



GSEU

**GEOLOGICAL
SERVICE | FOR
EUROPE**

GSEU to support CRM exploration in Europe

**EIS-GSEU event on CRM exploration in Europe, 13 December 2024,
Brussels, Belgium**

Guillaume Bertrand

BRGM (French geological survey)

Co-Chair of EuroGeoSurveys
Mineral Resources Expert Group

Coordinator of GSEU Raw
Materials team

www.geologicalservice.eu



Funded by
the European Union





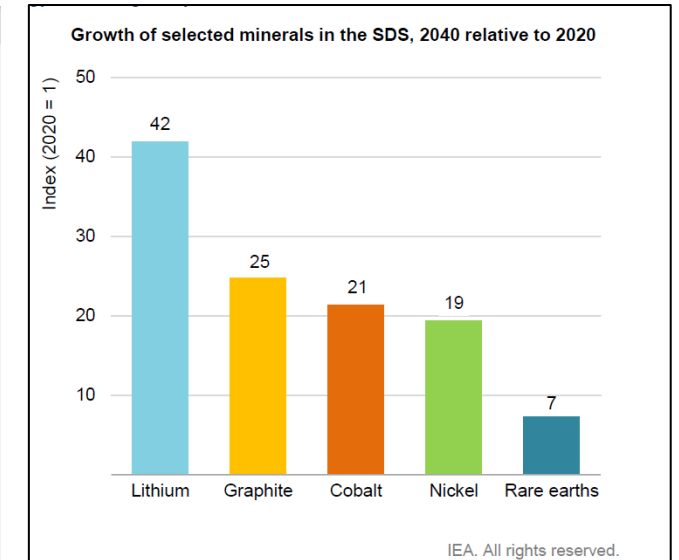
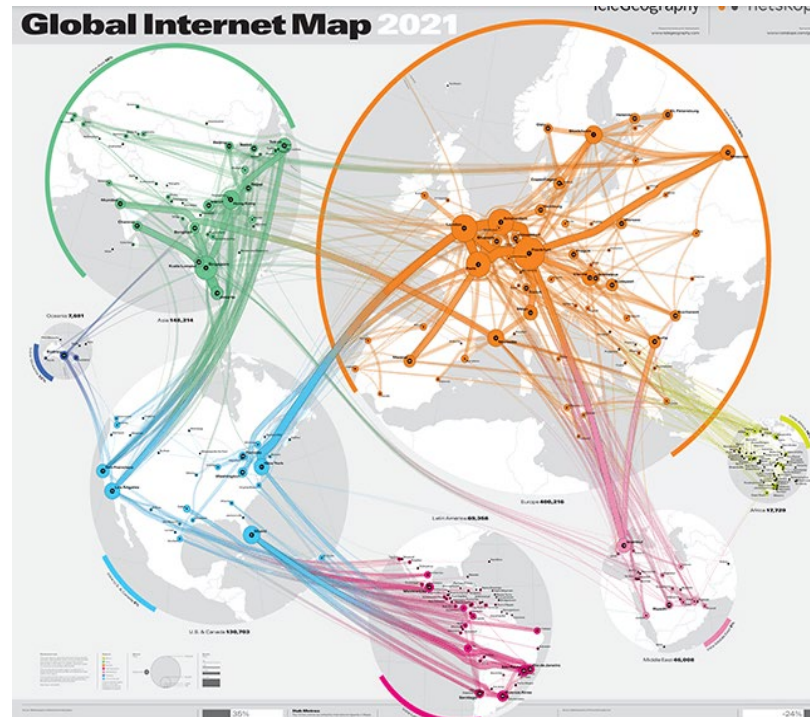
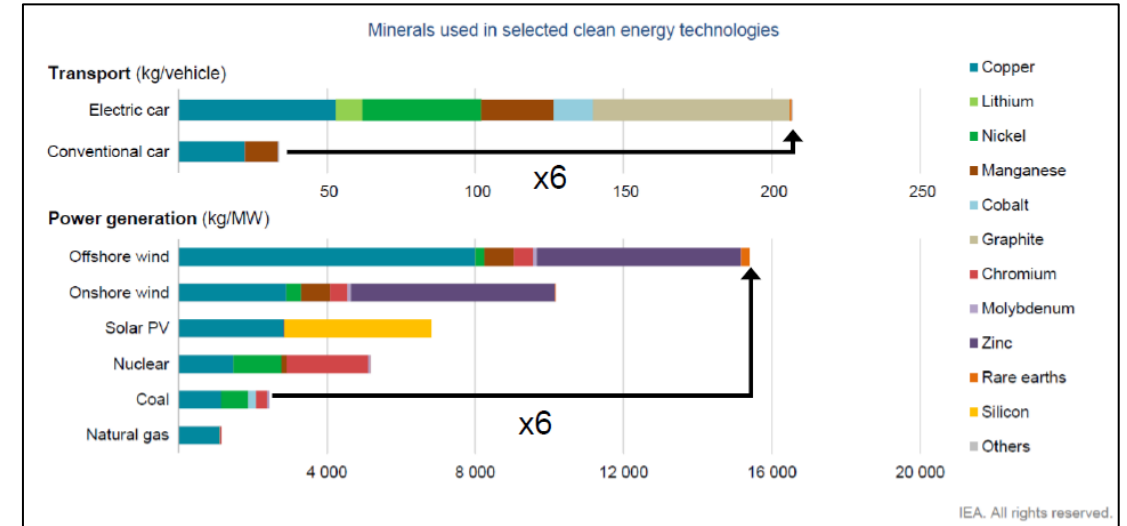
A growing demand for raw materials

The demand for raw materials has been increasing through centuries, in quantity and in diversity;

The energy transition is material intensive → it requires a lot of mineral and metallic raw materials (whatever the scenario!)

The exponential development of information and digital technologies relies on a physical infrastructure → massive amounts of materials (devices, data centers, data networks, energy, etc.)

Demand for CRM is and will keep surging !



IEA report, 2021

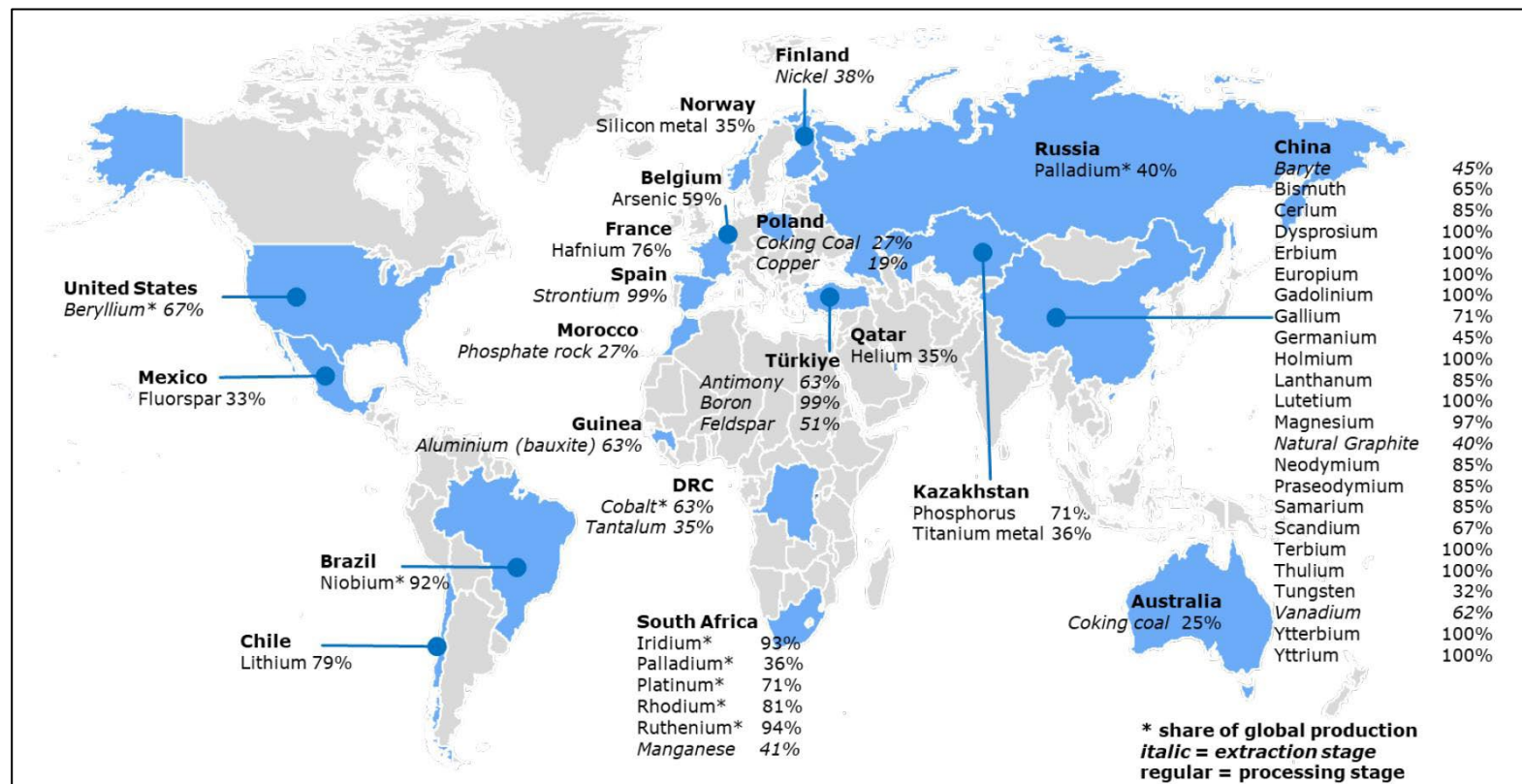


A challenge for Europe

European industry strongly depends on importation from third countries → Europe critically needs to secure its supplies in CRM:

- Increased recycling and secondary resources (e.g. mine and processing wastes);
- Bilateral cooperation with producing countries;
- Relocation of extraction and production in European countries.

The rising awareness in Europe led to actions with ambitious objectives (e.g. CRM Act);



SETTING 2030 BENCHMARKS FOR STRATEGIC RAW MATERIALS



EU EXTRACTION

At least **10%** of the EU's annual consumption for extraction



EU PROCESSING

At least **40%** of the EU's annual consumption for processing



EU RECYCLING

At least **15%** of the EU's annual consumption for recycling



EXTERNAL SOURCES

Not more than **65%** of the EU's annual consumption of **each strategic raw material at any relevant stage of processing** from a single third country





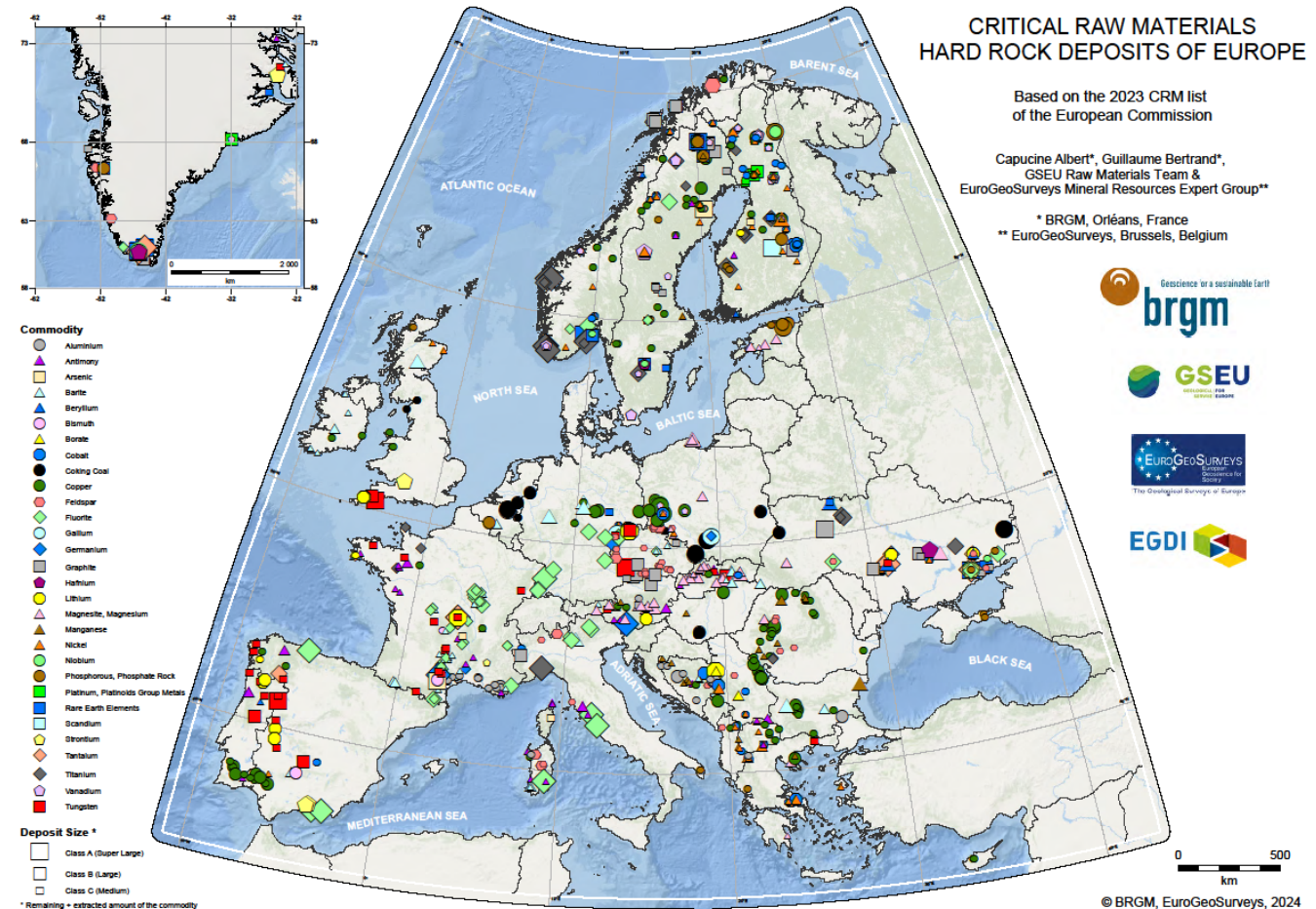
A challenge for Europe

Despite being an 'old mining continent', Europe still has a significant potential for CRM:

- Many elements that are critical today were not explored and extracted a few decades ago (e.g. Li);
- Deep and undercover potential is still poorly known;
- Despite the huge amount of existing data, much is missing, especially on CRM;

Relocating production of CRMs requires:

- increased investments (training, exploration, mine developments,...) with often long and hazardous returns;
- Large amount of data (GSOs, academia, etc.);
- A pan-European approach (geology does not care for political boundaries!)





The GSEU – Geological Service for Europe project

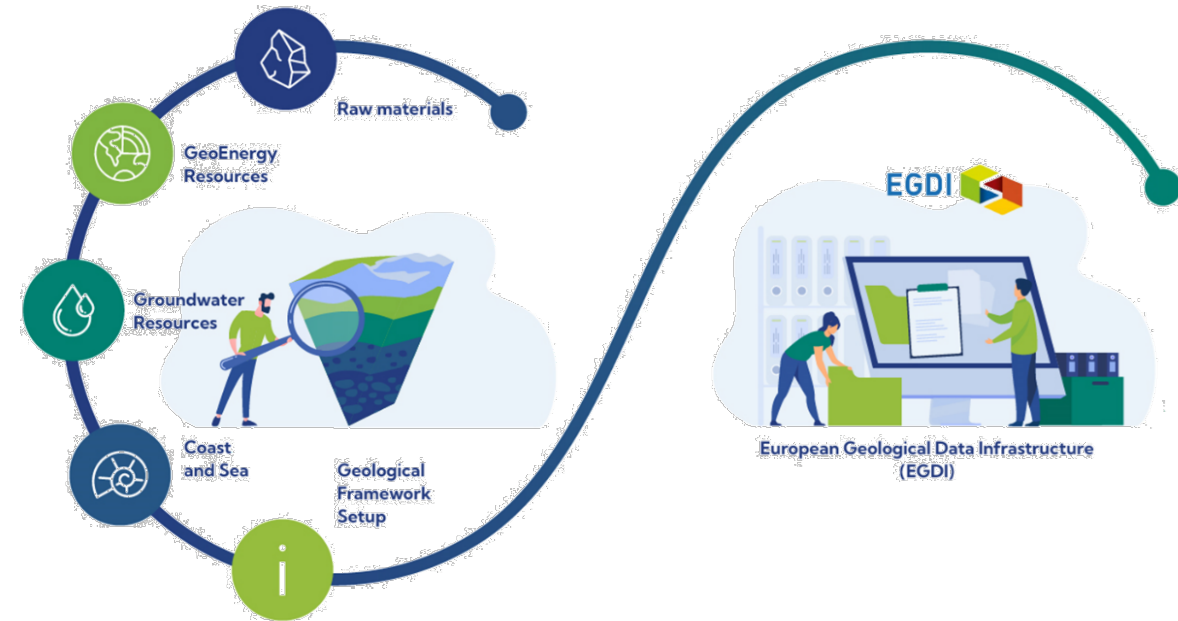
- Coordinated by EuroGeoSurveys
- 5 years (2022-2027)
- 48 partners (European GSOs)
- 24.4 M€ EU contribution

GSEU is a key provider of geoscientific data at the scale of Europe.

