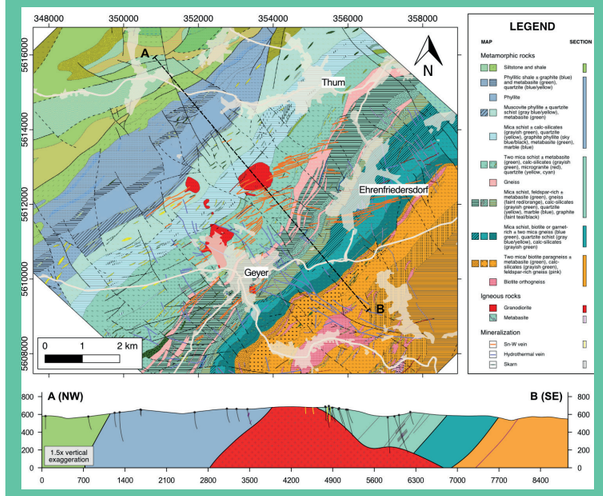
Reference database

- 904 drill holes and geological model
- Legacy magnetic susceptibility and density data
- Airborne EM (FD), magnetics and radiometrics (BGR, 2013–14, reprocessed 2018)
- SQUID Full Tensor Magnetic Gradiometry, FTMG (Supracon, 2014)
- Hyperspectral VNIR–SWIR (Dimap, 2015)
- Ground magnetics and gravity (1950–1980)
- SQUID Full Tensor Magnetic Radiometry, FTMG (Supracon, 2018)
- Airborne TEM data using VTEM ET™ system (incl. magnetic and radiometric data, Geotech, 2018) & AIP response (Aarhus Geophysics, 2019)
- UAV magnetics (HZDR, 2019)



Geological map and cross-section within the Geyer Exploration Permit. Source: Sächsisches Landesamt für Umwelt, Landwirtschaft und Geologie.

SAKATTI // NORTHERN REFERENCE SITE

Industry context

Scandinavia is one of the most attractive areas for exploration in the EU. Sakatti represents a typical modern day exploration target, as it is located deep underground.

Social / Environmental context

This northern reference site is located around 150 km north of the Arctic Circle in the sparsely-populated municipality of Sodankylä in Finnish Lapland. Economic activities in the area focus around mining, reindeer herding, forestry and tourism. The Sakatti area's climate is cold-temperate or subarctic. Parts of the local conifer forests, marshes and waterbodies of the site belong to the Viiankiaapa mire, an area protected by the European Natura 2000 network.

Geological introduction

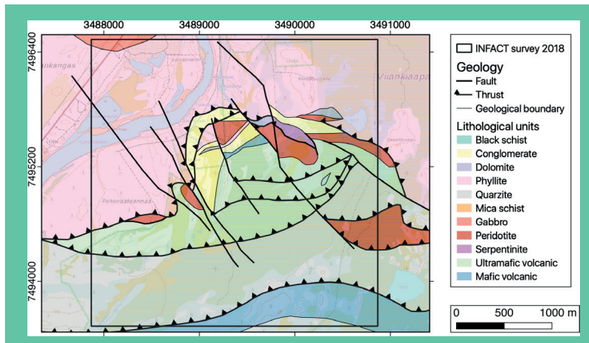
Sakatti represents a nickel-copper-PGE deposit located within the Paleoproterozoic Central Lapland belt. The mineralisation is magmatic, ultramafic-hosted and consists of massive-, disseminated- and vein-type sulphides. The Sakatti deposit includes three distinct mineralised peridotite bodies called "Main Body", "Northeast Body" and "Southwest Body". The northwest-plunging Main Body is the largest and deepest of the three, extending to a depth of ca. 1100 m below surface, with a maximum thickness of >400 m.

