



**Workshop on
Implementing the United Nations Framework
Classification for Resources (UNFC) in Southeast
Europe**

**UNFC National Inventories
from mining wastes and EOL**

**Belgrade, Republic of Serbia
4 – 5 July 2024**

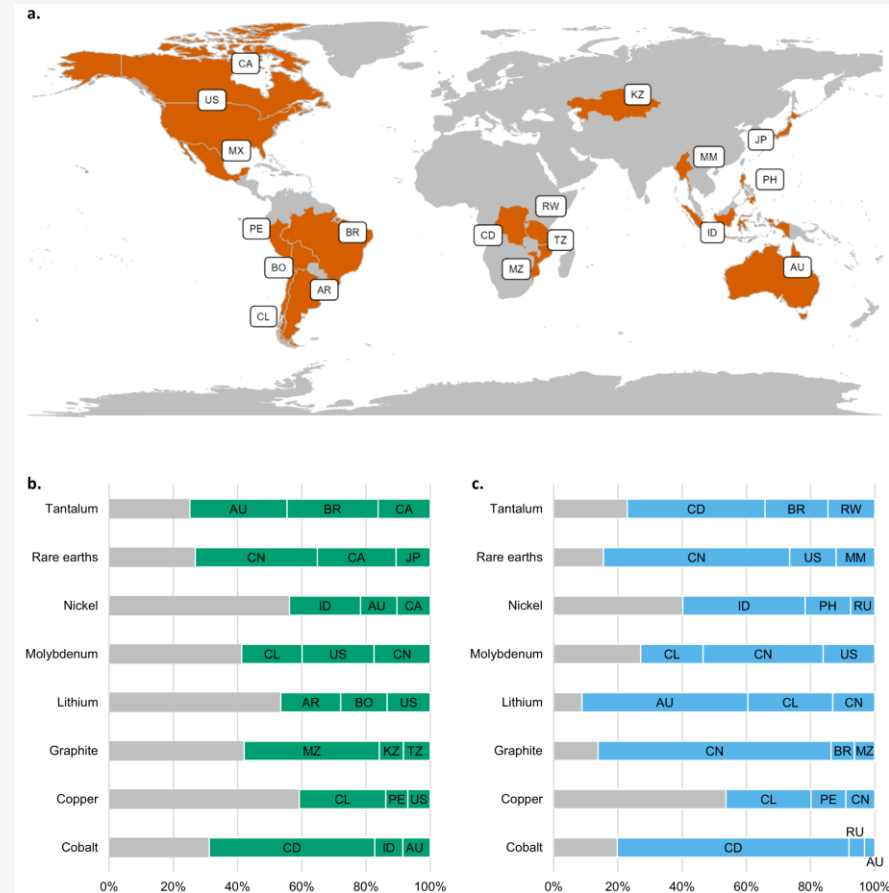
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Relevance of the topic

Estimates on the future supply of raw materials require

- (national) resource inventories,
- extraction policies, industrial capability, investments and social acceptance.



Owen, J.R., Kemp, D., Schuele, W. et al. Misalignment between national resource inventories and policy actions drives unevenness in the energy transition. *Commun Earth Environ* 4, 454 (2023). <https://doi.org/10.1038/s43247-023-01134-4>

EU Critical Raw Materials Act

- **Article 2: Definitions**

‘**critical raw material project**’ means any planned facility or planned significant extension or repurposing of an existing facility that is active in the **extraction, processing or recycling** of critical raw materials

- **Article 21: Information obligations for monitoring**

Member States shall [...] provide information to the Commission on **new or existing critical raw material projects** on their territory [...] **including a classification of new projects according to the UNFC.**

- **Article 27: Recovery of critical raw materials from extractive waste**

8. [...] Where possible, the Member States shall include in the database a classification of the **closed extractive waste facilities according to the UNFC.**