A WP is dedicated to mineral resources:

- Re-evaluate the European potential in primary onshore and offshore CRMs and mining wastes;
- Develop the use of the UNFC classification system in mineral resources databases ;
- Create of an International Center of Excellence on Sustainable Resources Management.

→ Data, knowledge and expertise will be served in the EGDl platform: <https://www.europe-geology.eu/>

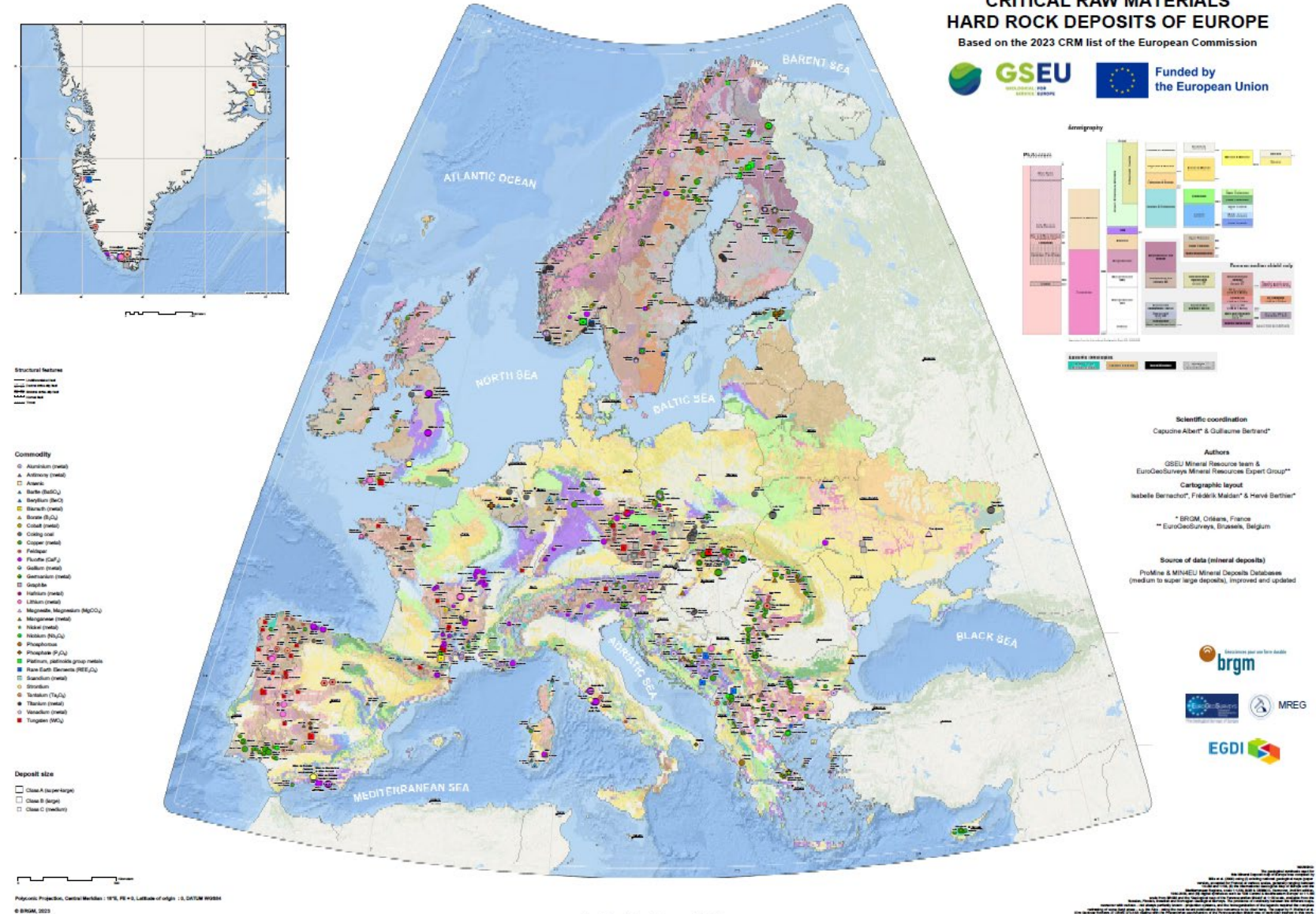




Onshore CRM potential assessment

Pan-European map of CRM deposits:

- Based on the 2023 CRM list;
- Covers geographic Europe;
- All known medium to world-class deposits;
- 30 commodities (all except helium and silicon);
- Complete check and update by all data providers;

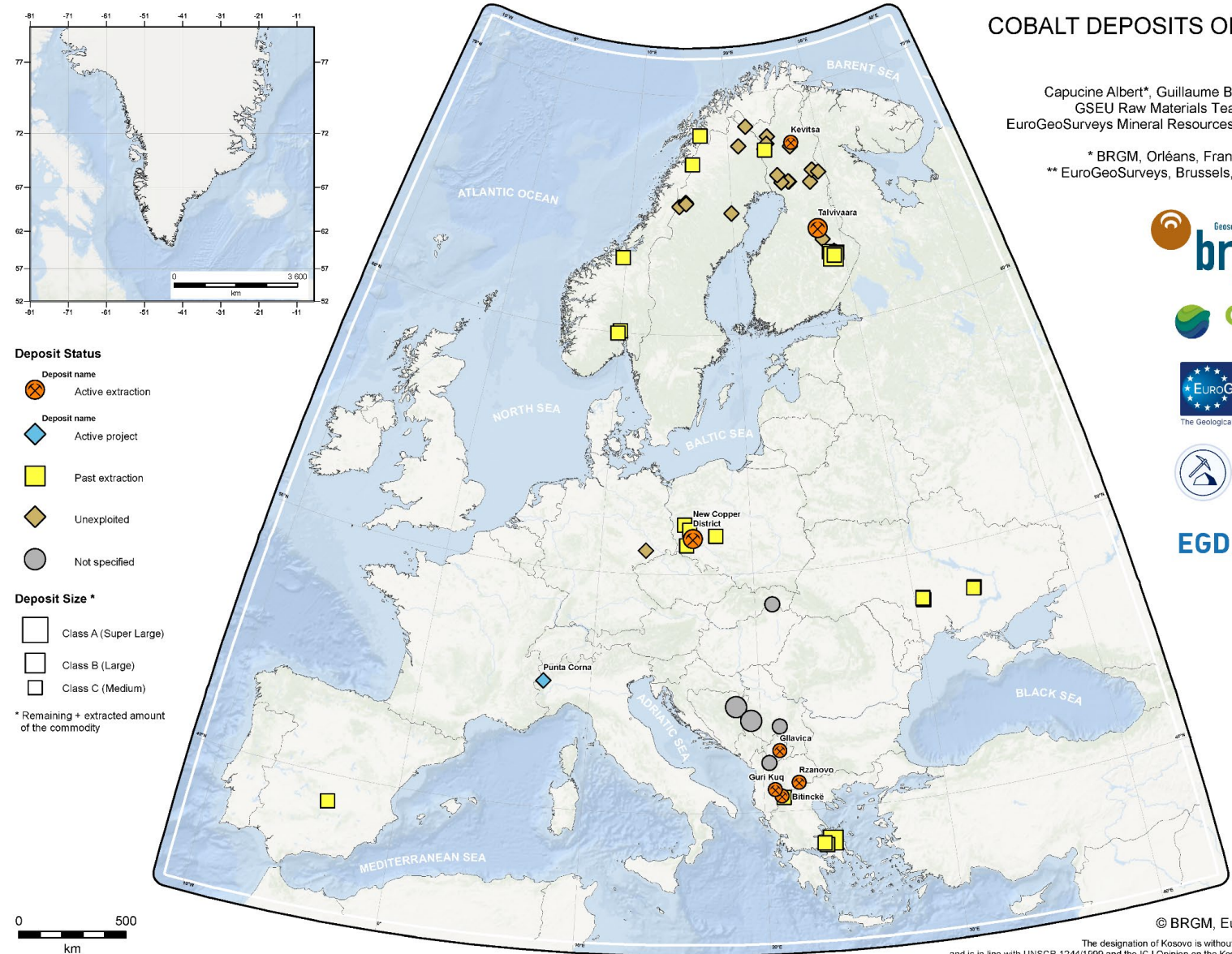




Onshore CRM potential assessment

Pan-European commodity maps:

- Derived from the Pan-European map of CRM deposits;
- 30 maps for 30 commodities;
- Display all medium to world-class deposits;
- Symbology based on size and status of deposit;





Onshore CRM potential assessment

Pan-European commodity assessments:

- Resource assessment for 30 commodities;
- Resources aggregated at country level and classified on their level of confidence;

Name	Country	Class	Deposit status	Commodities currently mined	Confidential	Resources (t)	Reserves (t)	Extracted (t)	Total endowment (t)
Jadar	Serbia	A	Under development		no	2697003			2697003
Zinnwald	Germany	A	Feasibility		no	1078443			1078443
Beauvoir (Echassières)	France	A	Under development		no	1053000			1053000
Cínovec	Czechia	A			yes				1000000 ^m
Dobra	Ukraine	A	Not operating		yes				1000000 ^m
San Jose	Spain	B	Under development		no	678930	234360*		913290
St Austell Granite	UK	B			no	869613			869613
Las Navas	Spain	B	Under development		no	811370			811370
Kvanefjeld/Kuannersuit	Greenland	B	Not exploited		no	505885			505885
Sepeda (Romano)	Portugal	B	Under development		no	300000			300000
Barroso	Portugal	B	Under development		no	293400			293400
Weinebene	Austria	B	Not exploited		no	128500			128500
Sadisdorf	Germany	B	Closed		no	127284			127284
Trelavour	UK	B			no	124080			124080
Shevchenkivske	Ukraine	B	Not operating		yes				100000 ^m
Polokhivske	Ukraine	B	Operating	Li	yes				100000 ^m
Rapasaaret	Finland	C	Not exploited		no	94877			94877
Alberta I	Spain	C			no	90340			90340
Altenberg	Germany	C	Closed		no	71039			71039
Tréguenec-Prat-ar-Hastel	France	C	Not exploited		no	68680			68680
^m minimum estimate * reserves not included in resources									

GSEU assessment of Li potential in Europe; above: list of known European deposits; left: potential per country and level of confidence.

Country	Remaining resources – lithium contained (tons of Li ₂ O)	Category
Austria	128500	2 – mineral resources
Finland	94877	2 – mineral resources
France	1121680	4 – historical or non-compliant
Germany	1078443	2 – mineral resources
	198323	4 – historical or non-compliant
Greenland	505885	2 – mineral resources
Portugal	593400	2 – mineral resources
Serbia	2697003	2 – mineral resources
Spain	234360	1 – mineral reserves
	1580640	2 – mineral resources
UK	993693	2 – mineral resources



Onshore CRM potential assessment

Country maps of CRM

deposits:

- 32 commodities;
- 30 European countries covered;
- Symbology based on commodity and size of deposit;

CRITICAL RAW MATERIALS HARD ROCK DEPOSITS OF SWEDEN

Based on the 2023 CRM list
of the European Commission

Capucine Albert*, Guillaume Bertrand*,
GSEU Raw Materials Team &
EuroGeoSurveys Mineral Resources Expert Group**

* BRGM, Orléans, France

** EuroGeoSurveys, Brussels, Belgium



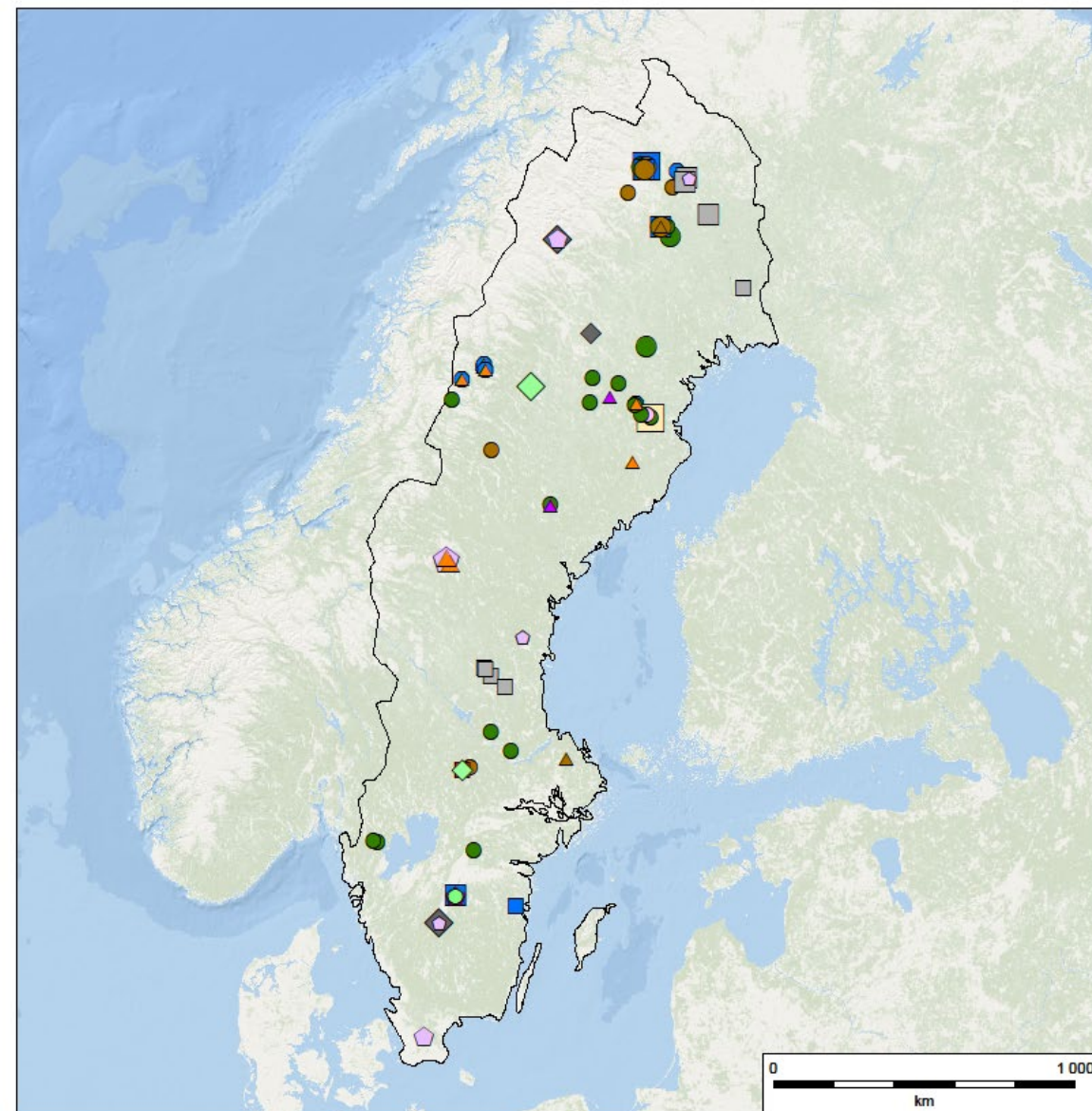
Commodity

- Antimony
- Arsenic
- Bismuth
- Cobalt
- Copper
- Fluorite
- Graphite
- Hafnium
- Manganese
- Nickel
- Niobium
- Phosphorous, Phosphate Rock
- Rare Earth Elements
- Titanium
- Vanadium
- Tungsten

Deposit Size *

- Class A (Super Large)
- Class B (Large)
- Class C (Medium)

* Remaining + extracted amount of the commodity
© BRGM, EuroGeoSurveys, 2024





Onshore CRM potential assessment

Pan-European mineral prospectivity maps:

- Display the spatial distribution of geological favourability for a targeted commodity;
- 11 CRM processed so far: Co, Cu, Li, Mg, Mn, Nb, Ni, Sb, Ta, V, W;
- More to come ...

