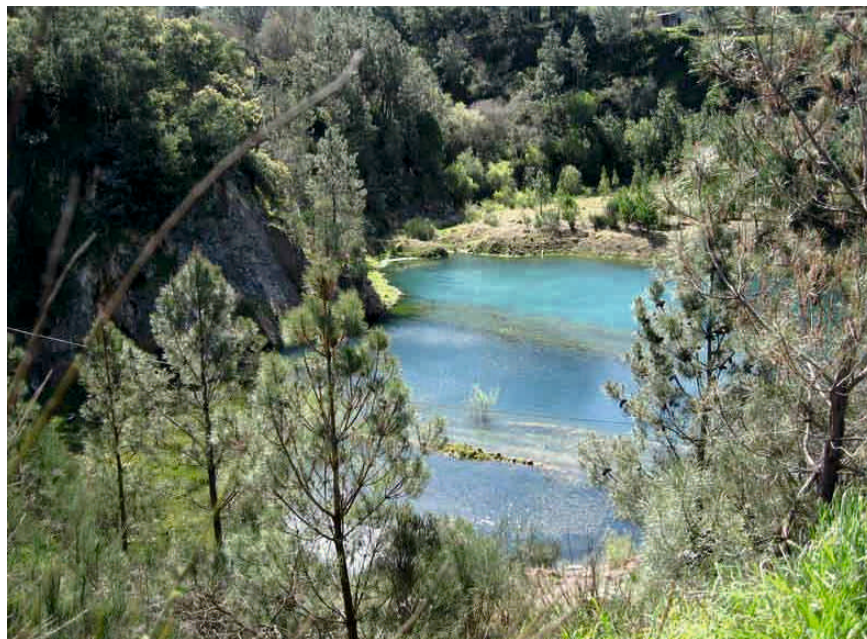
Client/Owner: EDM – Empresa de Desenvolvimento Mineiro, S.A

Environmental Impact Assessment: 2010



The "Cunha Baixa" Mining area comprised a focal point of pollution, both for soils and water resources, being an uncontrolled depot of debris and sludge with a high degree of contamination, particularly in what concerns heavy metals.

The EIA contemplated the analysis of the impacts associated to the construction and operation of this recovery project. Monitoring of the Air Quality, Radiological Parameters, Water Resources and Noise was proposed in order to assess the efficiency of the remedial measures implemented during their execution and upon complete recovery of the mining area.



DECOMMISSIONING OF THE XINGU DAM - Brazil

Client/Owner: VALE S.A.

Design Review; FMEA and FMECA Risk Assessment: 2019-2020



Type: Homogeneous earthfill dam
Upstream staged construction

Height: 70 m

Crest length: 838 m

COBA prepared the Peer Review of the Basic Design for the decommissioning of the Xingu Dam, located at Alegria Mine,

integrated in the Mariana Complex, in the Xingu River valley by the Piracicaba River, in the municipality of Mariana (MG).

The dam was designed with the purpose of storing the tailings generated in the mining and upgrading operations at the Alegria Mine. However, since 1998, the dam has been deactivated after reaching its storage capacity. The basic decommissioning design envisages the total removal of tailings, divided into three stages, with an estimated duration of 2 years each.



SOUTH DAM (CÓRREGO DO CANAL) PERIODIC DAM SAFETY REVIEWS - Brazil

Client/Owner: VALE S.A.

Periodic Dam Safety Reviews: 2020



Type: Homogeneous earthfill dam
Downstream staged construction

Height: 83 m

Crest length: 804 m

The periodic reviews include the conclusive report on the general condition of the structures and their safety conditions, as well as recommendations for updating the design criteria adopted and the correction of any anomalies encountered.

The South Dam (Córrego do Canal) is part of the Central Mines Complex located in the municipality of São Gonçalo do Rio Abaixo, Minas Gerais, at the Brucuru mine, about 104 km from the city of Belo Horizonte.

The dam, which was initially intended to contain tailings generated in the iron ore processing plant, as well as to be a water reserve for industrial water supply, is currently undergoing a tailings management process with the ultimate goal of closing the structure.



CAMBUCAL I AND II DAMS - PERIODIC DAM SAFETY REVIEWS - Brazil

Client/Owner: VALE S.A.
Periodic Dam Safety Reviews: 2020



Type: Homogeneous earthfill dam Downstream staged construction	
CAMBUCAL I	CAMBUCAL II
Height: 15,4 m	Height: 21,3 m
Crest length: 250 m	Crest length: 210 m

The periodic reviews include the conclusive report on the general condition of the structures and their safety conditions, as well as recommendations for updating the design criteria adopted and the correction of any anomalies encountered.

The Cambucal I and II Dams are part of the Itabira Mining Complex, Minas do Meio, in the municipality of Itabira, about 106 km from Belo Horizonte.

The Cambucal I Dam is located upstream from the urban area of the municipality of Itabira and was built in 1981 with the purpose of collecting sediments from the drainage of the Periquito Mine (Mina do Meio) and adjacent areas.



