



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

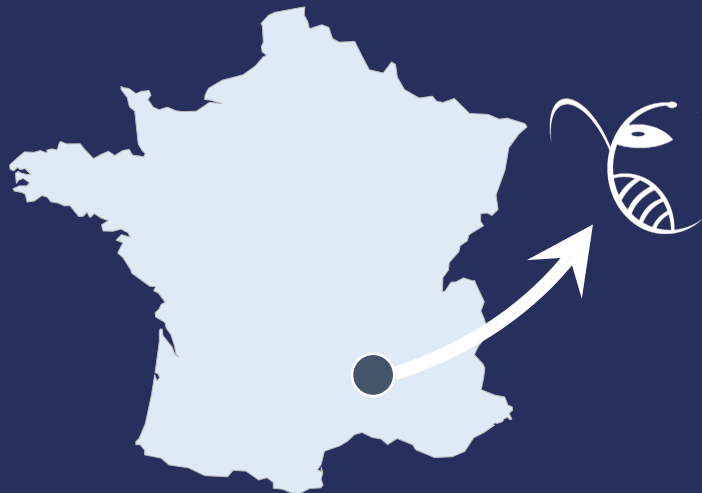
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**Extractive** designs and industrializes physical and chemical processes to extract metals and minerals from industrial wastes and waste waters.

**FAIRE  
& SAVOIR  
-FAIRE**





## Our main activities are:

**Manufacturing  
scrap**



Recycling of resin  
bonded abrasives

**Treatment  
of effluents**



Valorization of Li, Al  
Extraction of Hg

**Industrial  
Wastes**



Stabilization and  
valorization

**End life  
products**



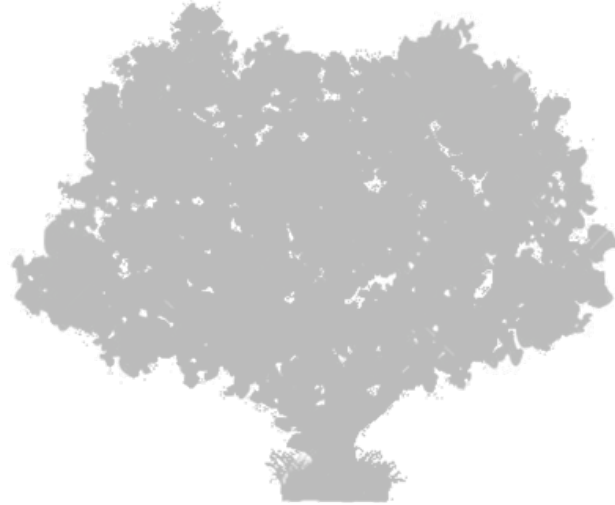
Valorization of  
metals from WEEE  
grinding dust





