Integrated Mobile modularised Plant and Containerised Tools for selective, low-impact mining of small high-grade deposits

This project is funded by the EU Horizon 2020 Programme; Grant no 730411

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Extracthive designs and industrializes physical and chemical processes to extract metals and minerals from industrial wastes and waste waters.
Our main activities are:

<table>
<thead>
<tr>
<th>Manufacturing scrap</th>
<th>Recycling of resin bonded abrasives</th>
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<tr>
<td>Treatment of effluents</td>
<td>Valorization of Li, Al Extraction of Hg</td>
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<tr>
<td>Industrial Wastes</td>
<td>Stabilization and valorization</td>
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<tr>
<td>End life products</td>
<td>Valorization of metals from WEEE grinding dust</td>
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Our objectives are to:

- Minimize the volume of final waste
- Increase the material efficiency
- Generate additional cash-flow through the selling of by-products

Extracthive can either act as an R&D service provider or as a partner to co-develop the process you need.
Europe has been largely mined out of world-class deposits, compared to the “big” mining nations.

There is a commercial necessity to reduce capital infrastructure in mining operations, particularly for ‘small’ deposits.
Price instability + lower return on capital employed

Market cap of Top 40 vs adjusted price index ($ billion)

Top 40 adjusted return on capital employed (ROCE)

Source: PwC Analysis

Market capitalization of the Top 40 companies against an adjusted price index for a basket of commodities including copper, coal, nickel, zinc, gold, silver and iron ore.
A solution that neither requires substantial infrastructure, electrical power nor water supply.

A new approach that requires lower capital threshold and has short payback periods.

A solution that can easily explore small, high grade, deposits.

A solution that minimise social and environmental impacts.

Integrated whole system solution of switch on-switch off (SOSO) mining.
• Responsive mine planning for geological uncertainty
• Selective mining tool as primary crusher
• Flexible flow-sheets for metallurgical variability
• Modularised mobile processing

• Feasibility studies
• Throughput of extracted material
• Infrastructure
• Land use
• Resource consumption
• Waste
Objectives

- Facilitate response of raw material supply to rapid fluctuations in market forces
- Facilitate smaller operators by finding solutions to reduce capital investment
- Optimize flexible technological solutions to rapidly ‘switch on’ or ‘switch off’ (SOSO) production at short duration operations
- Demonstrate that the SOSO concept will minimize environmental impacts and enhance social acceptability
- Use vertical integration and whole supply chain analysis to enhance commercial exploitation worldwide and to support companies in Europe
Consortium

Interdisciplinary consortium comprises of 7 industrial partners and 4 academic institutions, and one geological survey.
Technological solutions for selective mining and throughput reduction

Areas of IMP@CT Innovation

1. Intervention points using XRF facility
2. Innovation to combine Rados XRF facility with continuous mining
3. Continuous miner negates large primary crusher
4. Reduction in haulage distance and throughput
Work Packages – Extracthive operation

Work package 1: Project co-ordination and management

Work package 2: Feedstock and materials characterisation ⇔ dealing with geological uncertainty in SOSO mining

Work package 3: Metallurgy ⇔ dealing with metallurgical variability in SOSO mining

Work package 4: Modular mobile mining and processing ⇔ innovating technologies for SOSO mining

Work package 5: Environmental and social sustainability ⇔ legacies of SOSO mining

Work package 6: Project integration tools and business modelling ⇔ realising SOSO mining

Work package 7: Linkage with other H2020 projects

Work package 8: Project dissemination and communication

Work package 9: Ethics issues
Develop proof of concept - West Balkans

A lead carbonate (cerussite) deposit with complex mineralogy is located in Olovo - Bosnia & Herzegovina

The Gorazde antimony deposit (stibnite), small relative high grade antimony prospects located in Gorazde - Bosnia & Herzegovina

→ Imp@ct technology will validated in relevant environment in west balkans
→ **Gorazde deposit**: Quartz veins with Stibnite inclusions + residual Limestone

→ the difference in hardness of both material may enable a concentration via a grinding and sieving approach

1 kg of hand sorted samples from Gorazde was ball milled for 30 min.

**Grain sizes after 30 minutes crushing**

![Graph showing cumulated % against particulate sizes in µm for Gorazde Ore.]
The various size fractions were leached with aqua regia at 80°C for 6h with a L/S ratio of 10. The solution was analysed by ICP-OES.
Lab-scale process performed in column in order to simulate heap leaching
Gorazde & Olovo: perspectives

- Looking for a European internal market for the Antimony concentrate obtained
- Pilot scale testing to start in 2018

Olovo deposit → Experiments of the hydrometallurgical process on the Olovo tailings (> 10% in Pb) to start in 2018
Thank you for your attention!

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A ‘switch on-switch off’ mining paradigm

Improved viability of many critical metal and other small complex deposits.

1. lower the barriers to entry of new operators to the market,
2. smooth possible future over-production crises;
3. facilitate mining of metals that are consumed in relatively small quantities;
4. allow raw materials production to respond rapidly to global developments in the supply and end-user industries, by taking into account the social sustainability of these actions.

⇒ Adaptable and Responsive to Market Conditions
⇒ Better Balance Supply & Demand
⇒ Nimble and Opportunistic
⇒ Low CAPEX, Small Throughput, Shorter Life of Mine