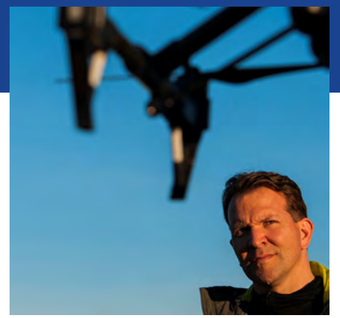
Session 1:
Mineral extraction

European Commission

m4mining



Steven Micklethwaite
Sustainable Minerals Institute,
University of Queensland, Australia

Funded by
the European Union

Project name

M4MINING

Real-time rock, mineral and environmental mapping via UAV allowing seamless 3D visualization and decision making.

Develop – Monitor – Demo - Trial

Project duration

1 January 2023 – 31 December 2025

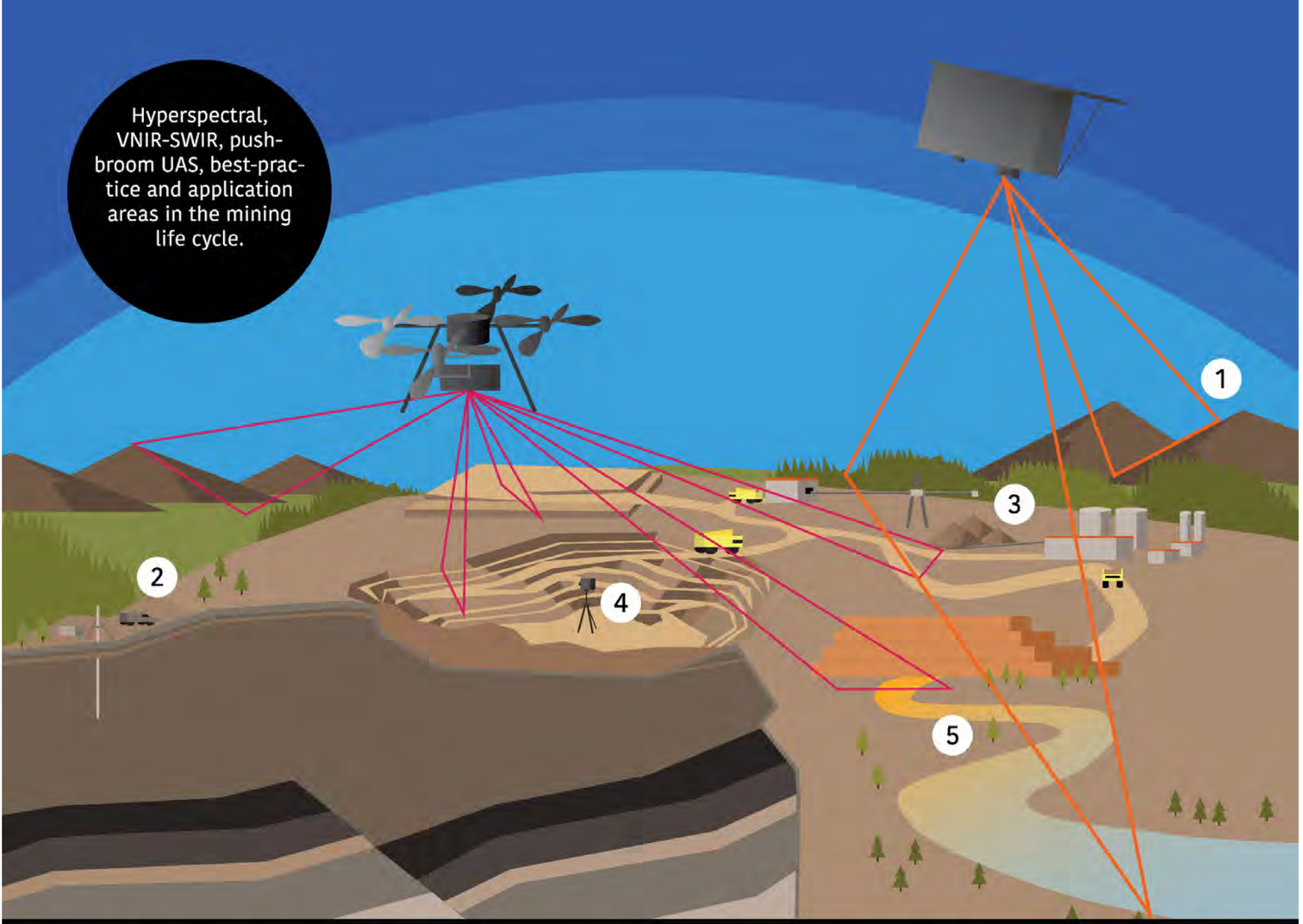
Budget

€ 4 696 629 (€ 4 499 512 EU contribution)