## Our objectives are to:

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



**Contract research**

**Collaborative research**

**Technology transfert**

**Extractive** 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.

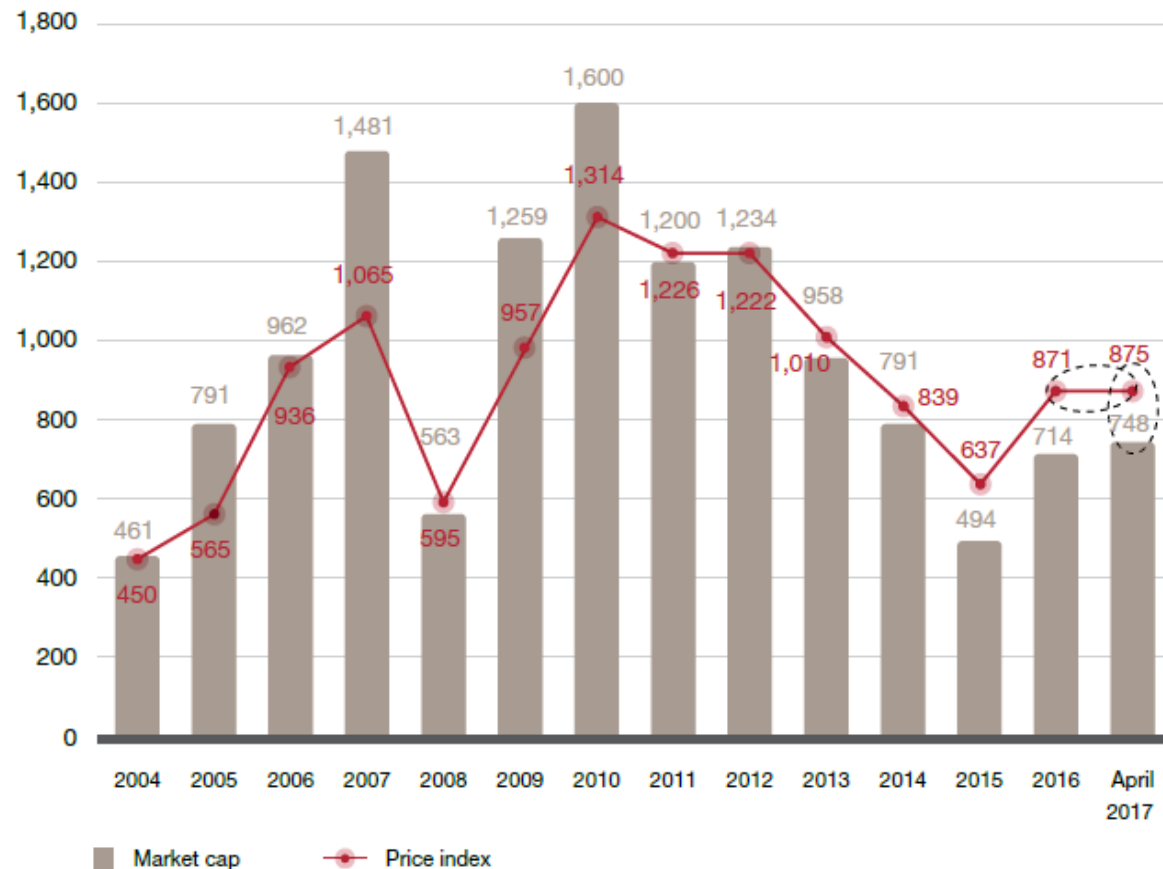


