



**ASGMI**

Asociación de Servicios  
de Geología y Minería  
Iberoamericanos

# Achievements and challenges of ASGMI's expert group on mining environmental liabilities

*Logros y desafíos del grupo de expertos en pasivos ambientales  
mineros de la ASGMI*

Dr. Fredy Guzmán-Martínez

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## The Association of Iberoamerican Geological and Mining Surveys (ASGMI)



Is a non-profit organization founded on 1993, representing 22 National Geological Surveys in Latin-America, plus Portugal, Spain and a regional geological survey in Spain. Since 2012, it has its own legal personality.

### Mission

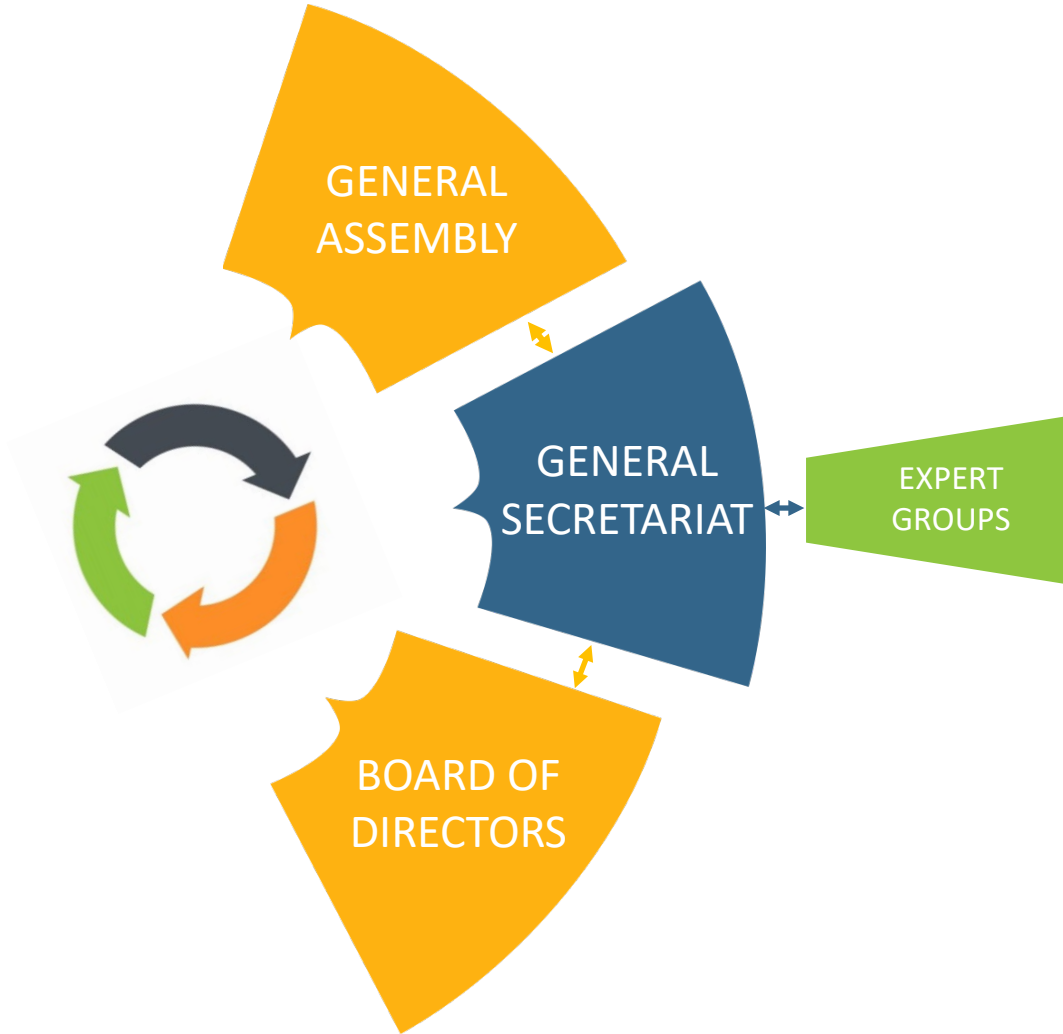
- ✓ Contribute to the socio-economic development of society through cooperation among its members
- ✓ Contribute to the institutional strengthening of associated geological and mining surveys

### Vision

To be an organization capable of providing geological knowledge of the territory in order to respond to the growing social sensitivity in aspects such as:

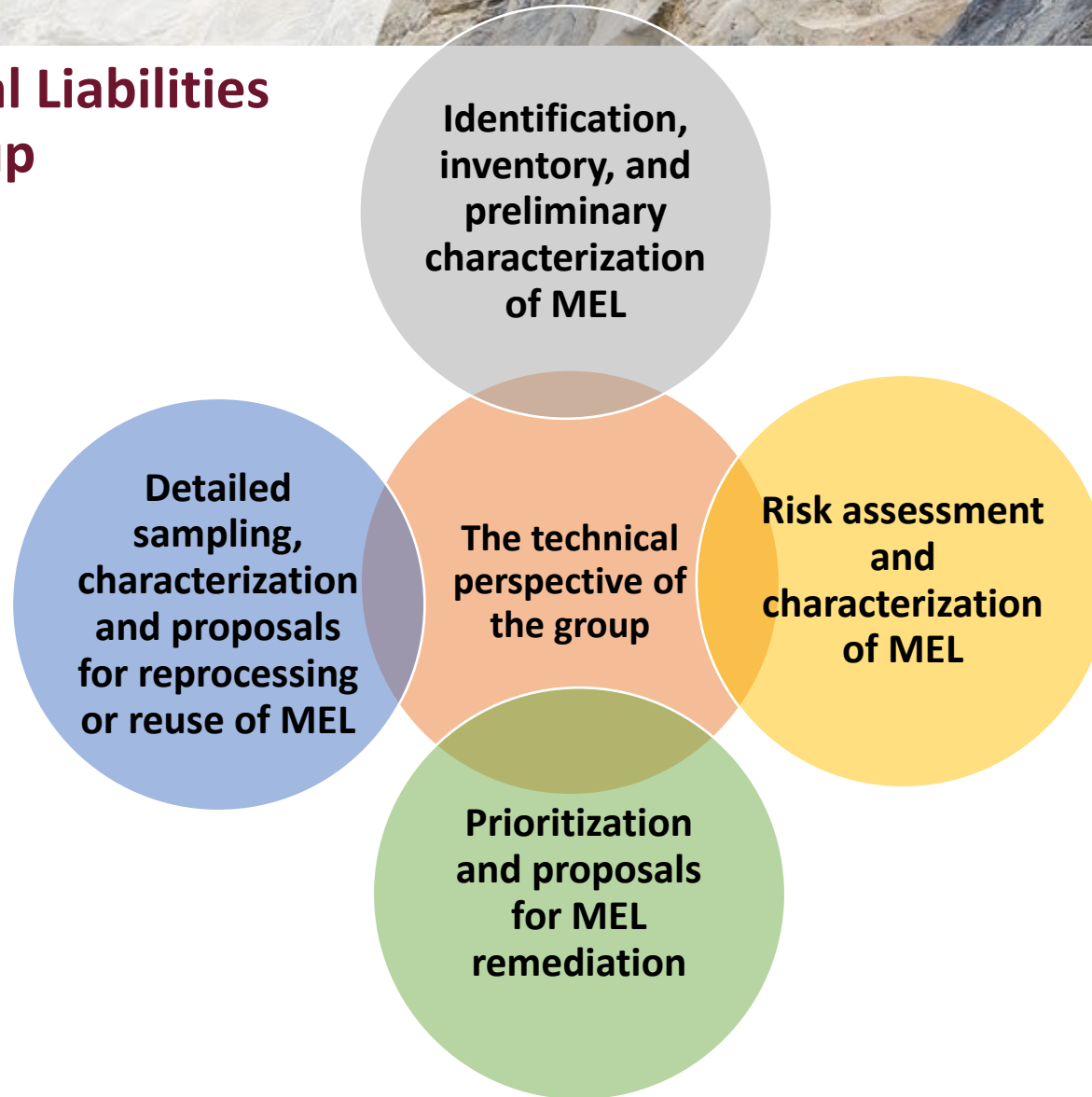
- ✓ Prevention and mitigation of disasters derived from geological hazards
- ✓ Rational and sustainable use of mineral and water resources
- ✓ Soil and water pollution as a consequence of mining activity
- ✓ Effects of climate change

## ASGMI Structure



- INTERNATIONAL COOPERATION
- GEOLOGICAL HERITAGE
- NETWORK OF GEOLOGICAL AND MINING MUSEUMS
- GEOCHEMISTRY
- METALLOGENY AND MINERAL RESOURCES
- MINING ENVIRONMENTAL LIABILITIES
- ARTISANAL SMALL-SCALE MINING
- HIDROGEOLOGY
- GEOLOGICAL HAZARDS
- GEOSCIENTIFIC INFORMATION SYSTEMS

## Mining Environmental Liabilities Expert Group (GEPAM)



### General objective:

To develop documents and methodological guidelines on mining environmental liability management that apply to ASGMI member countries.