UNFC Guidance Europe

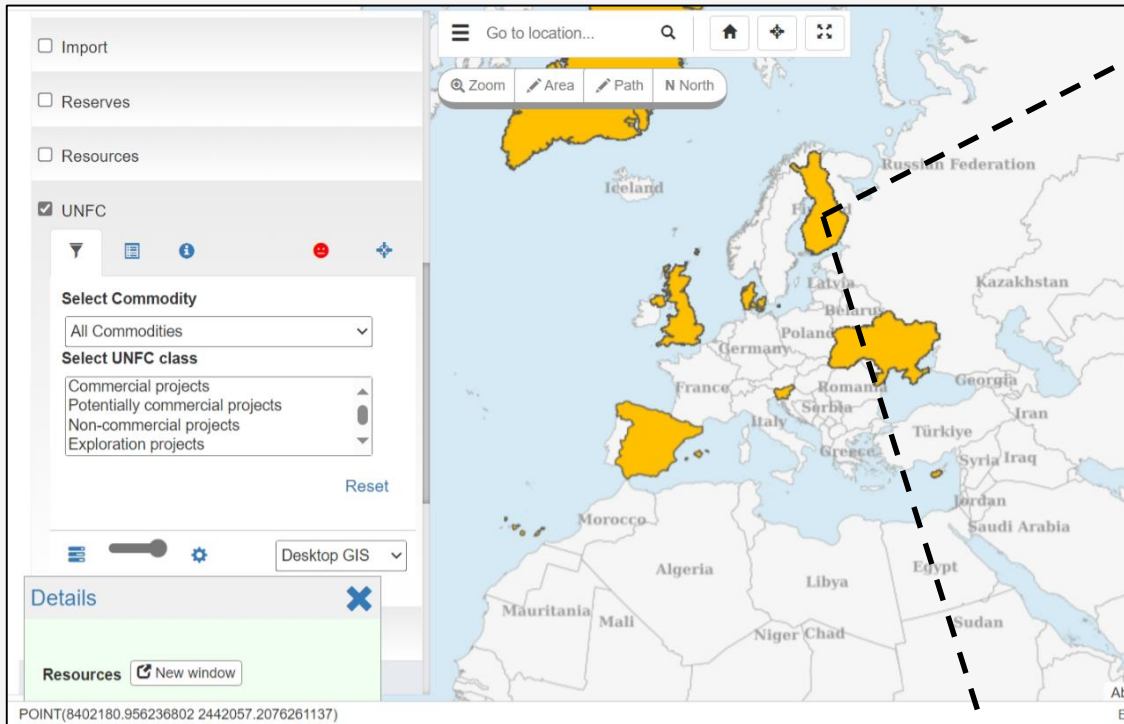


- This document facilitates the development of **UNFC-based inventories** across Europe.
- It provides alignment with Infrastructure for Spatial Information in Europe (**INSPIRE**) for mineral resources.
- The purpose is to provide a **uniform raw materials dataset** that would be suitable for **aggregated data across Europe** for both **primary and secondary raw materials**.