Exploration challenges & opportunities

- Deep (>500 m) massive sulphide main orebody
- Shallow massive sulphide orebodies
- Thin, conductive glacial till cover
- Location north of Arctic Circle: short, mild summers and long, freezing, extremely snowy winters. Avg. annual temperature/precipitation -1.1 °C/515 mm
- Deposit lies within a Natura 2000 protected area (Viiankiaapa mire)

Reference database

- 256 drill holes and geological model
- Magnetic susceptibility and conductivity measurements on cores
- Geological Survey of Finland HAKKU-service, low-altitude aerogeophysical measurements (magnetics, radiometrics, EM)
- VTEM™ and airborne mag (Geotech, 2009)
- SQUID Full Tensor Magnetic Radiometry, FTMG (Supracon, 2018)
- Fixedwind magnetic survey (Geotech, 2014)
- Airborne TEM data using VTEM ET™ system (incl. magnetic and radiometric data, Geotech, 2018)

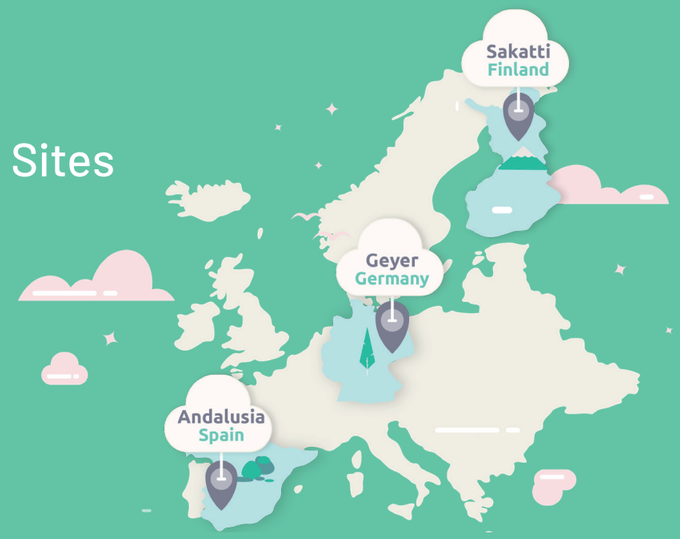


Source: Geological map of the Sakatti area. Source: AA Sakatti

INFACT

European Reference Sites

INNOVATIVE NON-INVASIVE AND FULLY ACCEPTABLE EXPLORATION TECHNOLOGIES



The INFACT European Reference Sites have been selected to provide a **rich and diverse exploration portfolio** including extensive drillhole and geophysical databases and covering a broad range of geological, social and climatic conditions to cater for a wide variety of exploration challenges. The sites will be **open for use by technology developers and exploration service companies** and will allow an assessment of innovative, non-invasive exploration techniques both in terms of **technical ability to map relevant geology** and identify mineral deposits as well as in terms of **environmental impact** and **perception of local stakeholders** in the diverse contexts of European exploration.

Why use the INFACT Reference Sites?

- World's first **test sites and associated framework** providing an assessment of **technical, social, and environmental performance** of exploration technologies on well-constrained geology and mineralisation
- Technology providers may develop **case studies** to demonstrate that their system can positively **contribute to an integrated mineral exploration program**
- **Increase the Technology Readiness Level (TRL)** of your system
- **Introduce your innovative methods** to the exploration industry
- **Feedback from multi-disciplinary experts** to broaden the understanding of performance potentials
- Participate in a credible **certification scheme for best-practice mineral exploration** to increase confidence of decision makers, investors and civil society

Fill in the survey and let us know how you would use the reference sites:
INFACT online survey

Interested in knowing more? Get in touch with us!
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RIO TINTO & COBRE LAS CRUCES // SOUTHERN REFERENCE SITES

Industry context

The Spanish reference region includes two sites: Cobre Las Cruces and Rio Tinto. Both sites are on the Iberian Pyrite Belt, a 300 km long and 80 km wide geological belt that extends eastward from southern Portugal into southern Spain. The belt is host to more than 100 mineral deposits, some of which were exploited for metals as long ago as the Bronze Age. Cobre Las Cruces is an open pit copper mine in Seville province, while Rio Tinto is a well-known, ancient, opencast polymetallic mine in Huelva province. The industry challenge is to find new deposits at greater depths and/or under post-mineral cover.