# Mining Environmental Liabilities Expert Group (2018 to date)



**Argentina**



**Chile**



**Brazil**



**Colombia**



**Costa Rica**



**Cuba**



**Ecuador**



**Spain**



**Honduras**



**Mexico**



**Peru**



**Portugal**



**Uruguay**

Ministerio  
de Industria,  
Energía y Minería



**Venezuela**

## Mining Environmental Liabilities Expert Group



Knowledge and perceptions  
about mining environmental  
liabilities



Technical glossary of mining  
environmental liabilities  
management

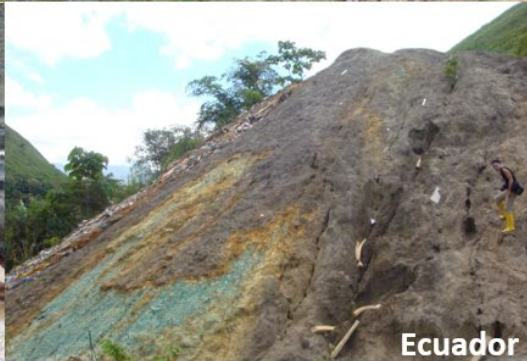


Handbook for the inventory of  
mining environmental liabilities



## Knowledge and perceptions about mining environmental liabilities

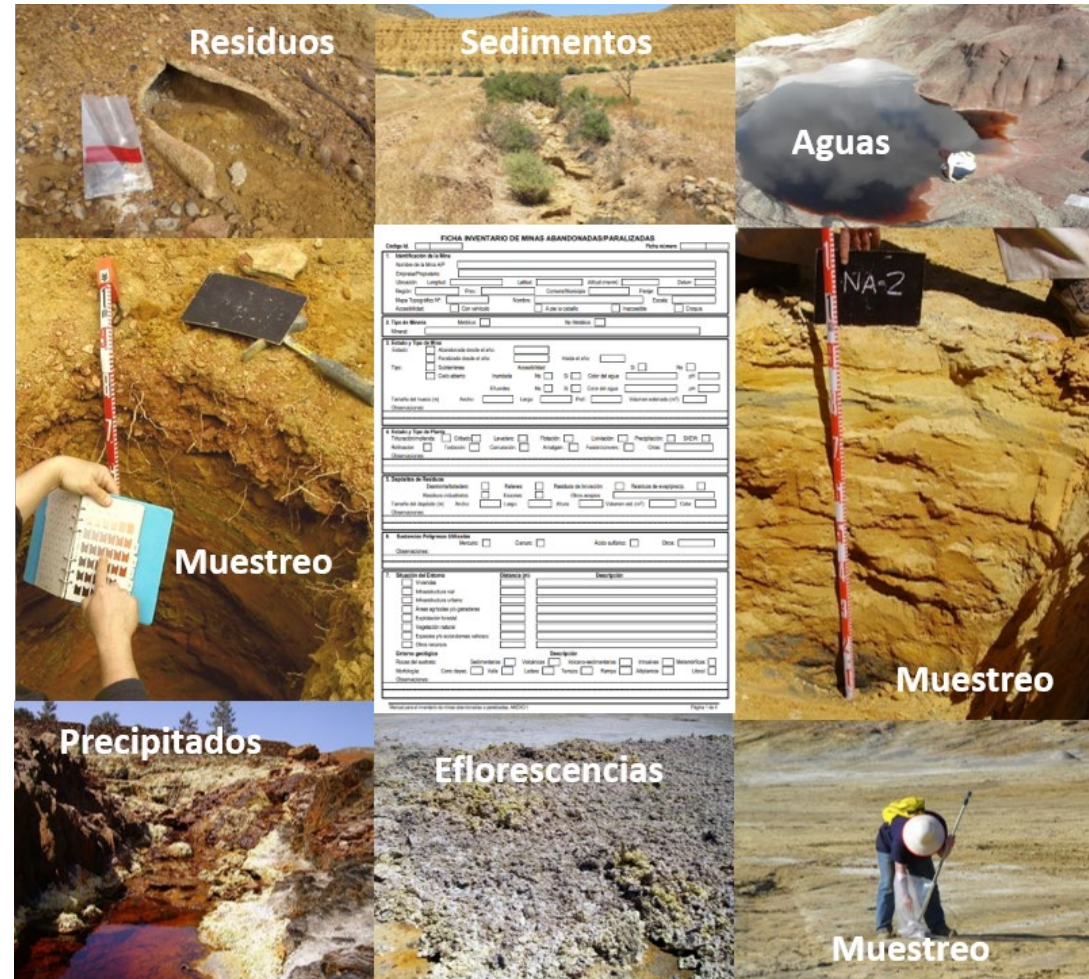
- Type of mining
- Perception
- Risk
- Transboundary risks
- Bibliography
- Legislation
- Compliance
- Rehabilitation/remediation projects