Case 1: EGDI UNFC layer



Finland, 2019, Potentially viable projects



Commodity group	Commodity	Amount	UNFC Code
Magnesite	Magnesite	.00 t(mc)	E2 F2 G3
Magnesite	Magnesite	.00 t(mc)	E2 F2 G2
Magnesite	Magnesite	.00 t(mc)	E2 F2 G1
Magnesite	Magnesite	.00 t(mc)	E2 F2 G2+G3
Gold	Gold (mine production, metal content)	105,900.00 kg(Au)	E2 F2 G2
Phosphate	Phosphorous pentoxide (P2O5)	10.94 Mt	E2 F2 G1
Nickel	Nickel (mine production, metal content)	110,724.00 t(mc)	E2 F2 G1
Lead	Lead (mine production, metal content)	11,880.00 t(mc)	E2 F2 G2
Vanadium	Vanadium (mine production, metal content)	131,948.00 t(mc)	E2 F2 G3
Copper	Copper (mine production, metal content)	1.31 Mt	E2 F2 G1+G2+G3
Chromium	Chromium (metal)	13.48 Mt	E2 F2 G1
Zinc	Zinc (mine production metal content)	141.87 kt	E2 F2 G2
Zinc	Zinc (mine production metal content)	157.60 kt	E2 F2 G1
Iron	Iron oxide	16.25 Mt	E2 F2 G2+G3
Chromium	Chrome (metal)	16.28 Mt	E2 F2 G2
Palladium	Palladium (metal)	171.00 t(mc)	E2 F2 G3
Cobalt	Cobalt (mine production, metal content)	177.23 kt	E2 F2 G1+G2+G3
Palladium	Palladium (metal)	178.00 t(mc)	E2 F2 G2
Platinum	Platinum (metal)	18.00 t(mc)	E2 F2 G1
Gold	Gold (mine production, metal content)	204,300.00 kg(Au)	E2 F2 G3
Titanium	Titanium metal	213,983.00 t(mc)	E2 F2 G2
Palladium	Palladium (metal)	22.00 t(mc)	E2 F2 G2+G3
Gold	Gold (mine production, metal content)	2,240.00 kg(Au)	E2 F2 G2+G3
Nickel	Nickel (mine production, metal content)	2,332,000.00 t(mc)	E2 F2 G1+G2+G3
Lithium	Lithium oxide (Li2O)	23.74 kt	E2 F2 G3
Titanium	Titanium metal	281,745.00 t(mc)	E2 F2 G3
Titanium	Titanium metal	3,064,795.00 t(mc)	E2 F2 G2+G3
Silver	Silver (mine production, metal content)	310.00 t(mc)	E2 F2 G3
Cobalt	Cobalt (mine production, metal content)	31.05 kt	E2 F2 G2
Copper	Copper (mine production, metal content)	311.20 kt	E2 F2 G1
Cobalt	Cobalt (mine production, metal content)	31.32 kt	E2 F2 G3
Silver	Silver (mine production, metal content)	348.00 t(mc)	E2 F2 G2

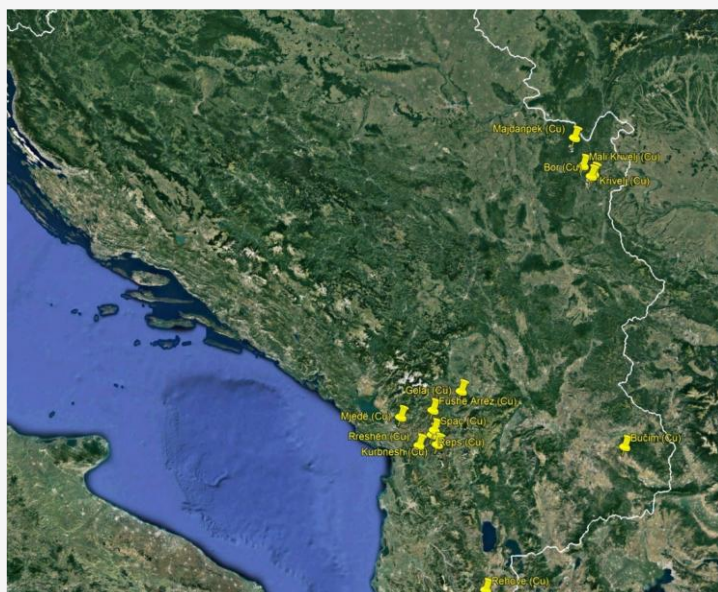
Case 1: Mineral potential of the Eastern and South-Eastern region

<https://reserve.eu/>

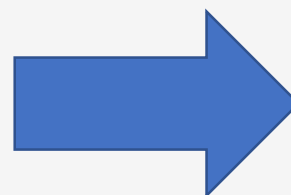
Storage site for mining and metallurgical residues

