SPANISH MINING LANDSCAPES

- 1. The Iberian Peninsula is one of the European regions with the greatest mineral wealth
- 2. In the past the abundance and variety of its mineral resources attracted foreign peoples (phoenicians, carthaginians, romans).
- 3. Even as late as the **beginning of the 20th century**, Spain still boasted
 - Still boasted some of the world's most important mineral deposits (**Rio Tinto**).
 - The economic development of certain regions (Basque Country, Asturias) was based on their mineral wealth.

- 1. Nowadays, Spain still **remains one of the richest** countries in Europe in terms of its mineral wealth.
- 2. The mineral production is characterised by its **diversity**.
 - There is practically no mineral absent, but the most significant volumes produced are
 - ✓ **Metal minerals**: various pyrites, zinc, copper and lead.
 - Non-metallic minerals: sand, refractory argil, bentonite, quartz, fluorite, glauberite, grain magnetite, rock and sea salt, potassium salts and sepiolite.
- However, while metal mineral production is insufficient to meet the country's needs, by contrast, non-metal minerals are produced to a surplus, exceeding domestic demand.



- After centuries of mining activities on a wide variety of substances, a very rich mining and metallurgical heritage has been generated
- 2. The state of conservation of this heritage is not good
 - In part due to the progress and development of extractive activities that dismantle the remains of the previous stages,
 - But above all due to **abandonment** (i.e. the great mining of the 19th century)



Andalucía

1. Cuenca Minera de Rio Tinto y del Río Tharsis (Huelva)

Asturias

11. Valle del Nalón12.-Valle del Caudal (Asturias)

Castilla-León 15 Paisaje minero de El Bierzo (León)

Murcia

22 Cuencas mineras de Cartagena y La Unión (Murcia)

País Vasco 24. Salinas de Añana (Álava)

GOLD ROMAN MINING LAS MÉDULAS



- A historic gold-mining site near the town of
 Ponferrada in the comarca of El Bierzo (province of León, Castile and León).
- 2. It was the most important gold mine, as well as the largest open-pit gold mine in the entire Roman Empire.
 - Spectacular by the volume of soil removed, the quantity of used water, longitude and number of ramifications of their channels...









- 1. Legal protection (Spain):
 - Declared a **Historic Monument** in 1931
 - Registered as Bien de Interés Cultural (Property of Cultural Interest) in 1998 → the Archaeological Zone of Las Médulas is legally protected at the highest level
 - Declared also a Natural Monument in 2002, so it is also subject to the current Environmental Laws
 - What does that mean?
 - Any intervention, including archaeological investigation, therefore requires previous administrative authorization
 - ✓ All projects concerning this site must be previously approved by the Commission for Cultural Heritage of Castile and León.

1. Listed by UNESCO as a **World Heritage Site** in 1997.

- Since then, the management has been monitored by the Las Médulas Foundation, which includes local, regional, and national stakeholders, both public and private.
- Currently, serves as an example of good research-managementsociety applied to heritage.



- 1. The inclusion of Las Médulas as a World Heritage Site was controversial.
- 2. The delegate from Thailand opposed the designation because he considered the site "a result of human destructive activities as well as harmful to the noble cause of environmental promotion and protection."

NATURAL CONDITIONS

- 1. Favorable circumstances
 - Alluvium lands with seeds of gold
 - Abundant water
 - **Mountain slopes** to use them as hydraulic force.
 - **Soft slopes** toward the river Sil for the drainages.

SOME HISTORY

- 1. The area was **conquered in 25 BC** by the emperor Augustus.
- 2. Before the Roman conquest, the indigenous inhabitants obtained gold from alluvial deposits.
- 3. Large-scale production did not begin until the 2nd half of the 1st century AD.
- 4. Why the romans develop such system?: the most important reason was an **economic system based on gold**

Gold currency

 (aureus) served as
 payment for
 wealthy trading
 and the state
 (army, public
 employees, braves
 to other cultures).



Denarios Romanos de Plata Fuente:aulaaragón

Aureo emperador trajano







Sextercios de Vespasiano de bronce Fuente: Blogpolis

Aureos de clunia





Silver (denarios, sesteces), bronze and cupper currency (dupondios and ases) were used for daily life.

Ruina montium

- 1. The spectacular landscape resulted from a singular **mining technique** (wrecking of the mountains)
- 2. Described by Pliny the Elder in 77 AD.
- 3. It is a type of **hydraulic mining** which involved undermining a mountain with **large quantities of water**.
- 4. The water was supplied by interbasin transfer.
 - At least seven long aqueducts tapped the streams of the La Cabrera district (where the rainfall in the mountains is relatively high) at a range of altitudes.
 - Advanced aerial surveys conducted in 2014 using LIDAR have confirmed the wide extent of the Roman-era works.