## Handbook for the inventory of mining environmental liabilities

- MEL management
- Inventory sheet
- Sampling protocol
- Field and laboratory tests
- Preliminary identification of environmental impacts or hazards





## Inventory sheet

- 1. Mine identification**
  - 2. Type of mining**
  - 3. Condition and type of mine**
  - 4. Status and type of plant**
  - 5. Mining wastes**
  - 6. Hazardous substances used**
  - 7. Environmental conditions**
  - 8. Water status**
  - 9. Sampling**
  - 10. Preliminary identification of environmental impacts or hazards to goods and people**
-

## Sampling protocol and field and laboratory tests

The objective of sample collection and subsequent analysis is to facilitate the characterization of possible MELs in a simple and low-cost way, acquiring the minimum information that can be useful to facilitate the establishment of priorities for action among a large number of cases.

It is not necessary for the environmental risk assessment to know all the aspects that may be relevant for remediation, nor can one pretend to obtain all the data to define some type of use or reuse of each and every mining waste site or deposit, since hundreds could be treated in a single inventory.

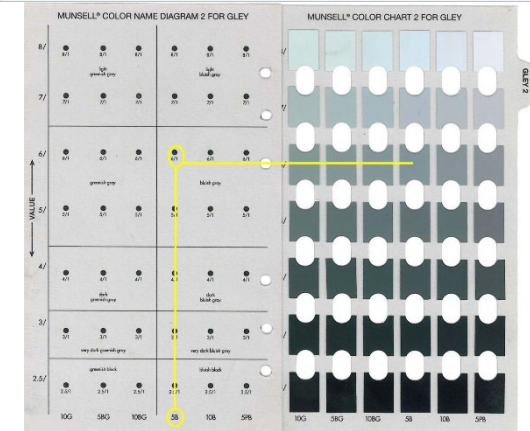




## Sampling protocol and field and laboratory tests

Data that can be obtained directly in the field:

- Total element contents by X-ray fluorescence.
- pH, electrical conductivity, temperature.
- Dissolved oxygen, redox potential (Eh).
- Color.





## Sampling protocol and field and laboratory tests

### Water sampling:

- Two samples per site.
- Filtered
- One of the samples is acidified.
- Another sample without acidification.
- Samples should be kept in a cooler.





## Sampling protocol and field and laboratory tests

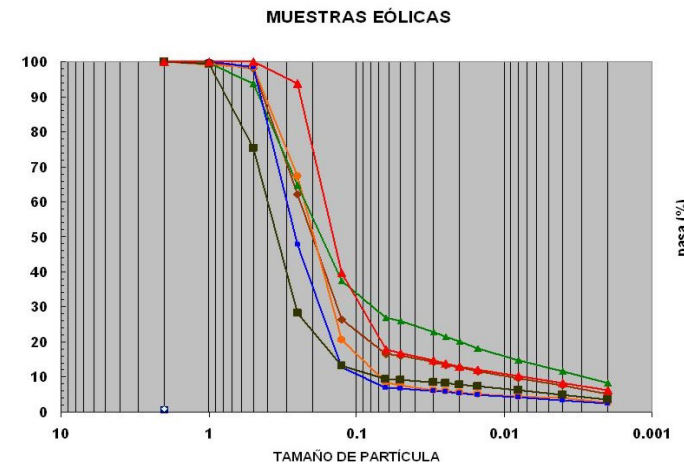
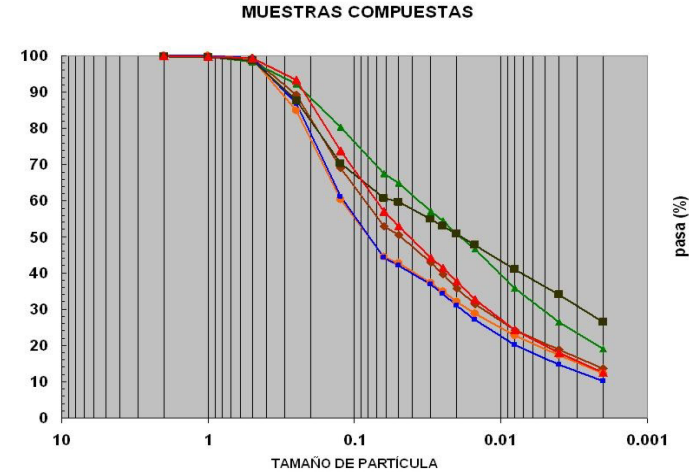
Composite surface sampling of mining wastes:

- Based on the methodology of Smith (2000).
- One composite sample per tailings deposit, consisting of at least 30 subsamples, was collected randomly throughout the mining waste deposit.
- Samples will be collected to a depth of 20 cm.
- A composite sample will be made up for analysis and sieved to 2 mm.



## Sampling protocol and field and laboratory tests

- Physical tests on mining wastes
- Percentage of coarse elements (>2 mm)
- Granulometric analysis of the fine soil fraction to determine fractions smaller than 2 mm.
- Moisture percentage after oven drying.





## Sampling protocol and field and laboratory tests

Leaching tests:

EN-LLT: *European laboratory leaching test*

USGS-FLT: *U.S. Geological Survey field leaching test*

NOM-141-LLT: *Mexican laboratory leaching test*



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## Technical glossary of mining environmental liabilities management



**GLOSARIO TÉCNICO EN MATERIA DE  
GESTIÓN DE PASIVOS AMBIENTALES  
MINEROS**



Glosario técnico en  
materia de gestión de  
pasivos ambientales  
mineros.

(Segunda Edición - Noviembre 2022)

GRUPO DE EXPERTOS EN PASIVOS  
AMBIENTALES MINEROS DE ASGMI



**Methodological guides being  
developed:**

**PASIVOS AMBIENTALES MINEROS**

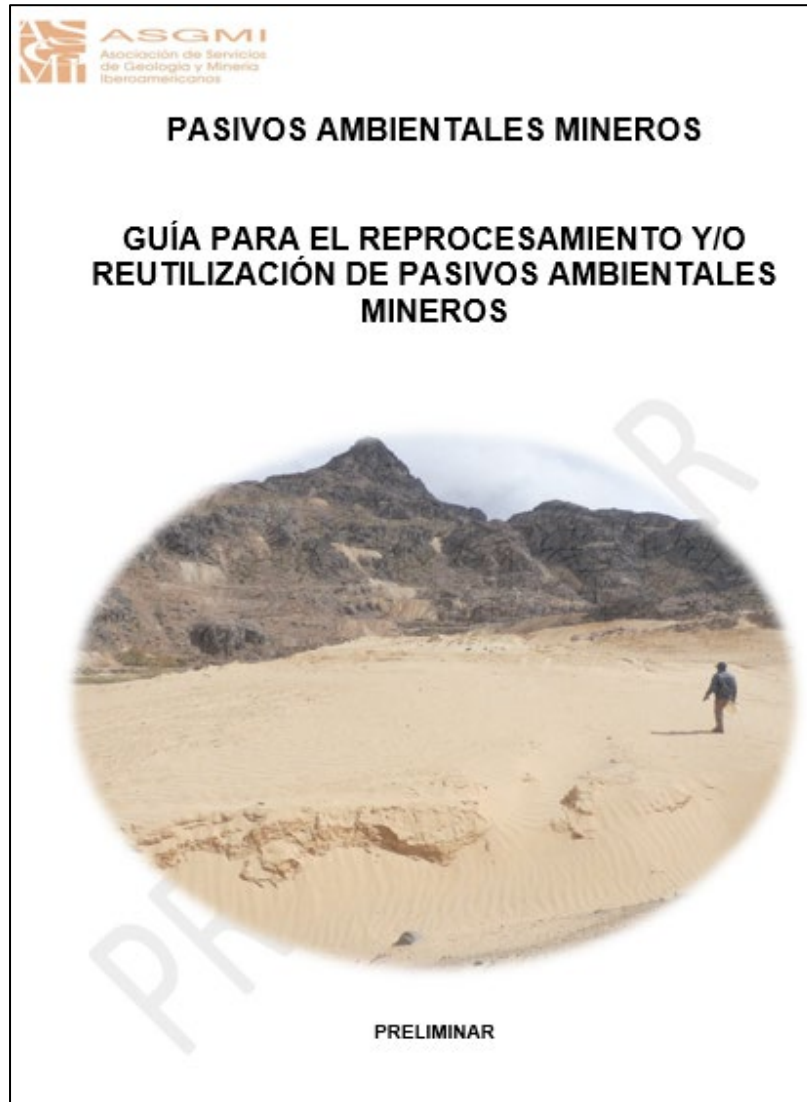
**MANUAL PARA EL ANÁLISIS Y LA EVALUACIÓN  
DE RIESGOS AMBIENTALES DE MINAS  
ABANDONADAS Y/O PARALIZADAS**



