

# BioMine

Biotechnology for  
Metal bearing materials  
in Europe



<http://biomine.brgm.fr>

BioMinE

# BioMinE Consortium

BioMinE



TAMPERE UNIVERSITY OF TECHNOLOGY

UNIVERSITÄT  
DUISBURG  
ESSEN



Hellenic Copper Mines Ltd



WAGENINGEN UNIVERSITY  
*University for Life Sciences*



UNIVERSITY OF CAPE TOWN

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UNIVERSITY  
OF TECHNOLOGY

MEAB



Imperial College  
London



RIO  
TINTO



WARWICK



OUTO  
KUMPU

umicore  
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SKERIA  
UTVECKLING



CENTRE NATIONAL  
DE LA RECHERCHE  
SCIENTIFIQUE

IKP  
Universität Stuttgart

GaBi



PE EUROPE GMBH  
Life Cycle Engineering

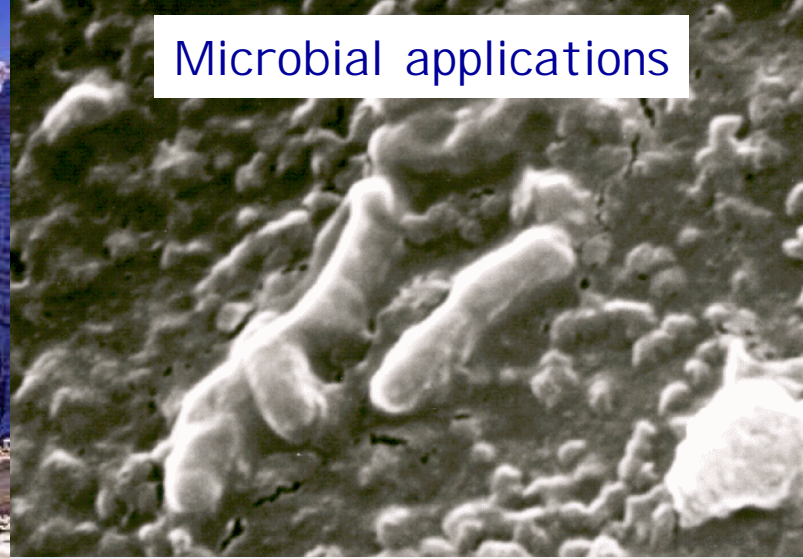


MILTON ROY  
Mixing

Resource identification



Microbial applications



Metal winning



Industrial applications





## BioMinE Rationale



Depletion of rich primary resources of metallic ores

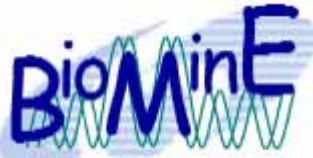
Metal economics

Competitiveness in metal production

Environmental impacts of conventional methods

Discovery of biological properties leading to viable processing routes

Progress in hydrometallurgical methods



## Bioleaching



From passive uses to specific applications

Copper recovery from mine effluents



Heap, dump, in situ leaching  
for copper, gold & uranium recovery  
Static leaching technique



Agitated tank leaching for gold, copper  
nickel, and cobalt recovery  
Dynamic leaching technique





## BioMinE impact



Deal with primary resources uneconomic for conventional methods (marginal grades or penalizing elements)

Produce a valuable product on site  
with a flexible size of the installation

Chemical compounds solubilized  
are confined to aqueous phase

More environmentally friendly than conventional techniques

Operating costs are competitive

Technically easy to operate and reliable



## BioMinE Integrated Project



Project supported by the European Commission in the frame of the 6th Framework Programme of RTD

### Economically

To investigate "the production of tomorrow" by carrying out biotechnological research for the European mineral extractive industry