Social / Environmental context

The Iberian Pyrite Belt is an active mining region with a medium population density. The centuries-old mining activity has shaped the landscape and local communities and coexists with habitats of high environmental value. The southern sites are characterised by Mediterranean climate (avg. temperature/rainfall 16.5°C/581 mm).

RIO TINTO

Industry context

Since 2016, this historic mine has been operated by Atalaya Mining PLC which produces copper concentrates from mineralisation with a grade of ca. 0.42% Cu.

Geological introduction

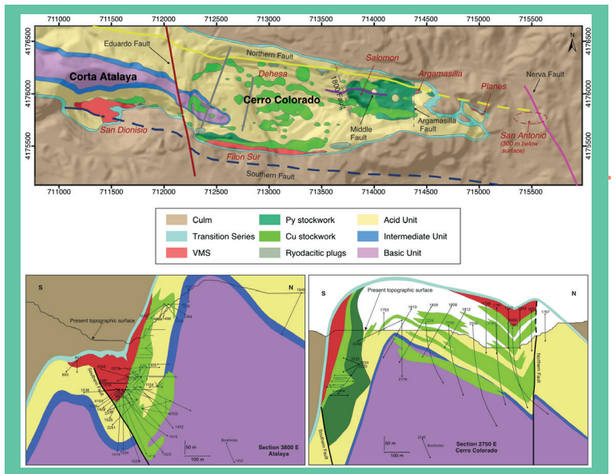
Rio Tinto is a volcanogenic massive sulphide (VMS) deposit hosted in volcanic rocks of the Iberian Pyrite Belt and is exposed at surface. The massive sulphide has been largely mined out but there is much more stockwork mineralisation remaining.

Exploration challenges & opportunities

- High levels of cultural noise
- Several large graphitic shale lenses that interfere with electrical or electromagnetic methods
- Active mining environment
- Tailings potential for re-mining

Reference database

- 480 drill holes
- Density and resistivity measurements on core and surface samples
- Airborne magnetics and radiometrics (Sanders, 1996-97)
- Ground AMT (Geognosia, 2015-17)
- Ground gravity (different datasets, 1980–2016)
- Airborne EM (VTEM Max™, GFEM™, Geotech, 2019)
- Airborne AFMAG (ZTEM™, Geotech, 2019)
- AIP from airborne EM (Aarhus Geophysics, 2019)
- UAV magnetics (HZDR, 2019)
- UAV hyperspectral (HZDR, 2019)



Geologic map and cross sections for the Rio Tinto reference site. Source: Martin-Izard et al. (2015)

LAS CRUCES

Industry context

Las Cruces is owned by First Quantum Minerals Ltd (FQM). The average copper grade at this opencast mine is 5% (in the chalcocite enrichment blanket) and the deposit represents the sort of target under post-mineral cover that will be a focus of future exploration in the Pyrite Belt.

Social / Environmental context

Las Cruces is located in Gerena, 20 km northwest of Seville, Andalusia's capital. Land use around Cobre Las Cruces is dominated by agriculture (80.5% of the area) followed by mining, urban and other industrial or tertiary uses.