PRELIMINAR

Handbook for environmental risk assessment of abandoned mines

**Methodological guides being  
developed:**



Guidelines for the reprocessing and reuse of mining environmental liabilities





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Iberoamericanos

12.01.2016

# **GEPAM collaboration with other working groups:**



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Iberoamericanos



# REUSING SECONDARY MINERAL RESOURCES FOR THE ENERGY TRANSITION

The project **START (Sustainable Energy Harvesting Systems Based on Innovative Mine Waste Recycling**, Horizon Europe Grant Agreement ID: 101058632, [www.start-heproject.com](http://www.start-heproject.com)) is contributing to these objectives by researching the feasibility of **using secondary resources from mine dumps and tailings**

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## START PROJECT

# START - Sustainable Energy Harvesting Systems Based on Innovative Mine Waste Recycling

## The Consortium



- **Coordination**  
LNEG
- **Multidisciplinary Consortium**  
15 partners from 10 EU member states and 1 associated country, including 6 research organizations with strong background and knowledge on geology, materials science and renewable energies, 7 SME's companies that guarantee the entire supply chain, from production, exploitation and ecological footprint assessment, and 2 non-profit international associations with a consolidated network of partners and stakeholders
- **Duration**  
48 months (1 June 2022 - 31 May 2026)
- **Total eligible costs**  
9 194 441.25 €
- **Maximum grant amount**  
7 667 878.00 €
- **Website**  
[www.start-heproject.com](http://www.start-heproject.com)



## THERMOELECTRIC MATERIALS. TETRAHEDRITE.

Tetrahedrite is a copper and antimony sulfosalt ( $\text{Cu}_{12}\text{Sb}_4\text{S}_{13}$ ). It is the antimony-terminating member of the continuous solid solution series with tennantite, which contains arsenic.

In nature, there is a wide variety of minerals within the tetrahedrite group with different substitutions. Traditionally, the elements it contains (Cu, Ag, Sb, Te, etc.) have been exploited. From now on, it will be harnessed for its physical properties.





## THERMOELECTRIC MATERIALS. TETRAHEDRITE.

Minerals from the Tetrahedrite-Tennantite series are relatively abundant in some copper mine dumps. (They have been regarded as "dirty concentrates" because Sb and As are considered impurities in copper concentrates.)



Some of the environment and locations where samples were collected for the START project



# Mining Environmental Liabilities Expert Group



Financiado por  
la Unión Europea

DIÁLOGO POLÍTICO UE - AMÉRICA LATINA Y EL CARIBE SOBRE LA  
IDENTIFICACIÓN DE RECURSOS ESTRATÉGICOS Y CRÍTICOS DE  
**MATERIAS PRIMAS**

## Asociación de Servicios de Geología y Minería Iberoamericanos (ASGMI)

DIÁLOGO POLÍTICO UE - AMÉRICA LATINA Y EL CARIBE  
SOBRE LA IDENTIFICACIÓN DE RECURSOS ESTRATÉGICOS Y  
CRÍTICOS DE MATERIAS PRIMAS

“SERVICIO GEOLÓGICO MEXICANO”



Dr. Fredy Guzmán Martínez  
[fredyguzman@sgm.gob.mx](mailto:fredyguzman@sgm.gob.mx)



“Diálogo político UE - América Latina y el Caribe sobre la identificación de recursos estratégicos y críticos de materias primas”  
2 de noviembre de 2022