There is a commercial necessity to reduce capital infrastructure in mining operations, particularly for ‘small’ deposits.



# Price instability + lower return on capital employed

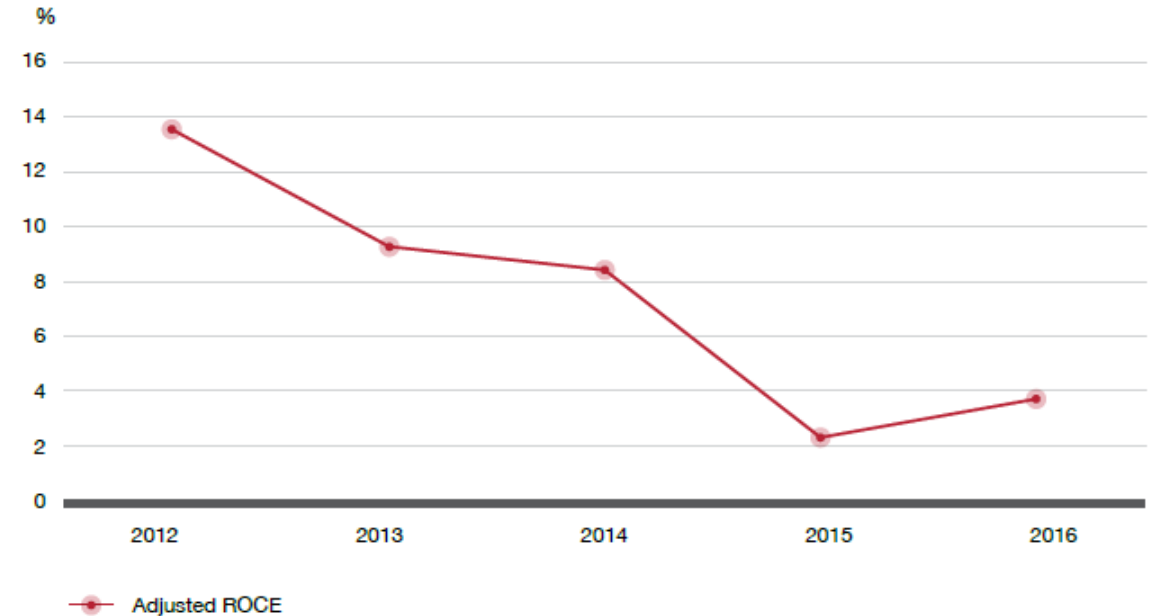
Market cap of Top 40 vs adjusted price index (\$ billion)



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.