1'461

Sites in total



Processing Waste Landfills-Cu flotation tailings



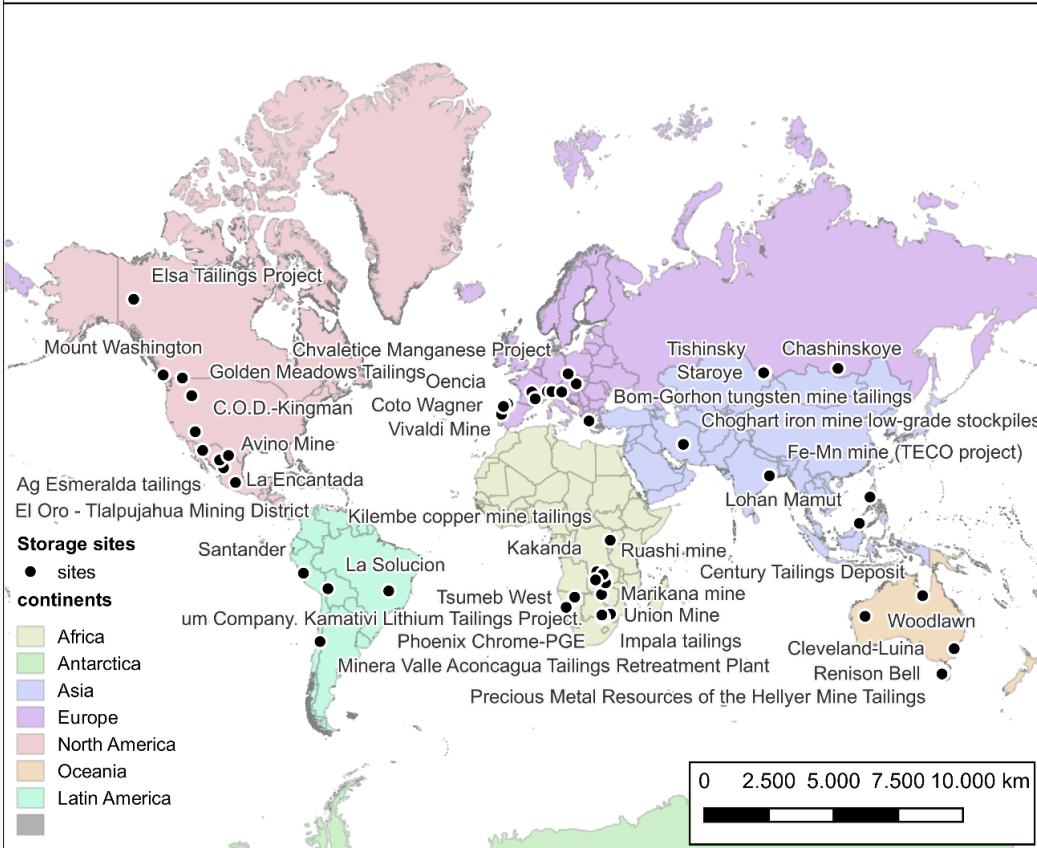
36

Sites with potential secondary sources of raw materials with economic value

Country	Counts
Albania	7
Bosnia & Herzegovina (FBiH)	2
Bosnia & Herzegovina (RS)	3
Montenegro	2
North Macedonia	9
Serbia	13