Funded by  
the European Union

EU-LATIN AMERICA AND THE CARIBBEAN  
POLICY DIALOGUE ON THE IDENTIFICATION OF  
**STRATEGIC AND CRITICAL  
RAW MATERIALS  
RESOURCES**

BUENOS AIRES, ARGENTINA  
23 · MAY · 2023



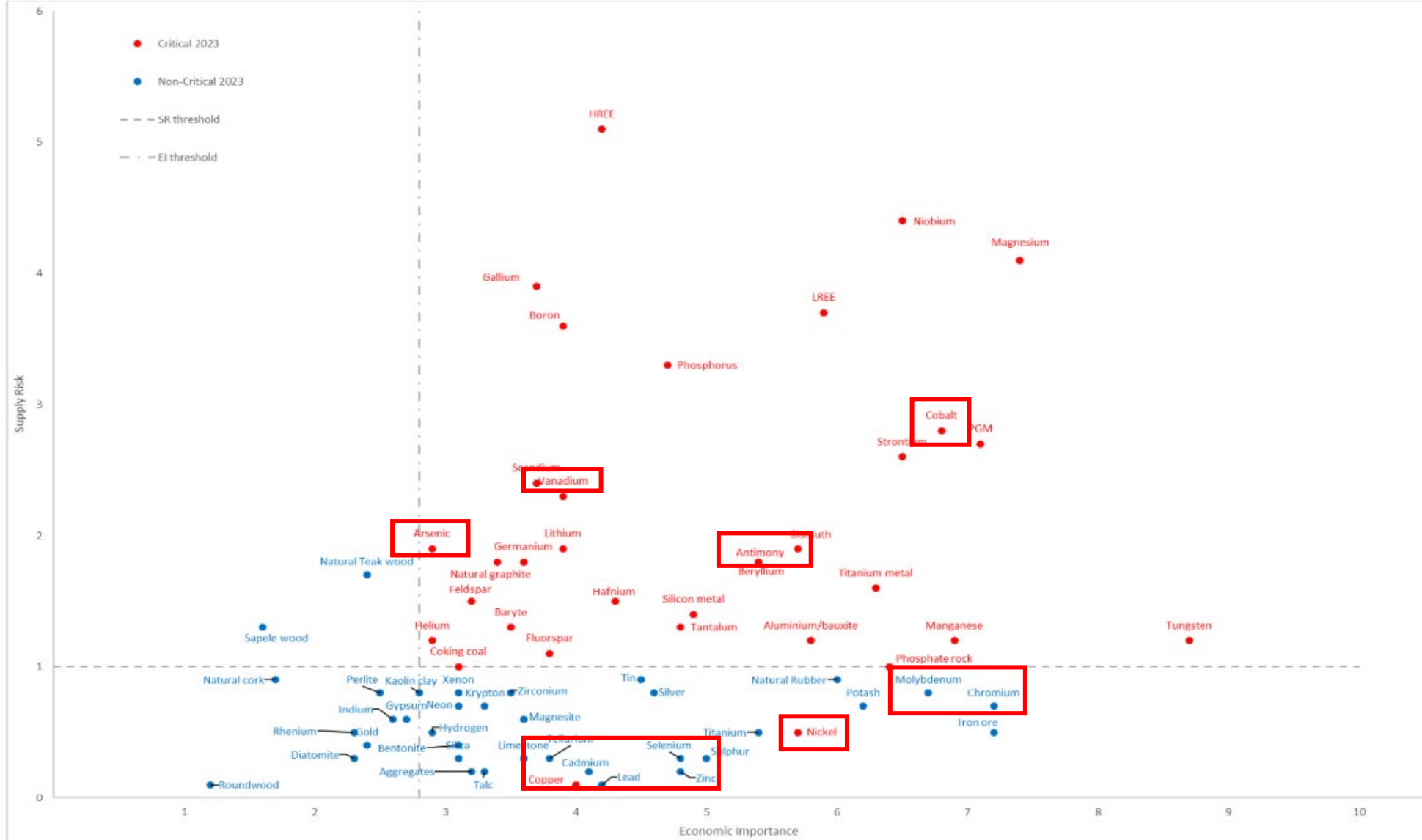
## Potentially toxic elements of environmental concern in mining wastes