FAVOURABILITY MAP FOR NIOBIUM MINERALIZATION IN EUROPE

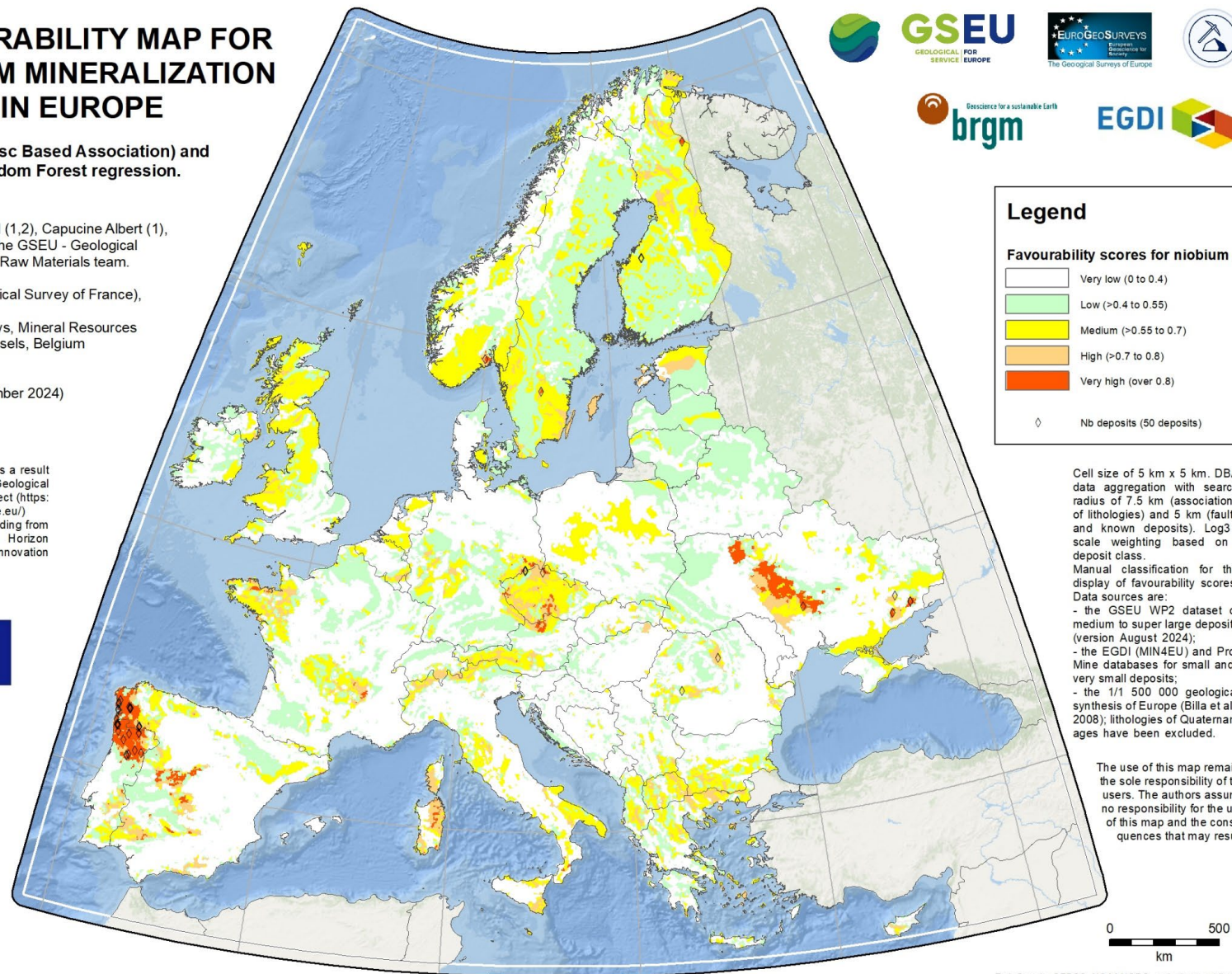
DBA (Disc Based Association) and Random Forest regression.

Guillaume Bertrand (1,2), Capucine Albert (1), Alex Vella (1) and the GSEU - Geological Service for Europe Raw Materials team.

1 – BRGM (Geological Survey of France), Orléans, France
2 – EuroGeoSurveys, Mineral Resources Expert Group, Brussels, Belgium

Version 1.0 (November 2024)

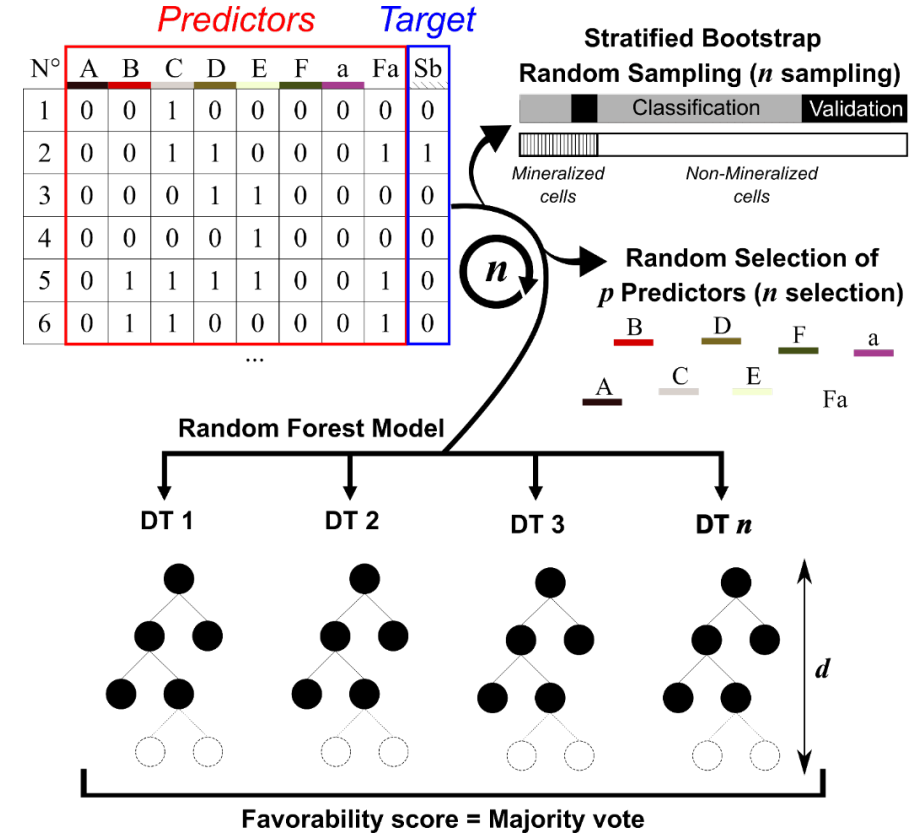
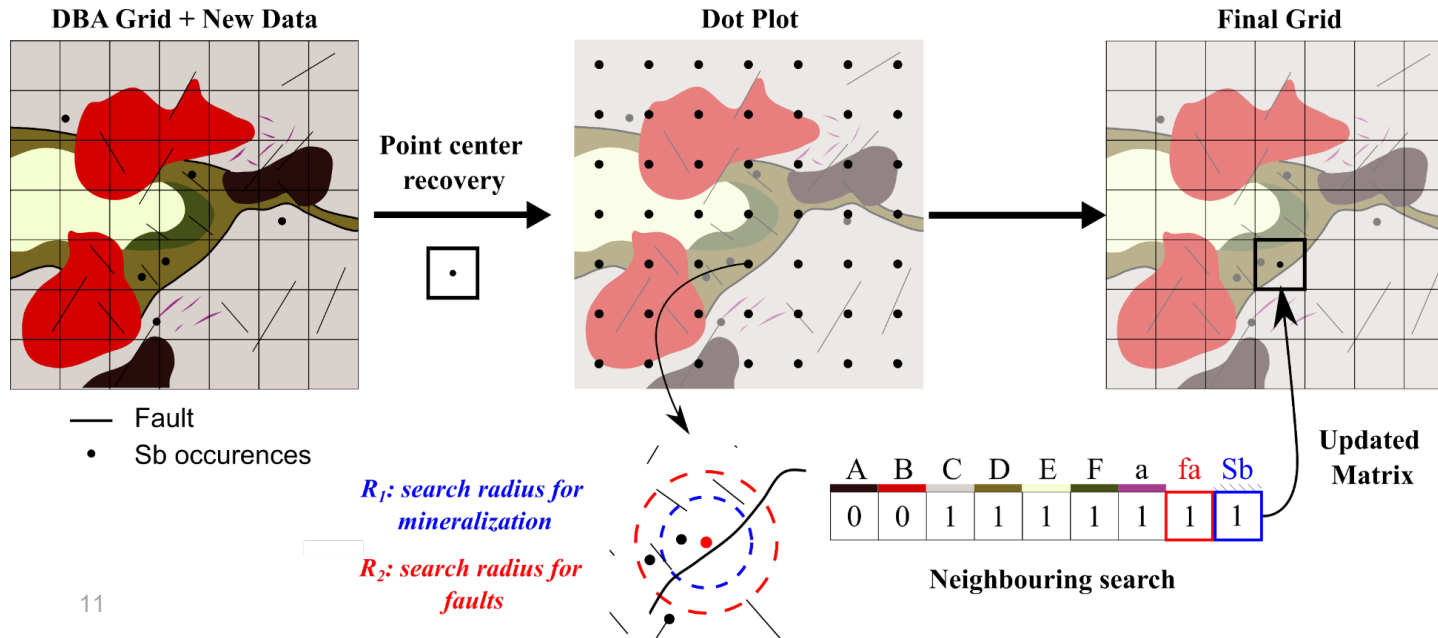
This favourability map is a result from the GSEU - Geological Service for Europe project (<https://www.geologicalservice.eu/>). GSEU has received funding from the European Union's Horizon Europe research and innovation programme.