Top 40 adjusted return on capital employed (ROCE)



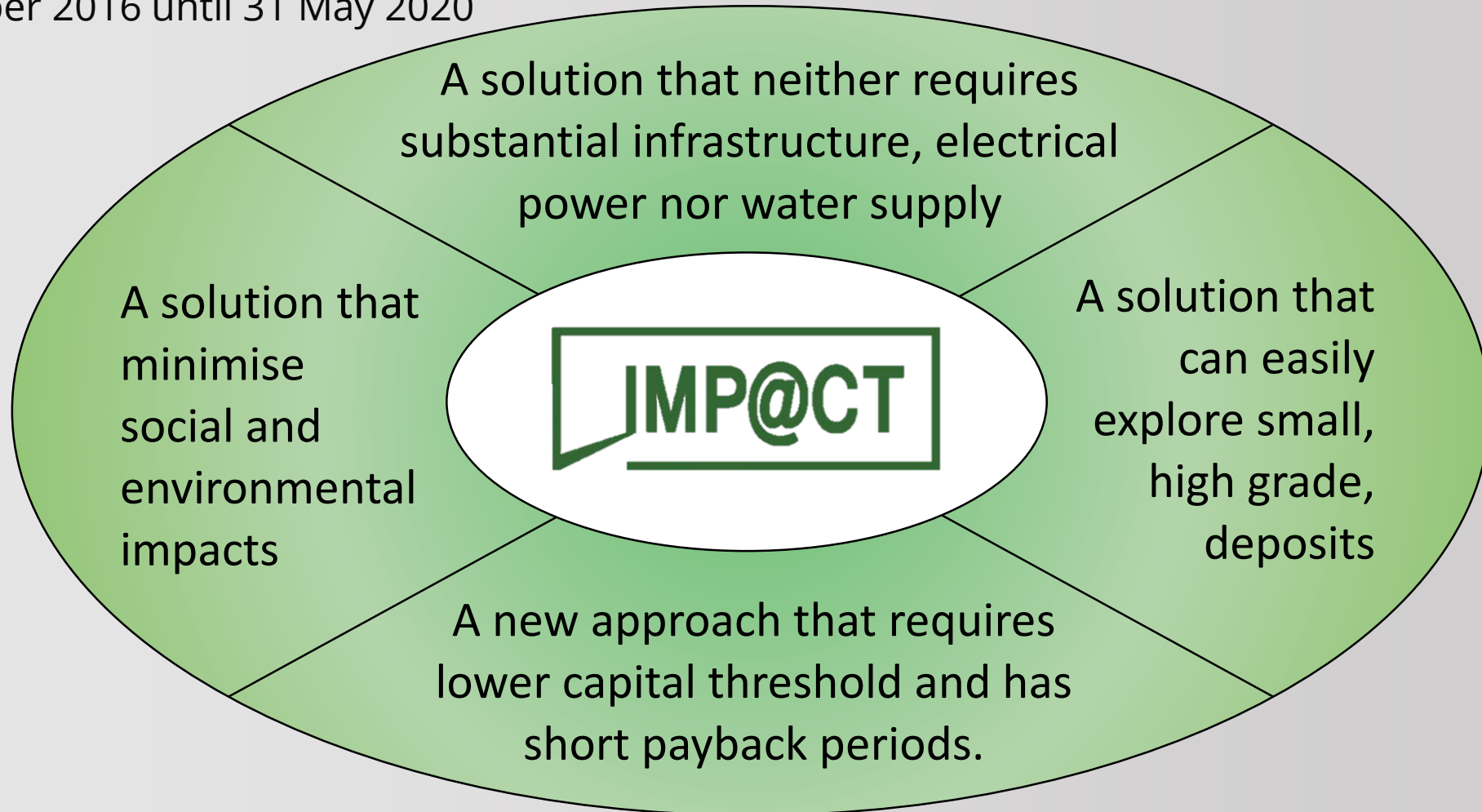
Source: PwC Analysis

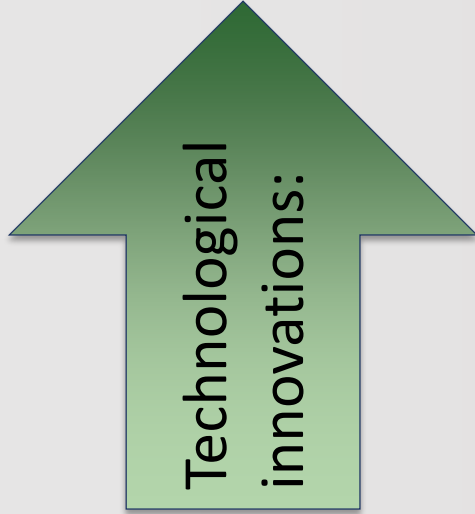




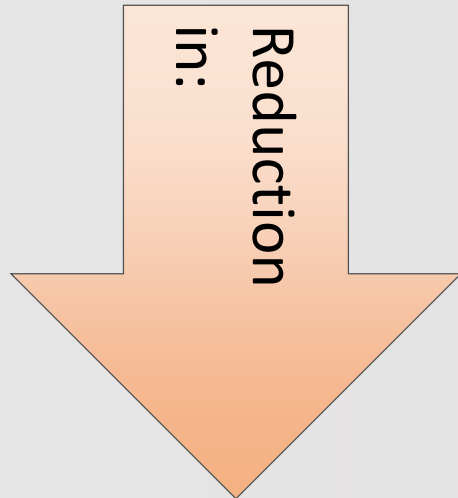
# Integrated whole system solution of switch on-switch off (SOSO) mining