**[European  
Commission  
Decision  
completing the  
definition of  
inert waste  
from the  
extractive  
industry]**

Element	Background contents of trace elements in soils (mg kg <sup>-1</sup> ) <sup>a</sup>	Dominant solution species <sup>b</sup>	Function; toxicity
As	4.7	As(OH) <sub>3</sub> , AsO <sub>3</sub> , H <sub>2</sub> AsO <sub>4</sub> , HAsO <sub>4</sub>	Unknown; toxic to plants and animals
Cd	1.1	Cd <sup>2+</sup> , CdSO <sub>4</sub> , CdCl, CdHCO <sub>3</sub>	Unknown; toxic animals
Co	6.9	Co <sup>2+</sup> , CoSO <sub>4</sub> , Co(OH) <sub>2</sub>	Nutrient in plants and animals; toxic to plants and animals
Cr	42	Cr(OH) <sub>2</sub> , Cr(OH) <sub>4</sub> , HCrO <sub>4</sub>	Nutrient in animals; Cr (VI) is toxic to plants and animals
Cu	14	Cu <sup>2+</sup> , CuCl, CuCO <sub>3</sub> , CuHCO <sub>3</sub> , Cu(OH)	Nutrient in plants and animals; toxic to plants and animals
Hg	0.1	Hg <sup>2+</sup> , HgCl <sub>2</sub> , CH <sub>3</sub> Hg, Hg(OH) <sub>2</sub>	Unknown; toxic to plants and animals
Mo	1.8	H <sub>2</sub> MoO <sub>4</sub> , HMoO <sub>4</sub> , MoO <sub>4</sub>	Nutrient in plants and animals; toxic to plants and animals
Ni	18	Ni <sup>2+</sup> , NiSO <sub>4</sub> , NiHCO <sub>3</sub> , NiCO	Nutrient in plants and animals; toxic to plants and animals
Pb	25	Pb <sup>2+</sup> , PbSO <sub>4</sub> , PbHCO <sub>3</sub> , PbCO <sub>3</sub> , PbOH	Unknown; toxic to plants and animals
Sb	0.62	Sb(OH) <sub>2</sub> , Sb(OH) <sub>3</sub> , Sb(OH) <sub>4</sub> , Sb(OH) <sub>6</sub>	Unknown; toxic to plants and animals
Se	0.7	HSeO <sub>3</sub> , SeO <sub>3</sub> , SeO <sub>4</sub>	Nutrient in animals; toxic to plants and animals
V	60	VO <sup>2+</sup> , VO <sub>2</sub> , VO <sub>2</sub> (OH) <sub>2</sub> , VO <sub>3</sub> (OH) <sup>2</sup>	Nutrient in plants and animals; toxic to plants and animals
Zn	62	Zn <sup>2+</sup> , ZnSO <sub>4</sub> , ZnHCO <sub>3</sub> , ZnCO <sub>3</sub> , Zn(OH)	Nutrient in plants and animals; toxic to plants and animals

Sources: Modified from Dubbin (2005); a) Kabata-Pendias (2011); b) Hayes y Traina (1998).

# European Union List of Critical Raw Materials, 2023



PTE of environmental concern in mining wastes

Source: Study on the CRM for the EU, 2023.



## European Union List of Critical Raw Materials, 2023

### 2023 Critical Raw Materials (*Strategic Raw Materials in italics*)

aluminium/bauxite	coking coal	<i>lithium</i>	phosphorus
<b>antimony</b>	feldspar	<i>LREE</i>	scandium
<b>arsenic</b>	fluorspar	<i>magnesium</i>	<i>silicon metal</i>
baryte	<i>gallium</i>	<i>manganese</i>	strontium
beryllium	<i>germanium</i>	<i>natural graphite</i>	tantalum
<i>bismuth</i>	hafnium	niobium	<i>titanium metal</i>
<i>boron/borate</i>	helium	<i>PGM</i>	<i>tungsten</i>
<b>cobalt</b>	<i>HREE</i>	phosphate rock	<b>vanadium</b>
		<b>copper*</b>	<b>nickel*</b>

\* Copper and nickel do not meet the CRM thresholds, but are included as Strategic Raw Materials.

**PTE of environmental concern in mining wastes**



Unidad de Políticas para el Desarrollo Sostenible  
División de Desarrollo Sostenible y Asentamientos Humanos  
CEPAL



**Proyecto MinSus**

Cooperación Regional para la gestión sustentable de los recursos mineros en los países andinos



## Challenges

**Strengthen the working group through the incorporation of new members and that the authorities of the geological services provide their technicians with facilities to carry out the group's work.**

**To position the GEPAM as a reference in the work on management of mining environmental liabilities in the region.**

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