### Environmentally

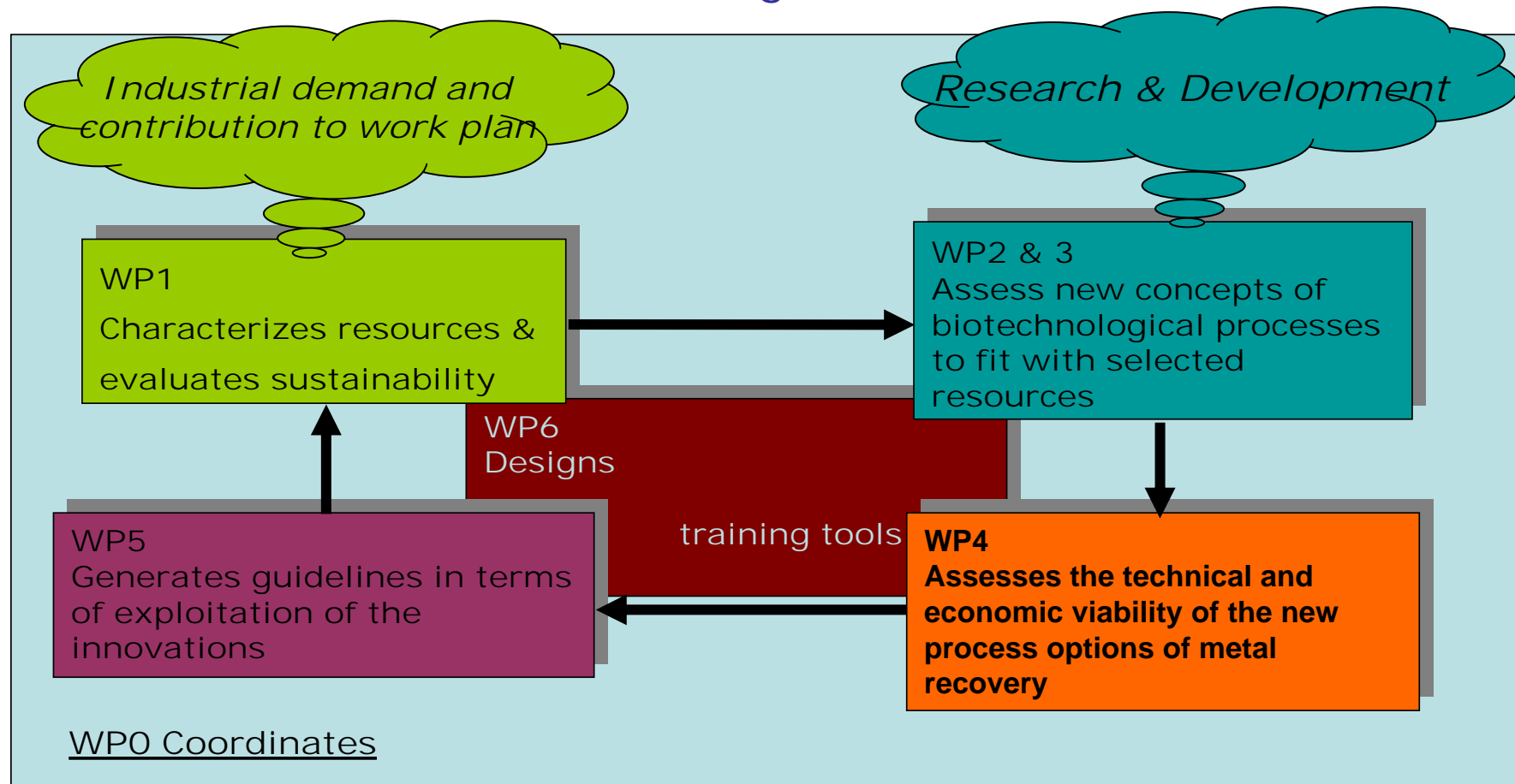
To develop sustainable biotechnological processes that will reduce the impact of mining & metallurgical activities and will cover the whole life cycle of products, equipment and infrastructures

### Technically

To integrate various innovative biotechnological processes for the recovery of metals from primary and secondary materials (ores and concentrates, and mining wastes, slags, scrap, and ashes)

# Project Structure

7 work packages - from the evaluation and selection of the potential resources to the exploitation of the results of the process investigations -





## BioMinE WP1

### Resources and Sustainability Assessment

To identify primary and secondary sources in Europe for metal extraction by integrated biotechnologies

To assess the potential impacts on European economy and environment of biotechnological versus conventional metal recovery

To put forward "benchmark resources" based on the detailed socioeconomic and environmental LCS evaluation with best practices for optimised recovery and minimisation of future wastes