From December 2016 until 31 May 2020





- 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



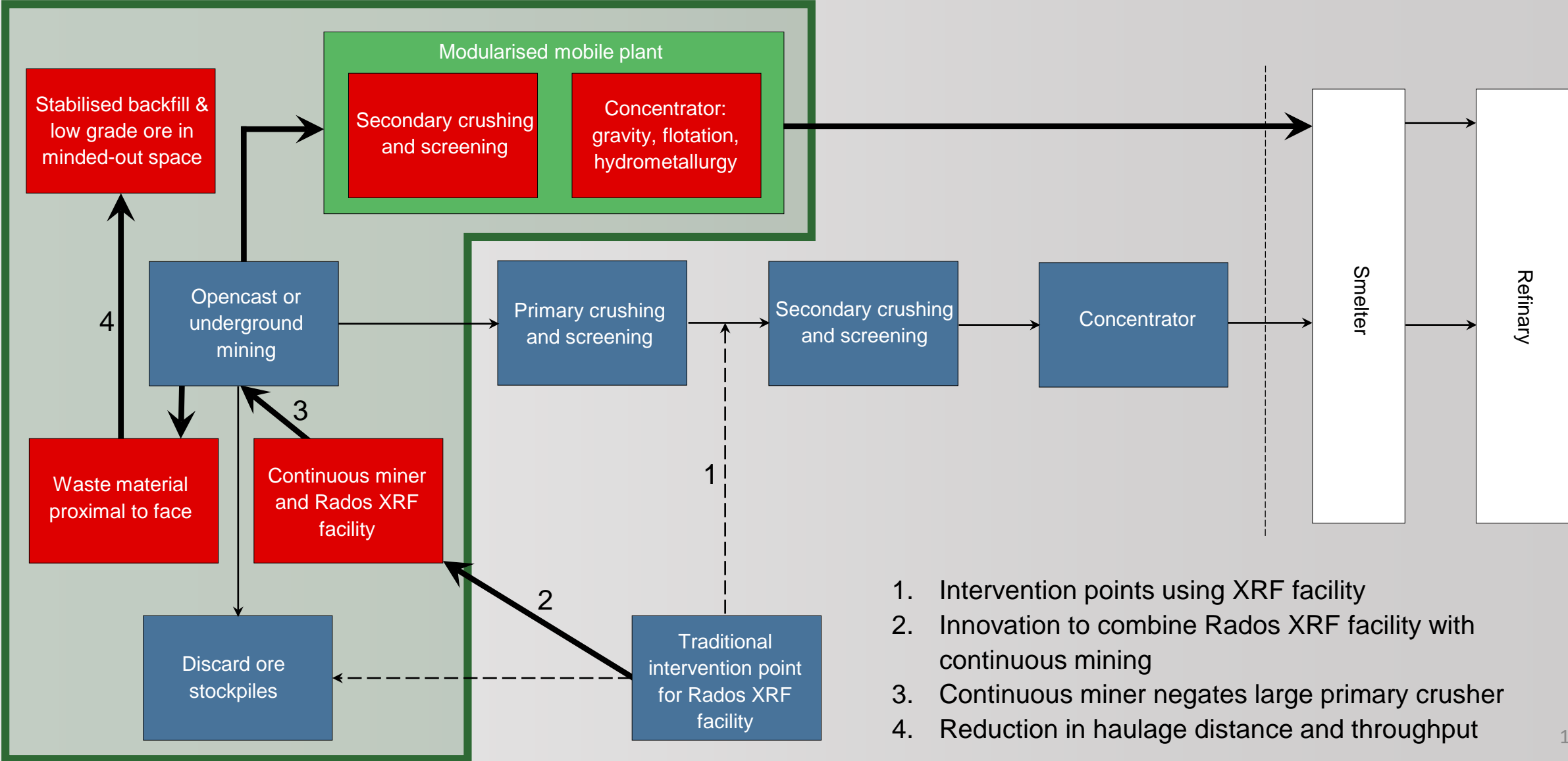
## Consortium

Interdisciplinary consortium comprises of 7 industrial partners and 4 academic institutions, and one geological survey.