WATER RECEPTIONS AREAS

Mountain areas \rightarrow Mount Teleno 2000 asl









DERIVING CHANNELS

1.Characteristics

- Longitude
 about 300 kilometers (total), some of them has individually 100 km
- Slope → between 0,6% and 1% (from 1000- 1300 to 900-500 meters.
- Width \rightarrow 1.28 meters, except in the curves, of 1.60
- **Depth** \rightarrow 90 centimeters.





DERIVING CHANNELS

1.CONSTRUCTION

•Most **difficult and expensive** task

•Strict recognition of the territory to project the layout → regular slope (around 0,5%) between the head and the arrival point.

•Excavation of the box of the channel and the construction of stone gable-wall in the side of the slope for the sustenance of the reserve ("speculum").





Ruina montium

→ Reception of the water by means of channels (2)

- → Storing of water in small deposits (3)
- → These deposits had floodgates (4) to distribute the water.
- → The water accelerated as it descended through the conduits, dragging materials (5)

→ The extracted soil was gathered around, forming banks
 (6).







Impacts:

- Political control of the gold mining districts by the roman state
 → controlled directly by the emperors through
 - A "Legati Imperator" → origin of Legio Gémina VI=León
 - Troops quartered close under the direction of a "Procurator Metallorum"





Maintenance and surveillance demanded numerous towns in both slopes of the Sierra of the Teleno and Mounts Aquilanos: high density of Roman occupation. https://www.youtube.com/watch?v=sgf9Jy5_Oho

https://www.youtube.com/watch?v=HrAgh51FNA0

https://www.youtube.com/watch?v=ByzpJYiAu5c

https://www.youtube.com/watch?v=vIwV08rGfX0

In Spanish Canales Romanos de Las Médulas en La Cabrera: <u>https://www.youtube.com/watch?v=jJN-BOVOtmg</u> <u>https://www.youtube.com/watch?v=_SVLRPHuplk</u>

El origen de la ciudad de León https://www.youtube.com/watch?v=ax58sbsNAYQ

RÍO TINTO

http://mineriaypaisaje.com/tag/paisajes-mineros-2/page/4/

- 1. Name: the **Riotinto-Nerva** mining basin
- 2. Where:
 - Located northeast of the province of Huelva (Andalusia).
 - Its main nuclei occupies the municipalities of El Campillo, Minas de Riotinto and Nerva, in the Cuenca Minera region.
- 3. It is in turn part of the socalled **Iberian Pyrite Belt**.



- 1. Historically, this area has been exploited for **mining purposes** but..
- 2. Accompained by an important **industrial complex** in contemporary times
 - As a result of the activities developed during this time → treasures a heritage, especially linked to the British period.
- 3. In recent decades various initiatives have been launched with a view to its **preservation** and use for **tourism** purposes.
 - In 2005 THE area was declared a Site of Cultural Interest with the category of historic site.

- 1. Probably with the Portuguese mine of Sao Domingos, the Ríotinto mine
 - is the oldest **almost operating in-interrupted mine** of the world.
 - the best example of the mineral wealth of the Iberian Peninsula.



The Iberian Pyrite Belt

- 1. Both mines belong to this particular geological feature.
- 2. This feature **stretches along much of the south of the Iberian Peninsula**, from Portugal to Spain.
 - It is about 250 km long and 30–50 km wide,
 - Running NW to SE from Alcácer do Sal (Portugal) to Sevilla (Spain).
- 3. The Iberian Pyrite Belt is the largest concentration of massive sulfides in the world
 - has provided more than **2000 million tons of ore**
 - still has more than **400 million left to exploit**.

The Iberian Pyrite Belt

1. The Riotinto complex was formed by several polymetallic masses that extended over an area of 4 square kilometers and that housed a total of 500 Mt (megatons) of ore.



- 2. The main formations identified are:
 - Filón Norte.
 - Filón Sur.
 - Masa Planes
 - Masa San Dionisio.
 - Masa San Antonio (extended over [™] the municipality of Nerva→ constitutes the most recent mineral formation located 2nd half of the 20th century)




The Iberian Pyrite Belt

- 1. Formed **350 million years ago** (Devonian Period),
- Connected to an active and hydrothermal volcanism → led to giant volcanogenic massive sulfide ore deposits (VMS) in the form of pyrite, chalcopyrite, sphalerite, galena and cassiterite.
- 3. Over 250 deposits are known in the belt.