Onshore CRM potential assessment

Pan-European mineral prospectivity maps:

- Improvement of the work initiated in GeoERA-FRAME;
- Based on purely data-driven approach combining innovative methodology of data aggregation (DBA) and Random Forest;
- Allows higher resolution, better performance than GeoERA-FRAME MPM and is appropriate for Continental scale MPM;





Offshore CRM potential

Global map of CRM occurrences in European and neighbouring seas:

- Based on the compilation and harmonization of 595 mineral occurrences and 1961 samples from 13 marine regions;
- Display areas of high potential for future research and exploration;

CRITICAL RAW MATERIALS OFFSHORE OCCURRENCES OF EUROPE

Based on the 2023 CRM list of the European Commission



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the European Union

Bathymetry

0 m -8000 m

Commodity

- Barite (BaSO_4)
- Cobalt (metal)
- Copper (metal)
- Manganese (metal)
- Phosphorous
- Rare Earth Elements (REE_2O_3)
- Titanium (metal)
- Tungsten (WO_3)

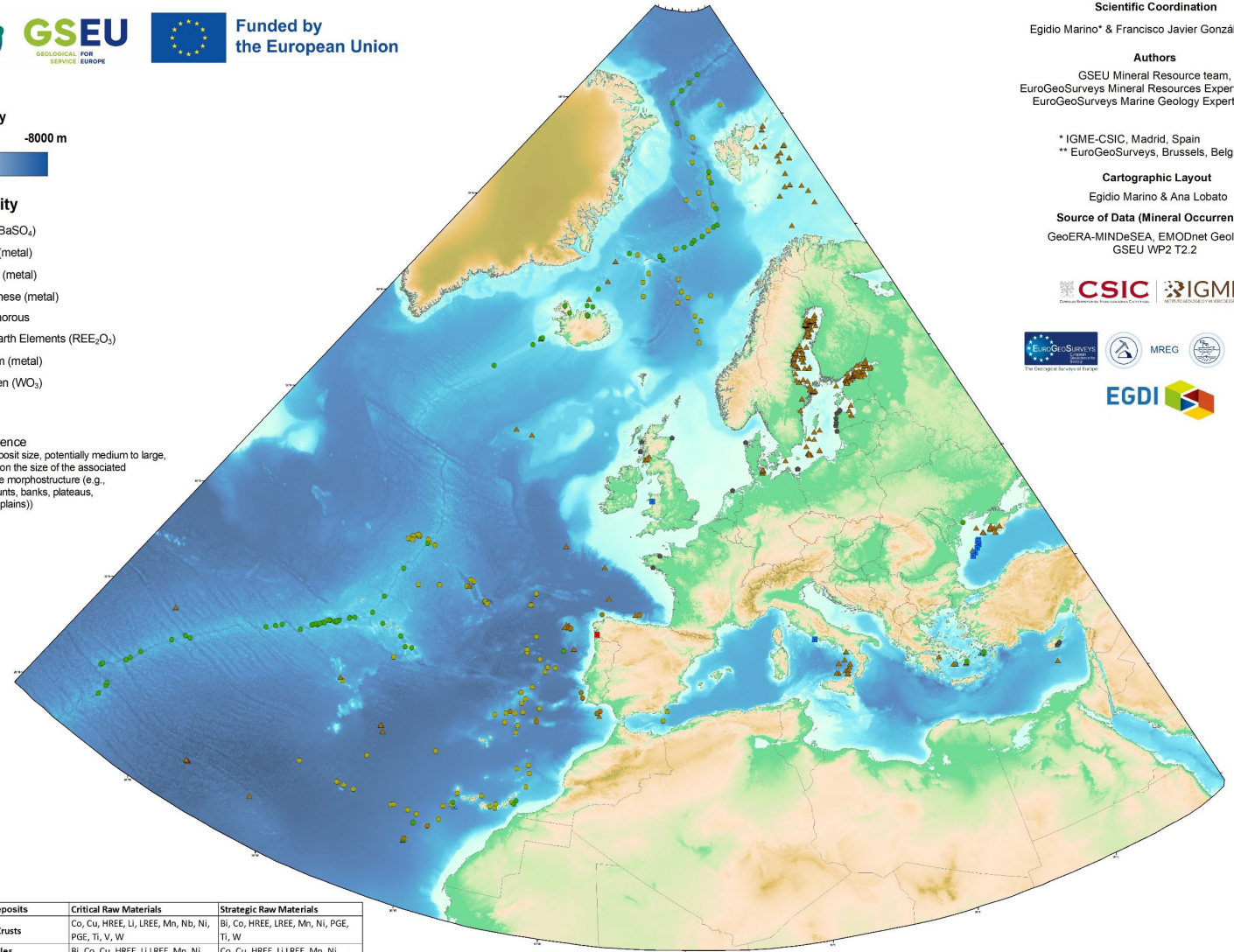
Size

- Occurrence
(The deposit size, potentially medium to large, depend on the size of the associated favorable morphostructure (e.g., seamounts, banks, plateaus, abyssal plains))

Marine Mineral Deposits	Critical Raw Materials	Strategic Raw Materials
Ferromanganese Crusts	Co, Cu, HREE, Li, LREE, Mn, Nb, Ni, PGE, Ti, V, W	Bi, Co, HREE, LREE, Mn, Ni, PGE, Ti, W
Polymetallic Nodules	Bi, Co, Cu, HREE, Li, LREE, Mn, Ni	Co, Cu, HREE, Li, LREE, Mn, Ni
Polymetallic Sulphides	As, Bi, Cu, Ga, Ge, Sb	Bi, Cu, Ga, Ge
Phosphorites	F, HREE, LREE, P	HREE, LREE
Placers	HREE, LREE, PGE, Ta, Ti, W	HREE, LREE, PGE, Ti, W

Scale 1:50.000.000
0 480 960 1.440 1.920
Kilometres

Polyconic Projection, Centra l Meridia n : 16° E, FE = 0, L a titude of Origin : 0, DAT U M WGS84



Scientific Coordination

Egidio Marino* & Francisco Javier González Sanz*

Authors

GSEU Mineral Resource team,
EuroGeoSurveys Mineral Resources Expert Group** &
EuroGeoSurveys Marine Geology Expert Group**

* IGME-CSIC, Madrid, Spain

** EuroGeoSurveys, Brussels, Belgium

Cartographic Layout

Egidio Marino & Ana Lobato

Source of Data (Mineral Occurrences)