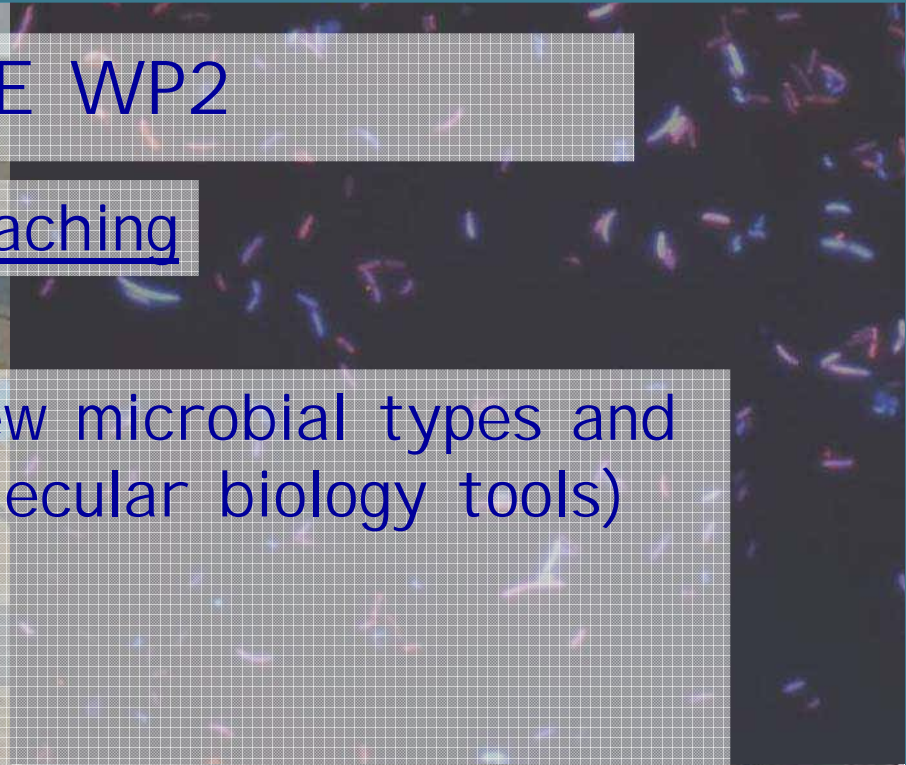
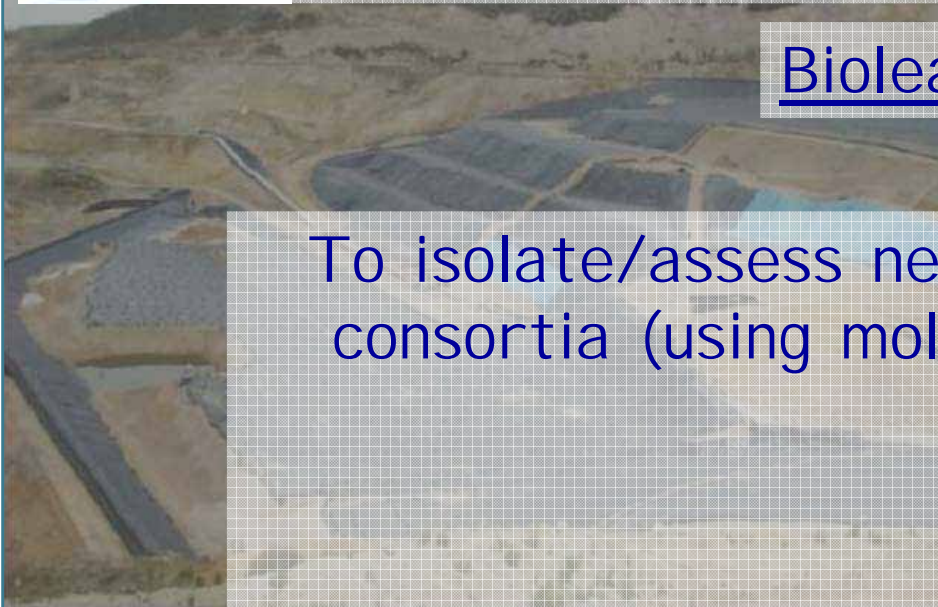