ETIMOLOGY

1.Reddish color (red wine)

2.Origin:

- **Meteorization** of minerals containing sulfurs of heavy metals, found in **deposits** along the river.
- **Hydrothermal deposits** of pyre (sulfurate of iron) and calcopirita (iron disulfuro and copper).
- Meteorization process → microbiological oxidation of these minerals, caused mainly by special bacteria (arqueobacterias), on the bottom of the sea.

3.Consequence \rightarrow very **acid** river water.



- 1. The mining activity goes back at least one thousand years ago: **TARTESSOS**.
 - In the 4th century BC the historian Ephorus describes "a very prosperous market called Tartessos, with much tin carried by river, as well as gold and copper from Celtic lands".
 - Trade in tin was very lucrative in the Bronze Age, since it is an essential component of bronze and is comparatively rare.
 - Herodotus refers to a king of Tartessos, **Arganthonios**, presumably named for his wealth in silver.
- 2. The people from Tartessos became important trading partners of the **Phoenicians**, whose presence in Iberia dates from the 8th century BC and who nearby built a harbor of their own, Gadir (present-day Cádiz).

- 1. The **Romans** exploited intensively the mines, which played a significant role in the expansion of Roman metallurgy.
 - Although the information is limited, the mining activity reached its maximum splendor between the 2nd a.C. to the 2nd dC
 - The mines declined in favor of the then thriving mines of Dacia or Britannia.
 - Extraction tasks were carried out through a network of underground galleries and complex systems of hydraulic wells to move the water inside.



- 1. The **Romans** exploited intensively the mines, which played a significant role in the expansion of Roman metallurgy.
 - The working conditions in the galleries were very severe for the miners —mostly slaves— due to the dust, the strong humidity, the poor lighting or the high temperatures.
 - Silver was the metal with the highest production during the High Imperial period, with Rio Tinto being among the best silver mines of Antiquity.
 - From the time of Augustus, **copper** extraction also reached great relevance.
 - For the development of mining-metallurgical activities, the Romans erected numerous buildings in the area, such as furnaces and foundries, as well as roads to facilitate the transit of goods.

- 1. The **Romans** exploited intensively the mines, which played a significant role in the expansion of Roman metallurgy.
 - The current Corta del Lago housed the main Roman settlement in the area, which classical sources identify as **Urium**.
 - This nucleus was connected to other urban centers in the SW Iberian Peninsula through a **road** that started from Hispalis and linked with Iptuci, Onuba, Urium, Arucci, Fines, etc.
 - The mining exploitations were **operative until the last quarter of the 2nd century**, when the activity declined.
 - The mining town continued to be inhabited at least until the 4-5th centuries.

1. Roman necropolises (the

most important, La Dehesa, around 290 tombs).

 Most of them were cremations deposited in tombs excavated in rock, indicated on the ground by cupae.



3. Partially preserved, since a part of its original enclosure was destroyed by mining activities

- In the Middle Ages continued the decline in mining, since mines were considered exhausted after their intense exploitation in Roman times.
- 2. At the beginning of the **18th century**, mining interest in this area was revived, but it was not possible because of the lack of infrastructure and technology.
- 3. In the mid-19th century, the poor financial situation made it impossible the re-use

- 1. Extraction intensified again during the Industrial Revolution.
 - After several transfers of ownership, the exploitation rights were transferred to a purpose-built British company, the Rio Tinto Company Ltd (RTC).
 - The new owner started a much more intense exploitation, becoming the **most important mining area of Spain**.
 - As the mining works progressed, the main exploitations were articulated: Corta Atalaya, Filón Sur, Filón Norte or Corta Peña del Hierro → for copper and iron (pyrites), manganese.
 - Initially, the traditional system of galleries was followed, but since the end of the 19th century was replaced by **open-pit mines** (so-called "cortas") → allowed a greater volume of mineral extraction → shaped the current landscape character of the area, with the large drillings.
 - Maximum production: 1930



- 1. Extraction intensified again during the Industrial Revolution.
 - At the same time, an important mining-industrial complex for the mining-metallurgical treatment was formed:
 - ✓ Ore washers,
 - ✓ Factories
 - ✓ Foundries
 - ✓ Power plants
 - ✓ Warehouses



- 1. Extraction intensified again during the Industrial Revolution.
 - 1. The expansion of mining and metallurgical activities meant the need for a **greater number of workers**
 - 1. Exponential **increase in the population** of the area: Minas de Riotinto population (the main center) went from 4957 inhabitants in 1877 to 11603 inhabitants in 1900.
 - 2.Newly created **workers' towns** were articulated: Alto de la Mesa, El Valle, La Atalaya, La Naya, Río Tinto-Estación or La





- 1. Extraction intensified again during the Industrial Revolution.
 - Working conditions were "extraordinarily harsh".
 - Led to labor disputes on numerous occasions: there were several general strikes between the end of the 19th century and the beginning of the 20th century, violently repressed and leading to the dismantling of the trade union movement
 - During the 1930s, labor unrest increased due to the effects of the 1929 crisis.
 - After the outbreak of the civil war, in July 1936, the mining basin was located in the republican zone —under the control of the workers' committees—. However, this experience did not last long, because a few weeks later the rebel forces conquered the region with hardly any resistance.