TRL level - 6

Major industrial/research partners

NORCE
neo NORSK ELEKTRO OPTIKK AS
GFZ Helmholtz-Zentrum Potsdam
Luleå University of Technology
Prediktera.
Cyprus Geological Survey 1950
University of Patras
The University Of Queensland Australia
ReSe Applications



IMAGING SPECTROSCOPY FOR THE MINING LIFE CYCLE: A GUIDE FOR DRONE APPLICATIONS

Exploration

1. 12 studies including imaging spectroscopy for exploration
2. 18 studies from the realm of hyperspectral drill core scanning

Operational mining

3. 6 studies utilizing hyperspectral imaging, including first studies of geometallurgy applications
4. 26 studies detailling ground-based hyperspectral scanning

Closure and Rehabilitation

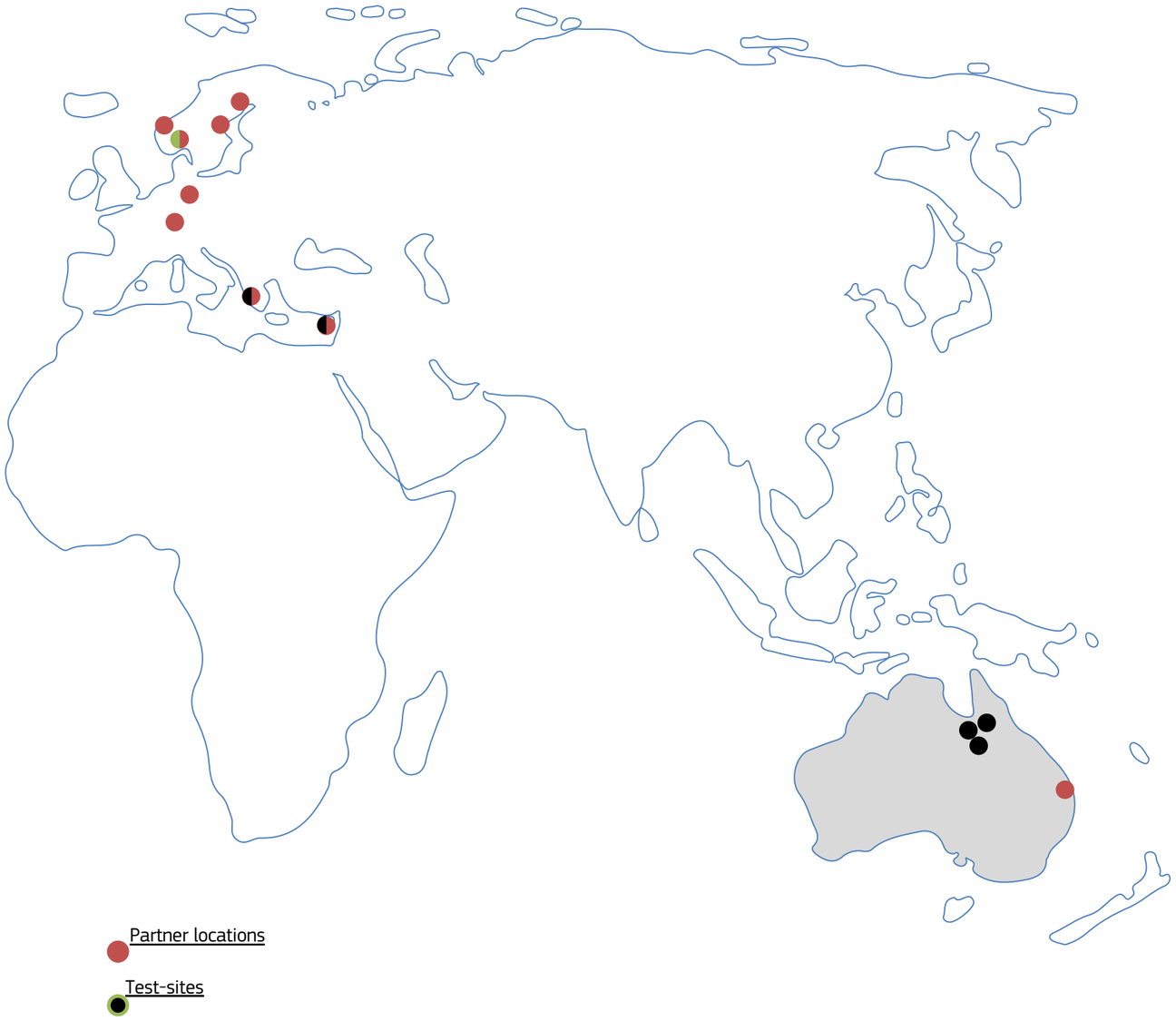
5. 59 studies in post-mining environments, including hyperspectral imaging for AMD monitoring, rehabilitation and geotechnical applications