Geological introduction

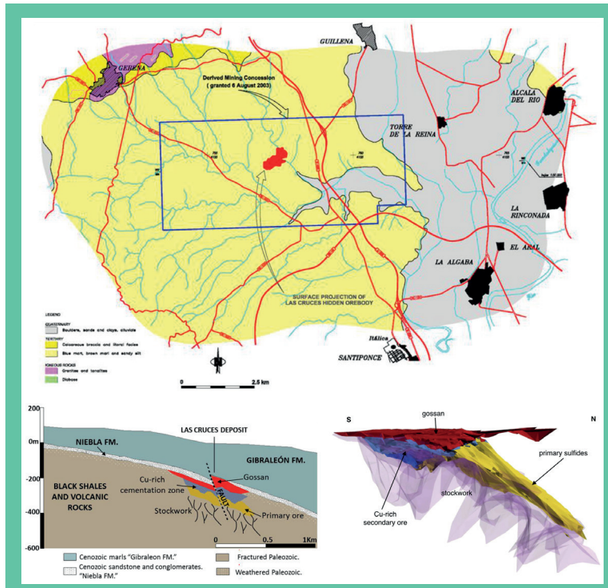
The Las Cruces volcanogenic massive sulfide (VMS) deposit is located at the eastern margin of the Iberian Pyrite Belt. A supergene copper orebody of chalcocite and a gossan cap overlie a primary, polymetallic sulphide orebody and Cu-rich stockwork. Las Cruces is a blind deposit, completely covered with over 100 m of sedimentary marls. A regional saline aquifer, from 0-10 m thick, sits at the interface between marls and basement volcanics.

Exploration challenges & opportunities

- Conductive marl cover (~ 5 ohm.m) from 0 to 350 m thick, with 0-10 m thick saline aquifer at the cover/basement interface
- Massive economic sulphide targets as small as 100 x 200 x 200 m
- Active mining environment
- Road and powerline infrastructure

Reference database

- 328 drill-holes+water wells (constraining depth of cover-basement interface)
- 500 drill holes (103,000 m drilled)
- Gravity (Rio Tinto M&E and Geognosia, 1990–2007)
- CSAMT, TEM and IP (Rio Tinto M&E, 1992–2002)
- Airborne EM (SKYTEM, 2017,)
- Ground AMT (Geognosia, 2016)
- Ground IP and AMT (Geognosia, 2018)
- 37 Ground-EM soundings (Aarhus and Geognosia, 2018)
- Passive seismic (Pacific Project, 2019)
- Airborne EM (VTEM-Max, GFEM, Geotech, 2019)
- AIP from airborne EM (Aarhus, 2019)
- Ground gravity (Geognosia, 2019)
- UAV magnetics (HZDR, 2019)
- UAV hyperspectral (HZDR, 2019)



Location map and schematic geologic cross sections for the Las Cruces deposit. Source: Cobre Las Cruces Operation Technical Report NI 43-101 (2015), Scheiber et al. (2018), Yesares et al. (2017).

GEYER // CENTRAL REFERENCE SITE

Industry context

Historically mined for silver, tin and tungsten, this region of Eastern Germany called Erzgebirge ("Ore Mountains") is now actively explored for lithium and other critical raw materials.

Social / Environmental context

Mining has been part of the region for 500 years and the local population of the small town of Geyer is generally supportive of mining-related activities. Today, forestry and agriculture are the main land uses. The area was designated a UNESCO World Heritage Site in 2019.

Geological introduction

Tin-tungsten deposits at the Geyer site in Germany have a late-Variscan magmatic origin and are hosted by a variety of vein structures (stringers, veins, and vein zones) and metasomatic structures (vein-type greisens, stockwork-like greisen bodies, and skarns). Although laterally extensive (several hundred metres), the deposit thicknesses are variable depending on type but are generally small: 6–10 m for stringer zones, 2–10 m for vein zones, <10 cm for vein-type greisens, and 0.2–2 m for skarns. The sulphide and tin mineralisation is genetically and spatially related to a dome-shaped granite pluton, which crops out in the center of the reference site.

Exploration challenges & opportunities

- Cultural noise: densely populated, power lines and radio towers
- Extensive forest cover
- Veins and skarn bodies of narrow width and steep geometry
- Metamorphic and igneous host rocks with steeply dipping contacts, steep foliation
- Local occurrence of highly conductive graphitic layers
- Humid continental climate. Avg. temperature/rainfall 6.2 °C/728 mm
- 300 m of relief
- Possible induced polarization effects