- 1. Through the 2nd half of the 20th century
 - Nationalization in 1954: their property passed into the hands of several Spanish companies
 - **Declining production** compared to the British period
 - ✓ Only one exploitation was active (the rest exhausted)
 - Mining and industrial facilities were outdated
 - Removal of sulfur remained significant until the 1950s because of its application in the chemical industry (production of sulfuric acid).
- 2. At present, **this mining area is again in decline**. The economic viability depends on the extraction of copper, zinc, lead and, in some cases, precious metals like gold and silver.
 - Ending \rightarrow copper in 1986, silver and gold in 1996.
 - Recently, the rise in copper prices have allowed the limited opening of some exploitation



CORTA ATALAYA

1. The **largest open-pit mine in Europe** and was at one time the largest in the world.

2. Dimensions: roughly elliptical in shape, 1200 metres long, 900 metres wide, and 350 metres deep.

3. Begun in 1907 **after major subsidence** in some of the higher-altitude parts of the area two years earlier, caused by the combustion of pyrites in the earlier subterranean mines.

4.At its peak it employed **2000 workers mining copper**; it was actively mined until 1992. Since at least 1994 it has been flooded up to the 16th ring.





LA ATALAYA (village)

1. Built by the mining company

2. Replaced initial shacks or cabins for more durable constructions \rightarrow 100 houses (45 m²)

3. Endowed to this nucleus of public square, chapel, groceries warehouse, casino, school, barracks of Guardia Civil.



LA ATALAYA (village)

1.1970 \rightarrow project to enlarge the mine \rightarrow demolition of this village

2.At the present time, only the **ruins of the school** can be observed



Remnants of the former village of Atalaya on the edge of the cut.



ENVIRONMENTAL IMPACT

1. Mineral (copper) **roasted outdoors** \rightarrow on vegetal bed ("teleras")

- Slow combustion → emissions of sulfurous anhydride to the atmosphere.
- Permanent burning from 6 to 12 months a year; up to 500 Tm. of toxic gases daily
- "Manta" (blanket) → toxic cloud → people was not allowed to work, locked into their houses and those that could afford it went to other places.
- Washing the remnants with acid waters of the river and precipitation of pure copper over iron bricks.

2. Roasting system already **prohibited in Portugal and England** at that time



ENVIRONMENTAL IMPACT

- 1. Long lasting impact.
- 2. Ice core data from Greenland suggest that mineral air pollution sions peaked during the Roman period \rightarrow levels of Estimated Lead atmospheric lead from this period were not reached again until the Industrial Revolution some 1700 years later.



CONSEQUENCES: INFRASTRUCTURES

1.Huelva's Jetty
2.In use from March 23, 1876 to 1975
3.To embark the mineral
4.Architecture characteristic of the end of the XIX century: made of two independent structures, a wooden one and another of iron

5.Total longitude: 1165 meters.





CONSEQUENCES: Rio Tinto Railway

1. To improve the connection of this entire network of mines and industrial facilities and send the mineral to the port of Huelva.

2. Inaugurated in 1875 3. Consisted in a **network of about 360 kilome**ters between the main track and the different branches. **4. Width** \rightarrow 1,067 meters \rightarrow typical of the british railways in África and Asia (narrower than the Spanish)





Three main **stations**: embarcadero de Huelva and two large stations of mineral classification (Ríotinto Station and Naya)





CONSEQUENCES

1.Barrio de Bellavista

2.British "Victorian style" neighborhood.

3.Initially for british engineers, late for spanish (after 1954)

- It also included a "protestant" chapel & cementery, sports fields and a social club → allowed a separate way of life from the indigenous population.
- Today constitutes an important historical and cultural heritage.



CONSEQUENCES

1.The birth of the spanish football

- 1878 "English Club" → Rio Tinto Foot-Ball Club.
- Huelva 1889→ "Huelva Recreation Club" founded by the british doctor W. Alexander Mackay → Recreativo de Huelva





https://www.youtube.com/watch?v=R3ADnI5rrEE

https://www.youtube.com/watch?v=gjb091fxSG8

https://www.youtube.com/watch?v=Nlch3R7-bMU

https://www.youtube.com/watch?v=zV781KaliVg