VARGEM GRANDE DAM - PERIODIC DAM SAFETY REVIEWS - Brazil

Client/Owner: VALE S.A.
Periodic Dam Safety Reviews: 2020



Type: Homogeneous earthfill dam Upstream staged construction	
Height: 35 m	
Crest length: 884 m	

The periodic reviews include the conclusive report on the general condition of the structures and their safety conditions, as well as recommendations for updating the design criteria adopted and the correction of any anomalies encountered.

The Vargem Grande Dam and its Saddle Dam are part of VALE's Vargem Grande Complex, located in the municipality of Nova Lima, Minas Gerais, about 50 km from the city of Belo Horizonte.

The dam was built in 2000 for the deposition of tailings generated in the processing of iron ore from the Tamanduá, Capitão do Mato and Abóboras mines, as well as for the retention of sediments generated in its basin and recirculation of industrial water.



SANTANA DAM - PERIODIC DAM SAFETY REVIEWS - Brazil

Client/Owner: VALE S.A.

Periodic Dam Safety Reviews: 2019-2020



Type: Homogeneous earthfill dam
Downstream staged construction

Height: 52,4 m

Crest length: 154 m

The periodic reviews include the conclusive report on the general condition of the structures and their safety conditions, as well as

recommendations for updating the design criteria adopted and the correction of any anomalies encountered.

The Santana Dam is located at the Cauê Mine, which is part of the Itabira Complex, located in the municipality of Itabira, Minas Gerais, about 100 km from the city of Belo Horizonte.

The Santana Dam is intended for industrial water storage and sediment containment.



PONTAL SYSTEM DAMS - PERIODIC DAM SAFETY REVIEWS - Brazil

Client/Owner: VALE S.A.

Periodic Dam Safety Reviews: 2019 - 2020



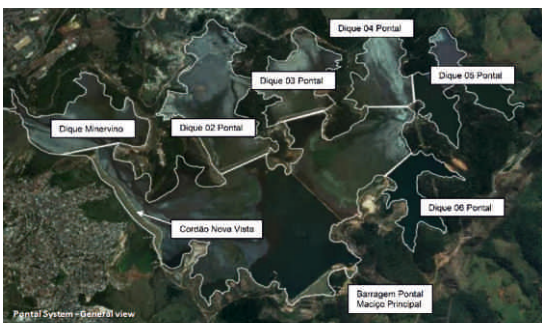
Type: Homogeneous earthfill dams
Upstream staged construction
(main dam) and downstream staged construction (dykes)

Height: 52,4 m

Crest length: 154 m

The periodic reviews include the conclusive report on the general condition of the structures and their safety conditions, as well as recommendations for updating the design criteria adopted and the correction of any anomalies encountered.

The Pontal System, intended for tailings deposition and river training, consists of the Pontal Dam and 6 other dikes, designated Dikes 2 to 5, Minervino Dam and Cordão Nova Vista Dam.



Pontal System	Height (m)	Length (m)
Pontal Dam	69	790
Pontal Dyke 02	21	620
Pontal Dyke 03	21	606
Pontal Dyke 04	13	485
Pontal Dyke 05	13	320
Minervino Dyke	14,5	1 200
Cordão Nova Vista Dyke	17	1 670



NEVES CORVO MINE - Cerro do Lobo TSF - Expansion Project - Portugal

Client/Owner: SOMINCOR S.A. (Lundin Mining)

Detailed Design, Technical Assistance and Construction Supervision: 2022/2025



Cerro do Lobo TSF Expansion Project includes the expansion of the current 187.9 ha of disposal area by a further 18.5 ha. There will be a regularization of the expansion area to shape the deposition area,

obtaining clean overburden materials from earth movement for the construction of the dykes and for cover, while gaining volume for deposition and ensuring minimum tailings thicknesses required for the geochemical stability of the deposit.

- Main, Secondary and Auxiliary Accesses
- Installation of new pipes for transporting of thickened tailings
- Temporary Storage 1 to 4 Earthworks
- Expansion Area and Southern Corridor
- Excavations in the southern expansion area, confinement dam foundation and southern corridor
- Embankments of the embankment and southern corridor and protection of slopes
- Electricity and automation (Power Supply and Distribution, Power, Signalling and Control, and telecommunications)
- North, East, Southwest and Northwest Control Reservoirs
- Concrete and steel structures (Box Culverts, junction boxes, surface and emergency spillways, pipe guards, pipe support, pipe support walkway (North West Reservoir), discharge control boxes, wing walls, valve boxes
- Pumping (North, North-West reservoir)
- Monitoring (installation of piezometers, inclinometers, topographic markers and load cells)



NEVES CORVO MINE - Mine Closure Plan - Portugal

Client/Owner: SOMINCOR S.A. (Lundin Mining)

Mine Closure Plan: 2022/2023



Development of SOMINCOR's Closure Plan considering the current LOM (Life Of Mine) of 2032.

Update and assessment of all measures, assumptions and approaches considered in the Closure Plan and Environmental and Landscape Rehabilitation Plan (PARP) of the Neves-Corvo Mine, dated 2016.