GeoERA-MINDeSEA, EMODnet Geology &
GSEU WP2 T2.2

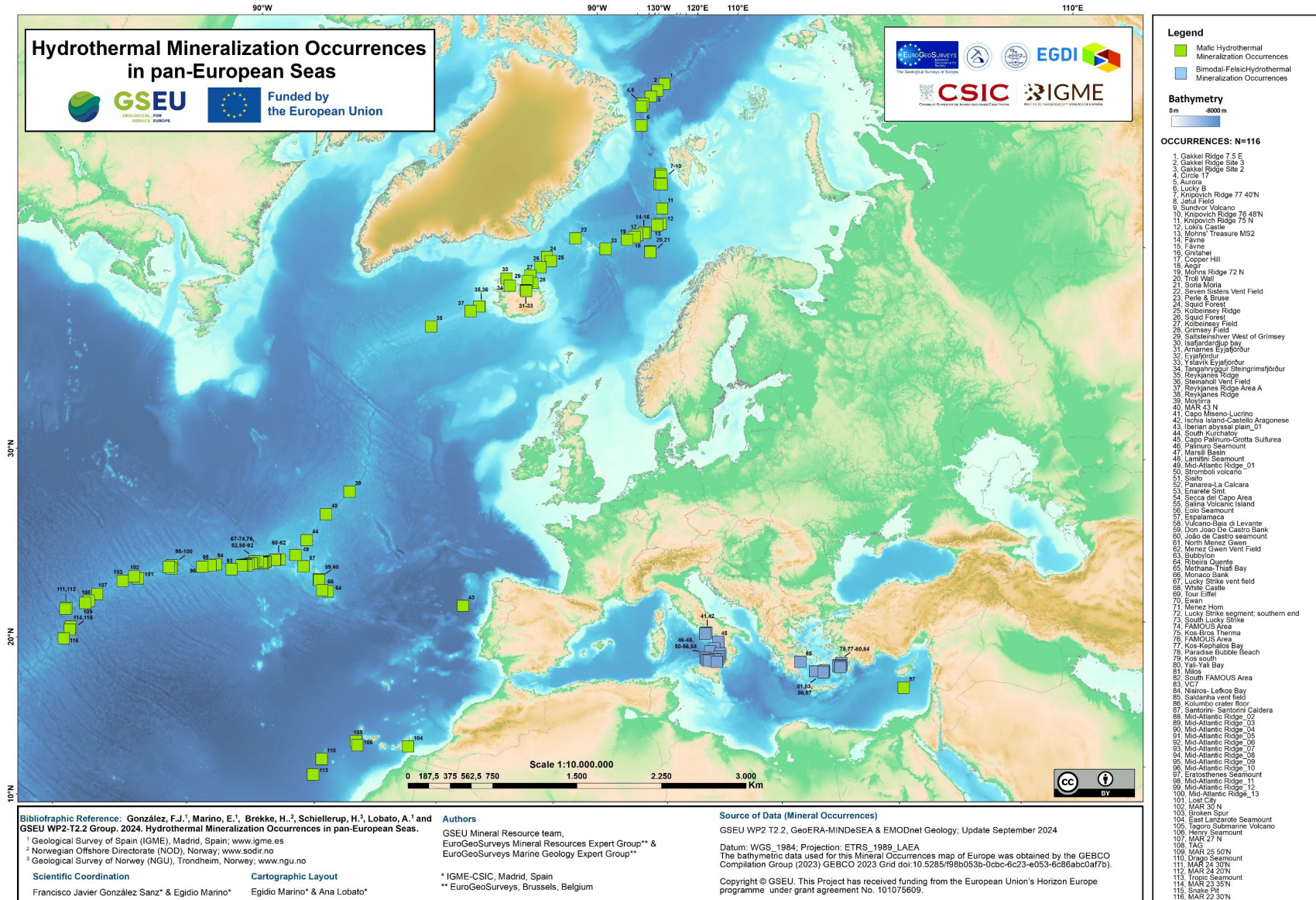




Offshore CRM potential assessment

Maps of offshore CRM occurrences per deposit types:

- 5 maps: marine placers, phosphorites, FeMn crusts, hydrothermal mineralization, polymetallic nodules;
- Additional focuses on selected European marine regions (regional maps);
- Include also summaries of genetic processes, lists of occurrences and potential assessments;

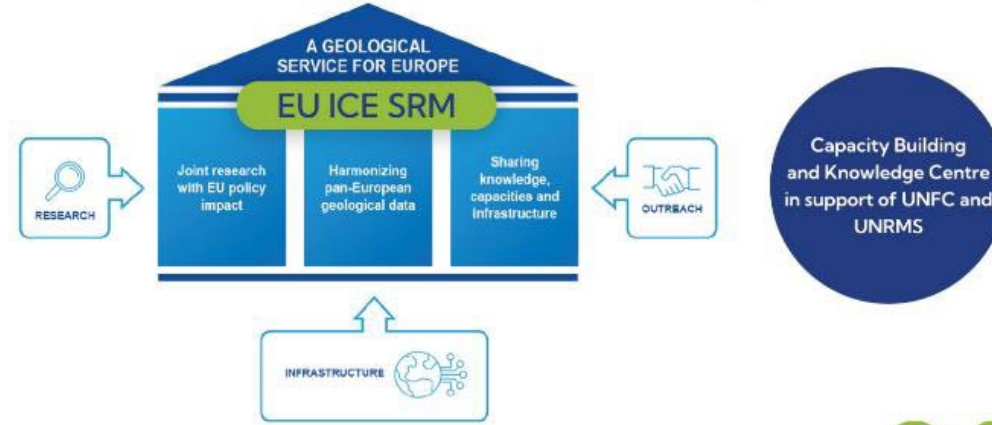




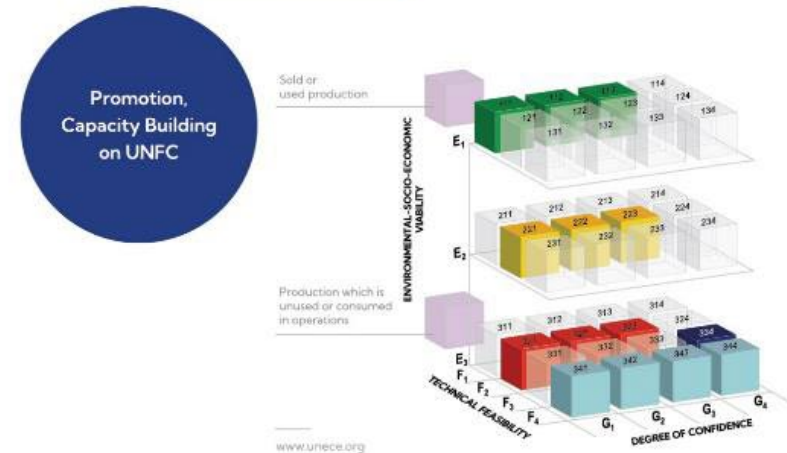
EU ICE-SRM

- Knowledge center to support the UNFC and UNRMS;
- Missions of promotion, networking, capacity building and policy support at regional to EU scale;
- Compliant with the UNECE ICE guidelines;
- ICE organisational scheme and IT platform under development;