Case 2: Mining and metallurgical residues

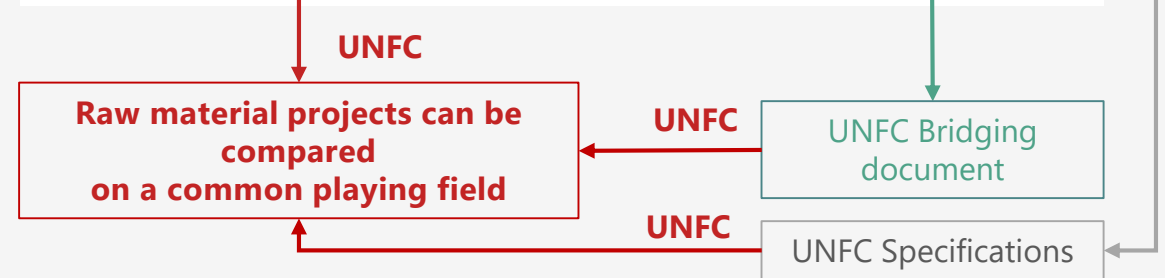
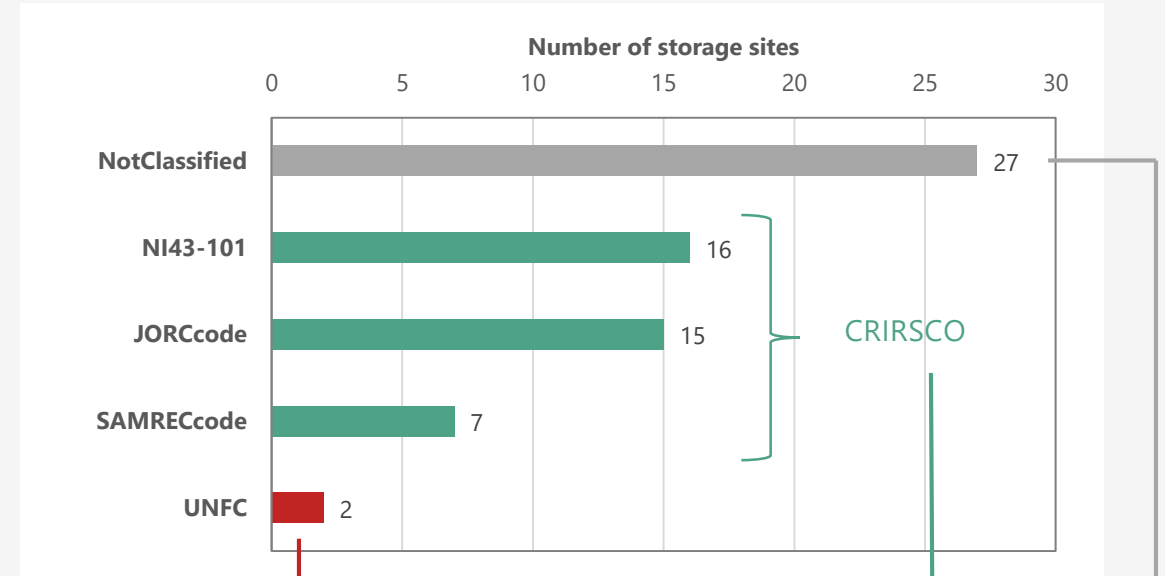
Storage sites for mining and metallurgical residues



Data sources: Data: Data repository for the storage sites [doi: 10.5281/zenodo.10029403]
 Continents: © EuroGeographics, modified

Editors: Kral, U., Alonso, M., Carvalho, T., Cleall, P., Cormio, C., Guglietta, D., Heuss-Aßbichler, S., Lemiere, B., Sinnet, D., Szabo, K., Werner, T., Zibret, G.

> 60 storage sites



Case 3: France

- National UNFC inventory for CRM recovery from post-consumer residues is under development at BGRM
- Focus on batteries, magnets and WEEE recycling projects
- Inventory based on public available data
- Without estimates on recoverable quantities (just announced capacities)



Figure: Von Original: Unbekannt Vektor: SKopp - Diese Fahne enthält Elemente, die von folgender Datei entnommen oder adaptiert wurden.: Gemeinfrei, <https://commons.wikimedia.org/w/index.php?curid=60739584>