Main activities:

- Legal framework and environmental restraints
- Reference situation characterization
- Closure scenarios
- Risk analysis
- Monitoring and environmental restoration measures
- Cost estimation

SIERRA RUTILE LIMITED - Sierra Leone
Operation Manual and Surveillance System
 Client/Owner: Sierra Rutile Limited
 Operation Manual and Surveillance System - 2022



Development of Sierra Rutile Operational Manual and Surveillance System.

Main activities:

- Site Visit and Field Inspection

- Analysis of existing documentation
- Sierra Rutile Operational Manual and Surveillance System Closure scenarios



CATOCA MINE - Angola
Training Course on Safety of Tailings Dams
 Client/Owner: CATOCA - Sociedade Mineira de Catoca Lda.
 Training course: 2023/Ongoing



Major Clients



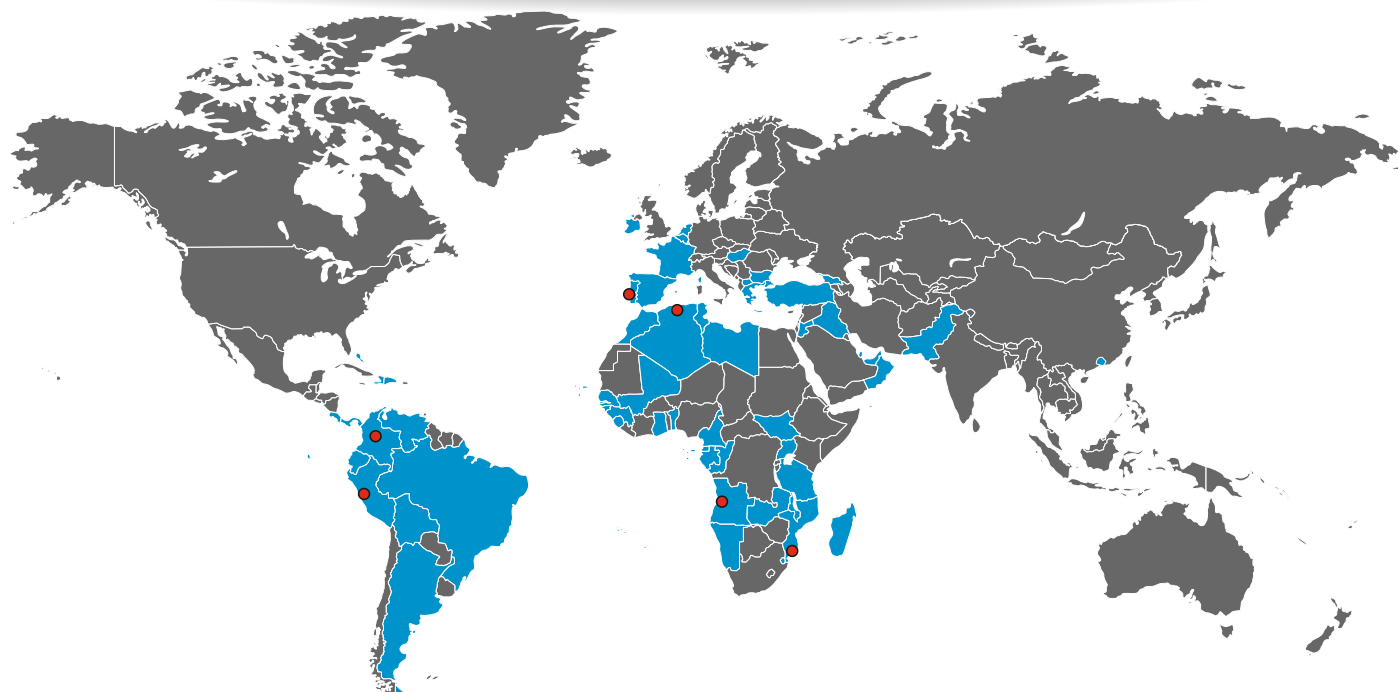
Empresa de Desenvolvimento Mineiro, SA



Sierra Rutile Limited



COBA worldwide



EUROPE: **Portugal**, Belgium, Bulgaria, Spain, France, Greece, Hungary, Ireland, Luxembourg, Macedonia, Netherlands, Turkey

AFRICA: **Algeria**, **Angola**, Benin, Cape Verde, Cameroon, Equatorial Guinea, Eswatini, Gabon, Gambia, Ghana, Guinea-Bissau, Guinea-Conakry, Libya, Madagascar, Malawi, Mali, Morocco, **Mozambique**, Namibia, Republic of Congo, São Tomé e Príncipe, Senegal, Sierra Leone, South Sudan, Tanzania, Tunisia, Uganda, Zambia

AMERICA: Argentina, Bahamas, Bolivia, Brazil, **Colombia**, Costa Rica, Dominican Republic, Ecuador, Haiti, Panama, **Peru**, Venezuela

ASIA: China (Macao), United Arab Emirates, Georgia, Iraq, Jordan, Pakistan, Oman, Qatar



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E n g i n e e r i n g a n d E n v i r o n m e n t a l C o n s u l t a n t s



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