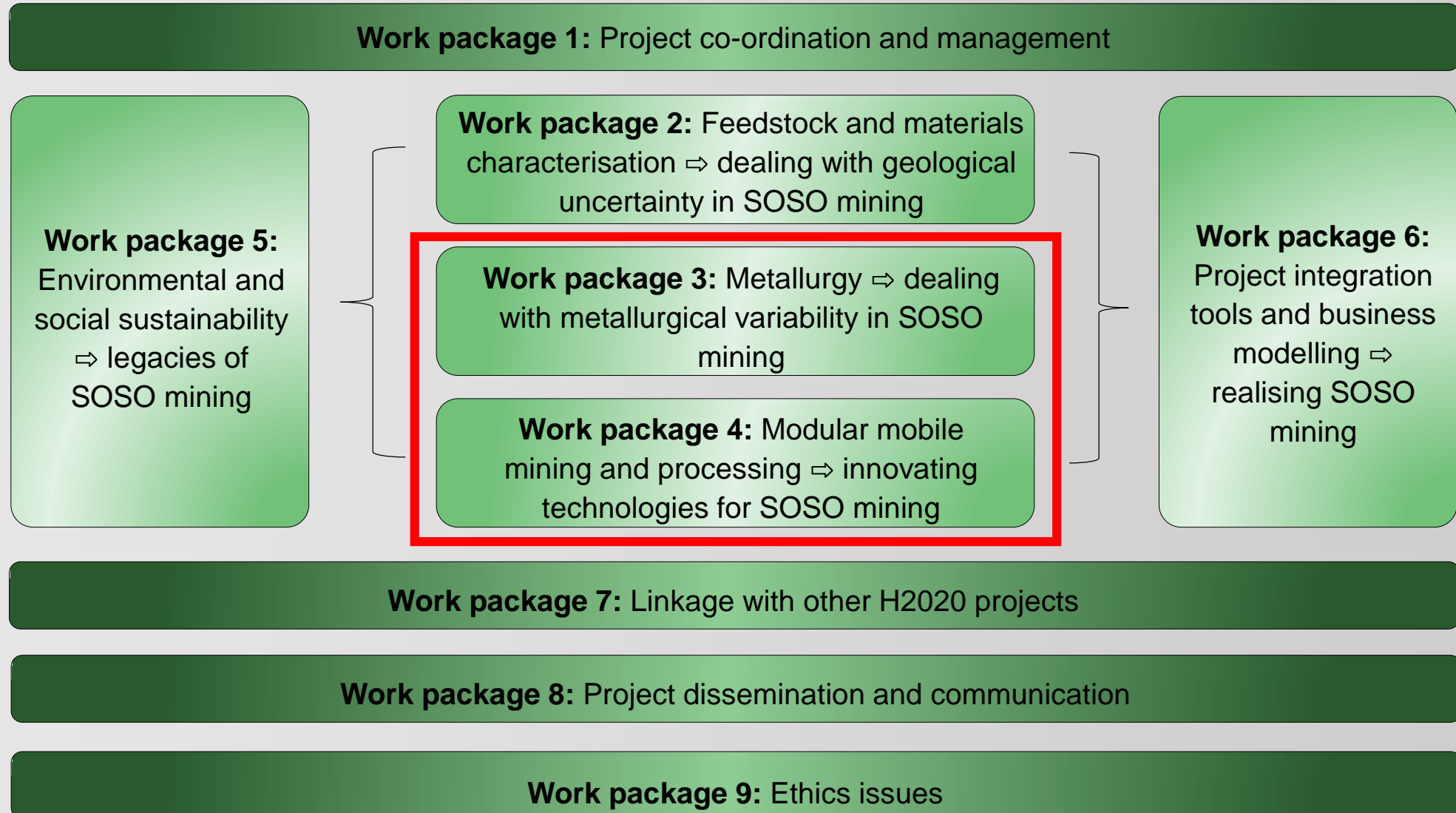
# Technological solutions for selective mining and throughput reduction