## BioMinE WP2

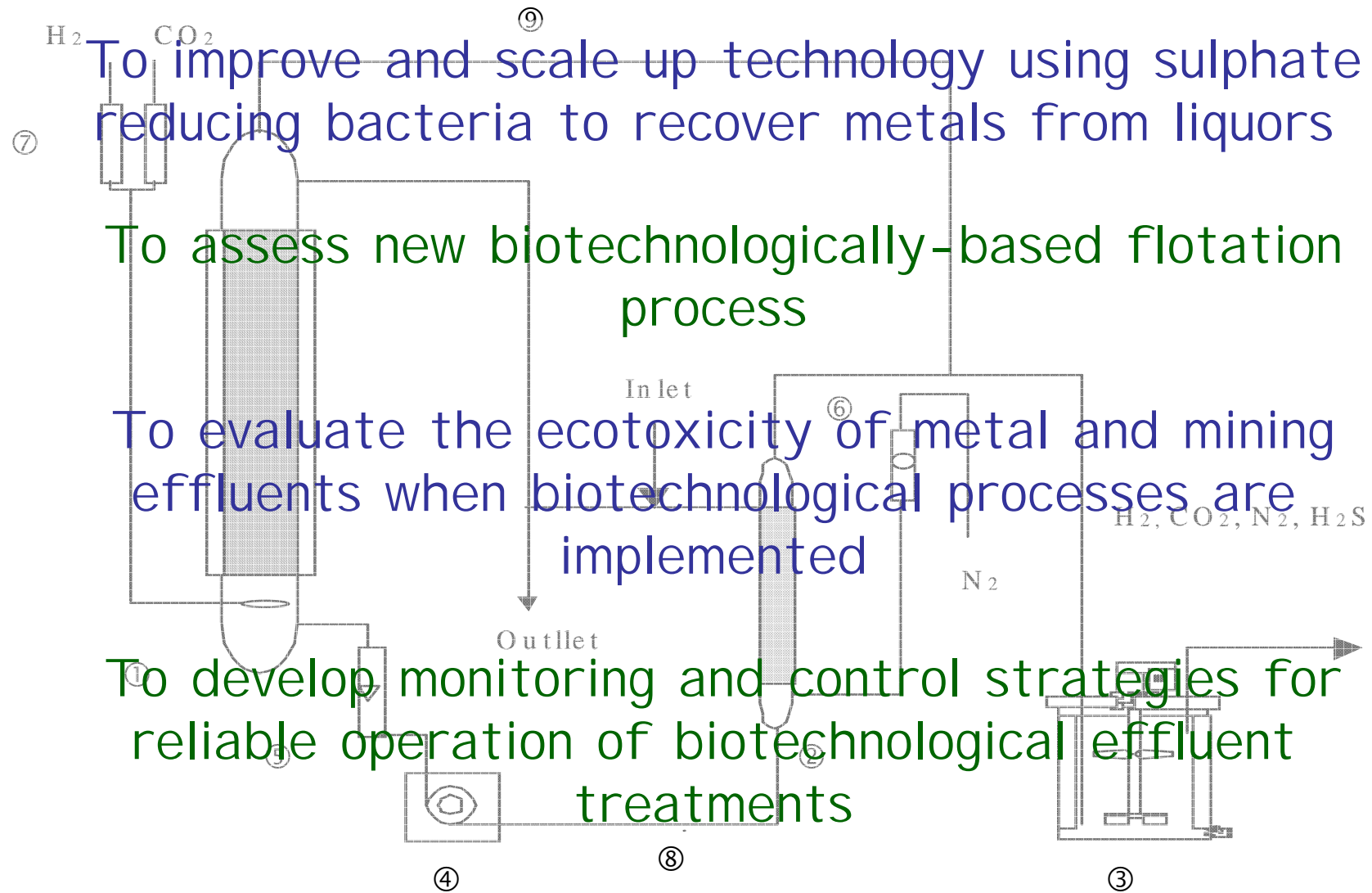
### Bioleaching

To isolate/assess new microbial types and consortia (using molecular biology tools)

To study and develop innovative process options, including alternative bioreactors