Case 5: End-of-life flows

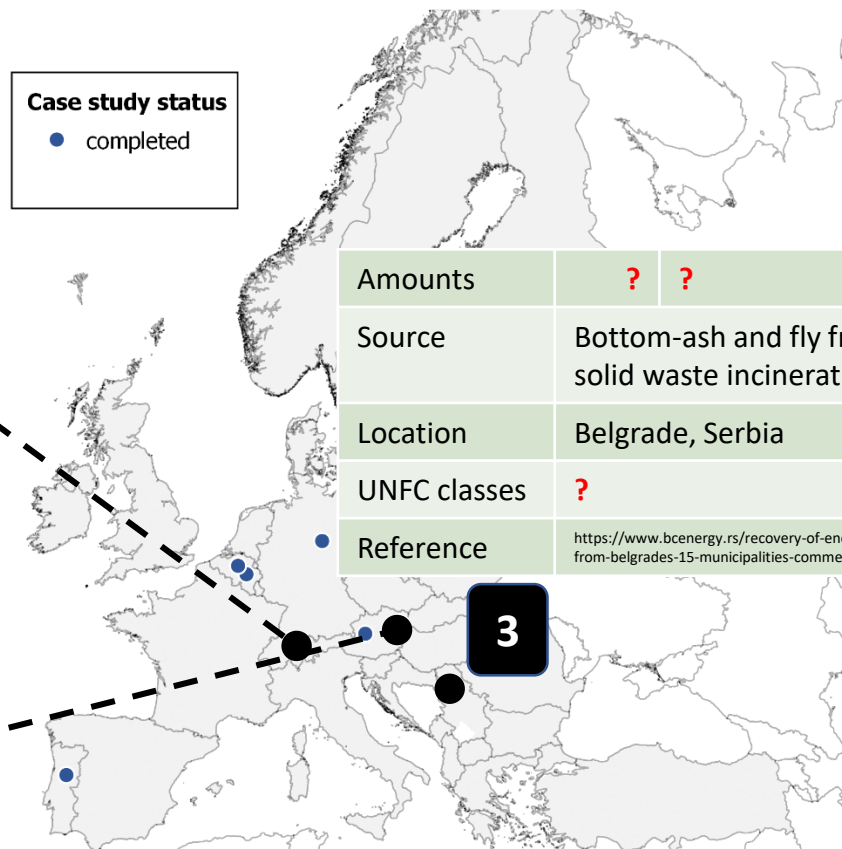
Amounts	5'840 t/20a 262'000 t/20a 67'640 t/20a	Metals (Zn, Pb, Cu, Cd) Mineral fractions for cement production Salt for deicing
Source	Fly ash from municipal solid waste incineration	
Location	Vienna, Austria	
UNFC classes	Commodity	Public entity view
	Private investor view	
	Metals	E1 F1 G1
	Mineral fractions	E1 F1 G1
	Salt	E3 F2 G1
Reference	https://doi.org/10.1016/j.resconrec.2018.08.003	

Amounts	2'800 t/a 610 t/a 200 t/a 110 t/a	Ferrous metals Non-Ferrous metals (heavy fraction) including Strategic Raw Materials Non-Ferrous metals (mixture) including Strategic Raw Materials VA steel
Source	Bottom-ash from municipal solid waste incineration	
Location	Canton Zurich, Switzerland	
UNFC classes	2003: E3.2 F4 G3 2009: E1.1 F2.2 G2 2015: E1 F1.2 G2	
Reference	https://doi.org/10.1016/j.jclepro.2020.120490	

Application of UNFC to anthropogenic resources in Europe

Case study status

- completed



Amounts	? ?
Source	Bottom-ash and fly from municipal solid waste incineration
Location	Belgrade, Serbia
UNFC classes	?
Reference	https://www.bcenergy.rs/recovery-of-energy-from-waste-collected-from-belgrades-15-municipalities-commenced-on-july-1st-2024/

Data sources
 © EuroGeographics for the administrative boundaries
 Dots Created by Ulrich Kral

Some final, personal thoughts

- Inventories with recoverable quantities exist for
 - in-ground resources (very often),
 - mining residues (sometimes),
 - end-of-life flows (rarely to never)
- Significant progress in developing and publishing harmonized inventories.
- UNFC-based raw material inventories are not the norm.
- Future efforts for data integration across different sources of supply needed.
- Inventories are snapshots.
- Inventories are on top of the information pyramid.
- Background data and knowledge on enabling conditions (e.g. extraction policies) are needed to make projections on future raw material supply.



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Thank you!

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THE VIEWS EXPRESSED ARE
THOSE OF THE AUTHOR AND
DO NOT NECESSARILY
REFLECT THE VIEWS OF THE
UNITED NATIONS