## Areas of IMP@CT Innovation





# Work Packages – Extractive operation





## 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 be validated in relevant environment in west balkans



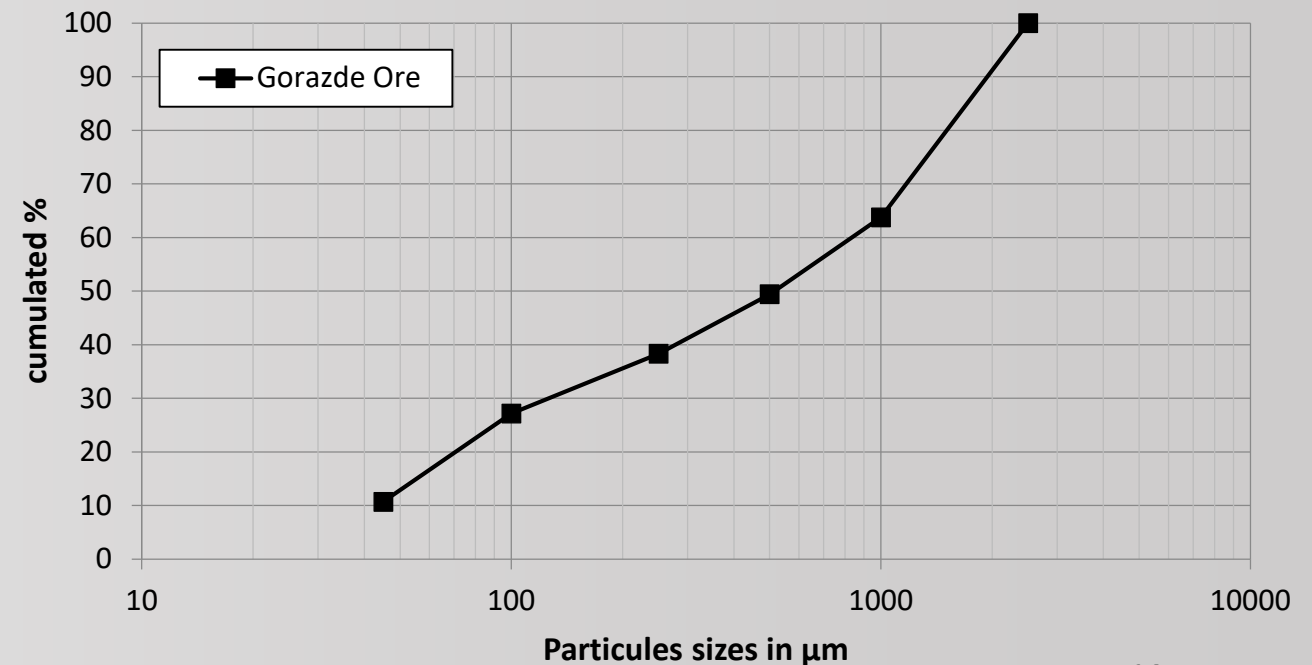


→ **Gorazde deposit:** Quartz veins with Stibnite inclusions  
+ residual Limestone

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

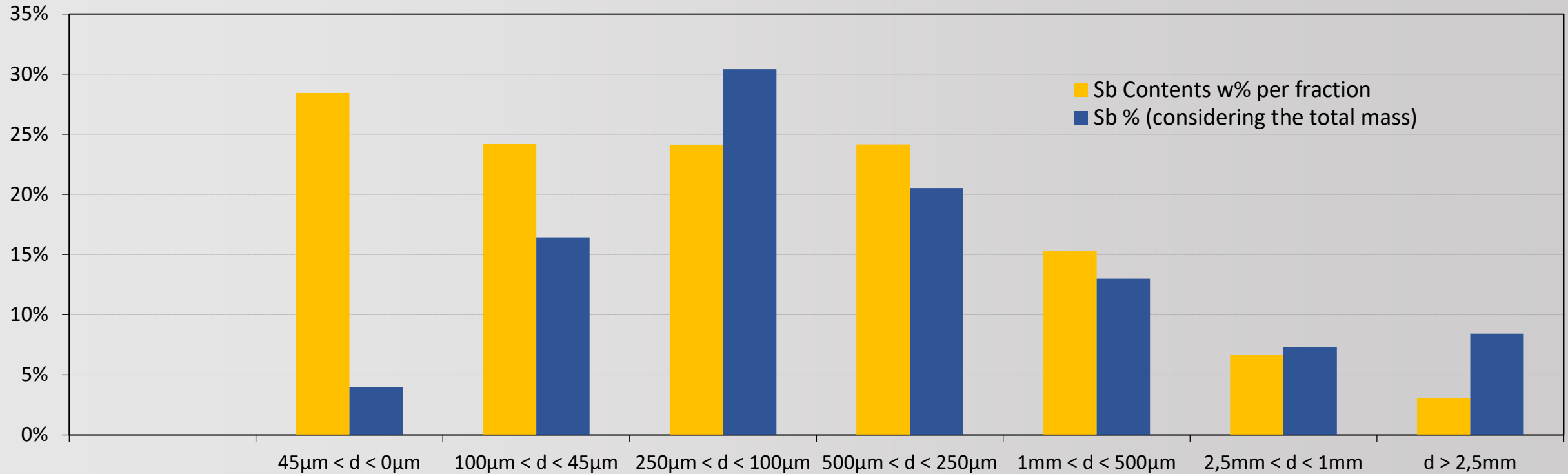
1 kg of hand sorted samples from Gorazde  
was ball milled for 30 min.