EU International Centre of Excellence on Sustainable Resource Management

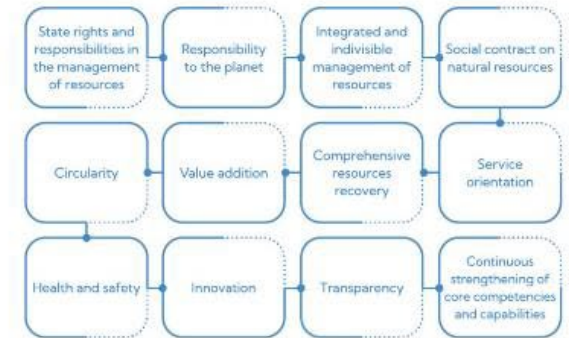


UNECE ICE-SRM



www.sdg3.un.org

UNRMS Fundamental Principles



www.unece.org

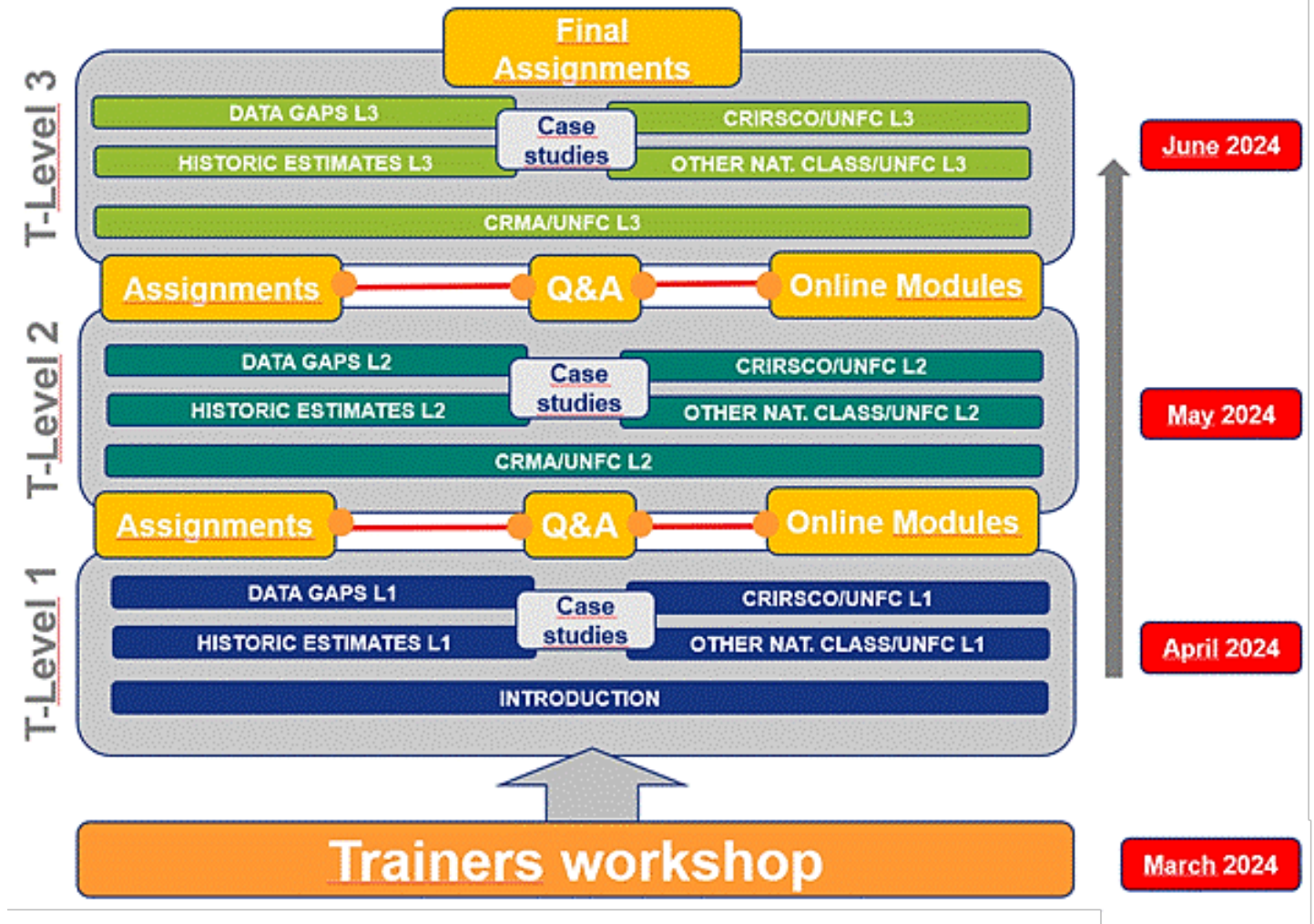




UNFC promotion and capacity building

‘Train the trainers’ training sessions:

- 3 levels training for future UNFC trainers at national level;
- Organized from March to June 2024 in Ljubljana, Slovenia;
- 40+ trainees from approx. 20 countries;
- Not ‘data’ strictly speaking, but training materials and recommendations available for future sessions;

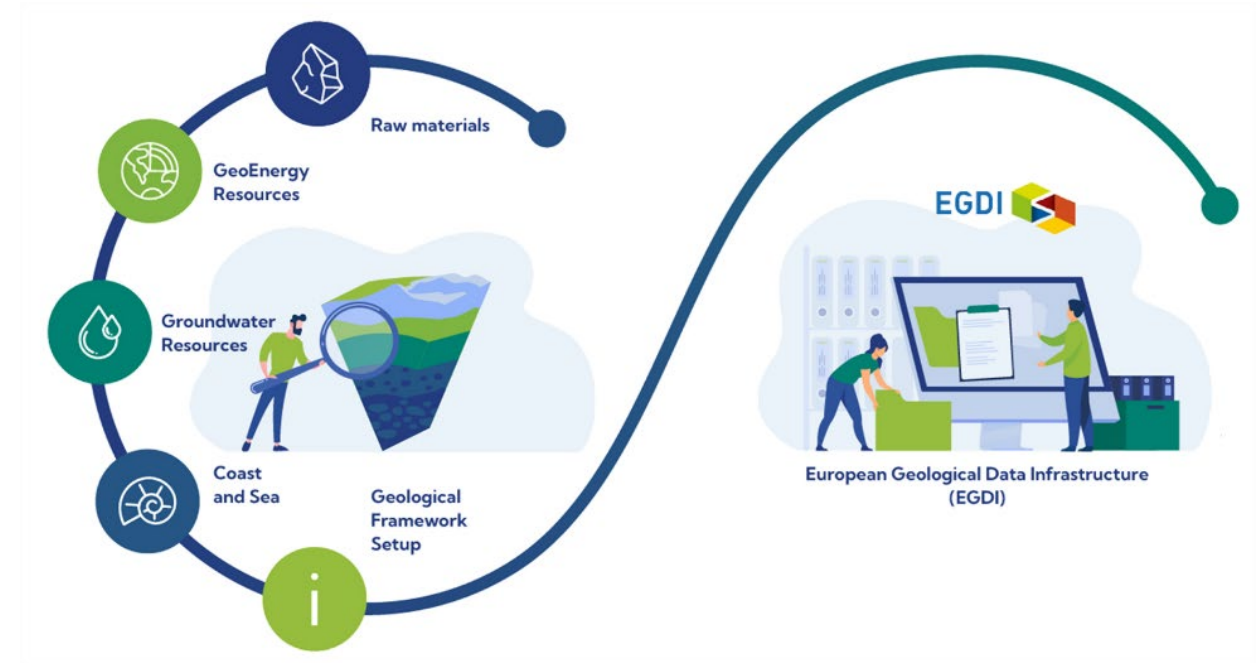




Conclusion

Key messages

- Various types of data and expertise produced by the GSEU Raw Materials WP, from databases to capacity building;
- Covers onshore and offshore CRM, mining wastes, UNFC and UNRMS ;
- Common points are Pan-European approach and harmonization at European scale;
- GSEU data and knowledge support the CRM Act (exploration progr. in art. 19, UNFC classification in art. 5, 19, 21 and 27, etc.);
- All data and knowledge will be served in the EGDI platform;
- All maps presented here (and many more) are available in the GSEU web site : <https://www.geologicalservice.eu/>

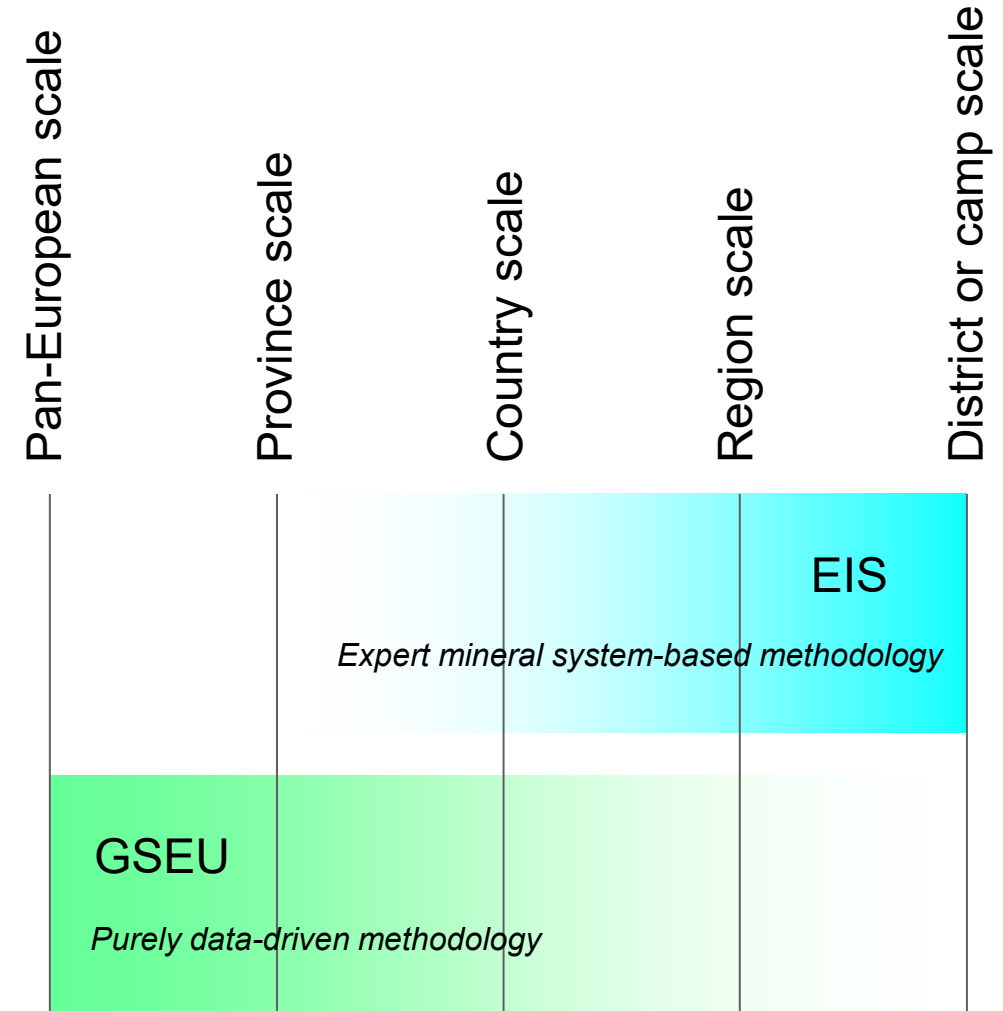




Conclusion

GSEU and EIS

- GSEU and EIS are collecting CRM data and producing prospectivity maps to support exploration in Europe;
- GSEU: pan-European to country scale; purely data-driven prospectivity mapping; harmonized data at European scale for transnational assessments;
- EIS: country to district scale; mineral system-based expert prospectivity mapping to serve local to pan-European potential assessments;
- Both project are highly complementary to address all scales and appropriate methodologies;





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Thanks for your attention !



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