## Metal recovery and other biotreatments



## Process integration

Pyrite 241 t/day

Nutrients

Limestone  
0.3 t/t concentrate

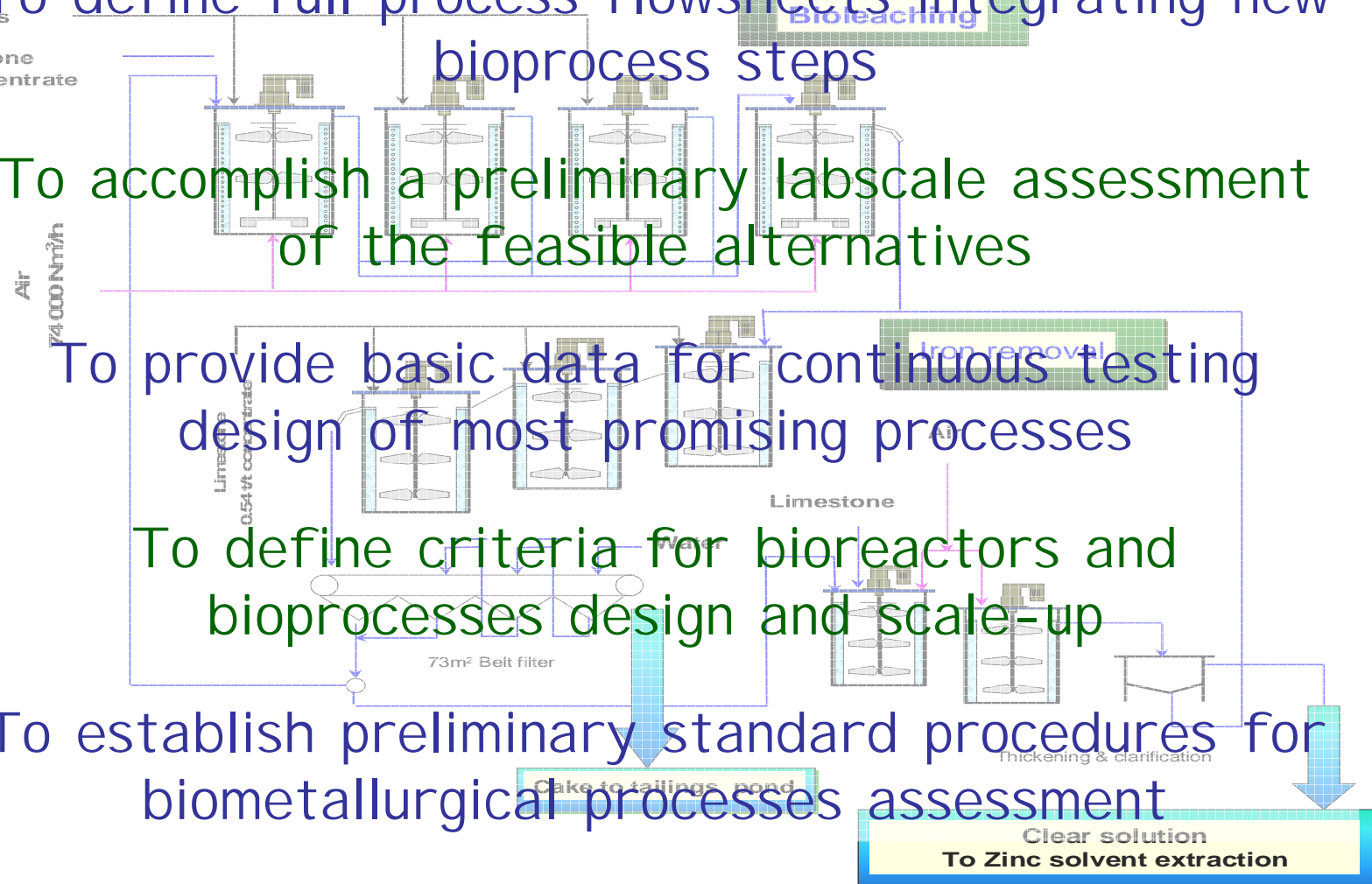
To define full process flowsheets integrating new bioprocess steps

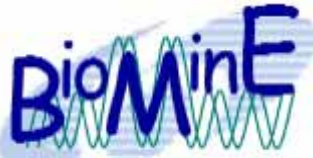
To accomplish a preliminary lab-scale assessment of the feasible alternatives

To provide basic data for continuous testing design of most promising processes

To define criteria for bioreactors and bioprocesses design and scale-up

To establish preliminary standard procedures for biometallurgical processes assessment





# BioMinE WP5

## Results exploitation



To promote opportunities for the exploitation of the results in terms of industrial applications

To develop plans for use and dissemination of the Knowledge arising from the project

## Training

To produce flexible, case-based, distance teaching materials ("Learning Objects")

To serve the partners with a web-based distance course (containing the Learning Objects) for training in biohydrometallurgy

To prepare for future exploitation by elaborating an international masters education