**Grain sizes after 30 minutes crushing**





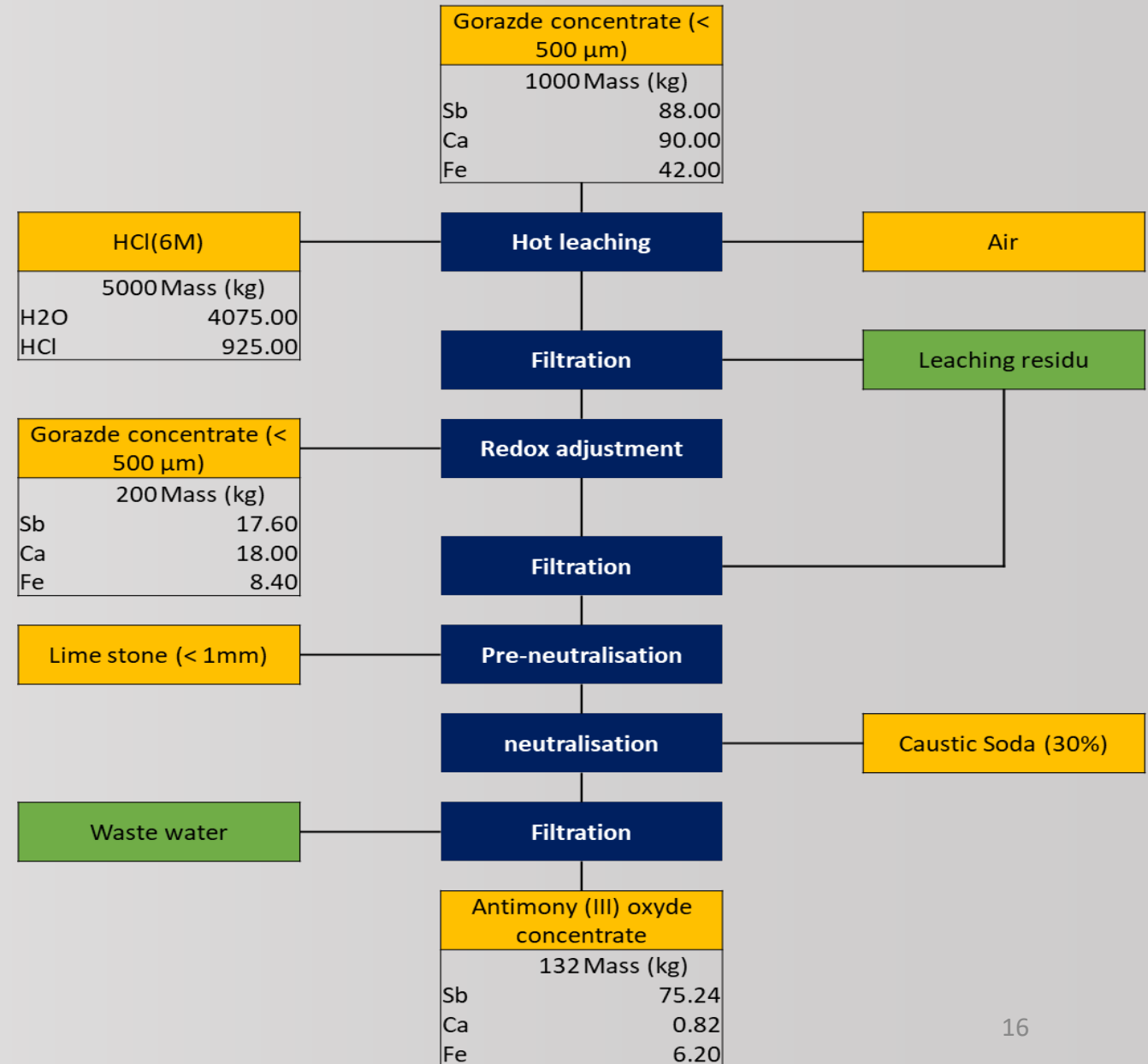
The various size fractions were leached with aqua regia at 80°C for 6h with a L/S ratio of 10.  
The solution was analysed by ICP-OES

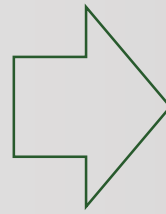


Sample	As	Ag	Au	Bi	Co	Cu	Fe	Pb	Ti	Zn	Sb	Ca
	w%	w%	w%	w%	w%	w%	w%	w%	w%	w%	w%	w%
500µm < d < 250µm	< d.l.	< d.l.	< d.l.	< d.l.	< d.l.	< d.l.	1.913	< d.l.	< d.l.	< d.l.	24.16	7.05

# Gorazde: hydrometallurgy

Lab-scale process performed in column  
in order to simulate heap leaching





- 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