Value Proposition

- Interoperable equipment
- High spatial resolution for optimisation of operations
- High temporal resolution for rapid decision making

Application

- Geology mapping
- Exploration vectoring (mineralogy)
- Open pit mapping
- Geotech monitoring
- Early-stage geomet data
- Ore/waste tracking
- Stockpile mineral chem
- ROM monitoring (soft sensor optimisation)
- Tailings monitoring
- AMD identification
- Sediment control & erosion
- Water chemistry
- Rehabilitation & weed control



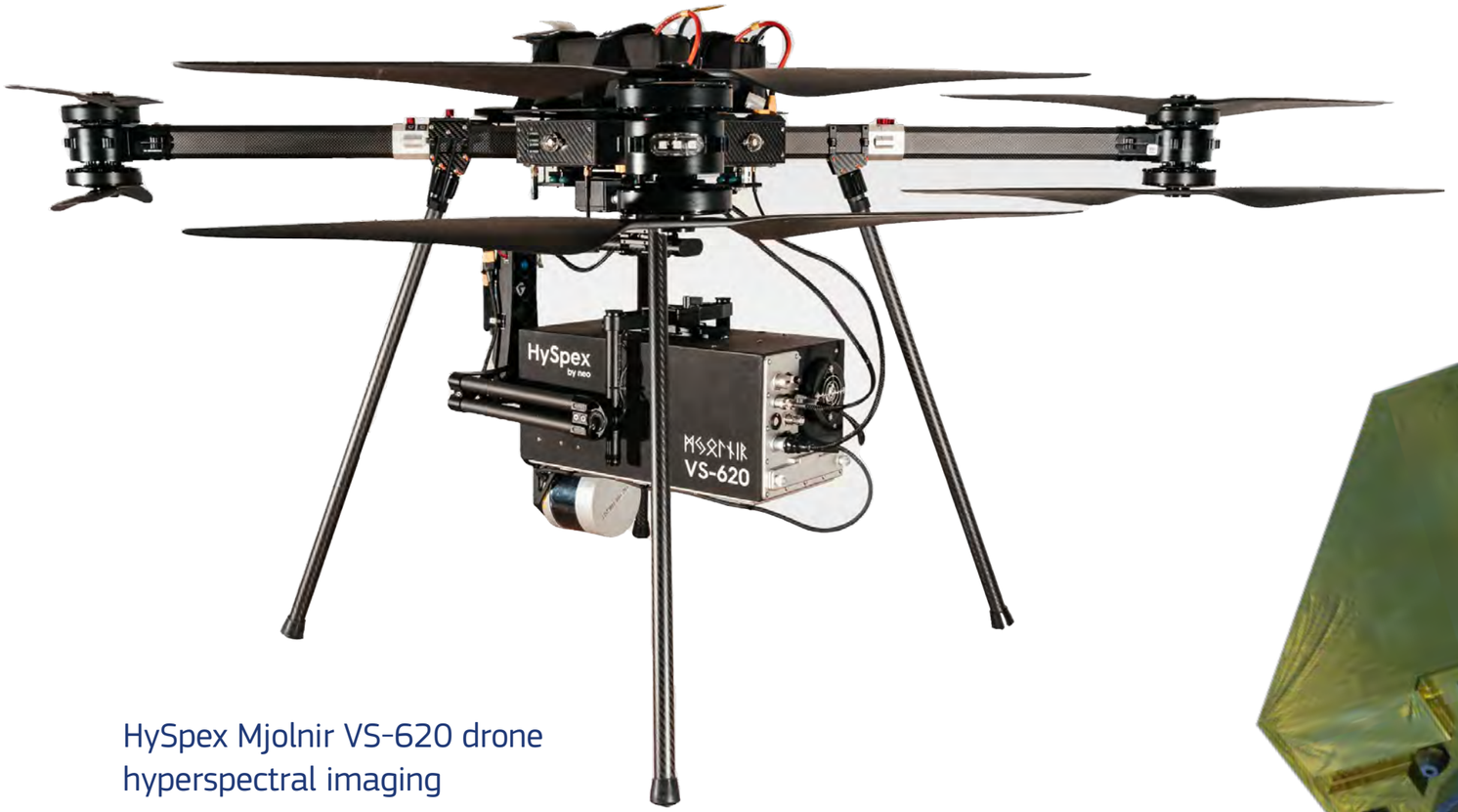
Demo

Australia – Active Cu-tailings and legacy Au- and U-REE- tailings and (mineral mapping, rehab, enviro)

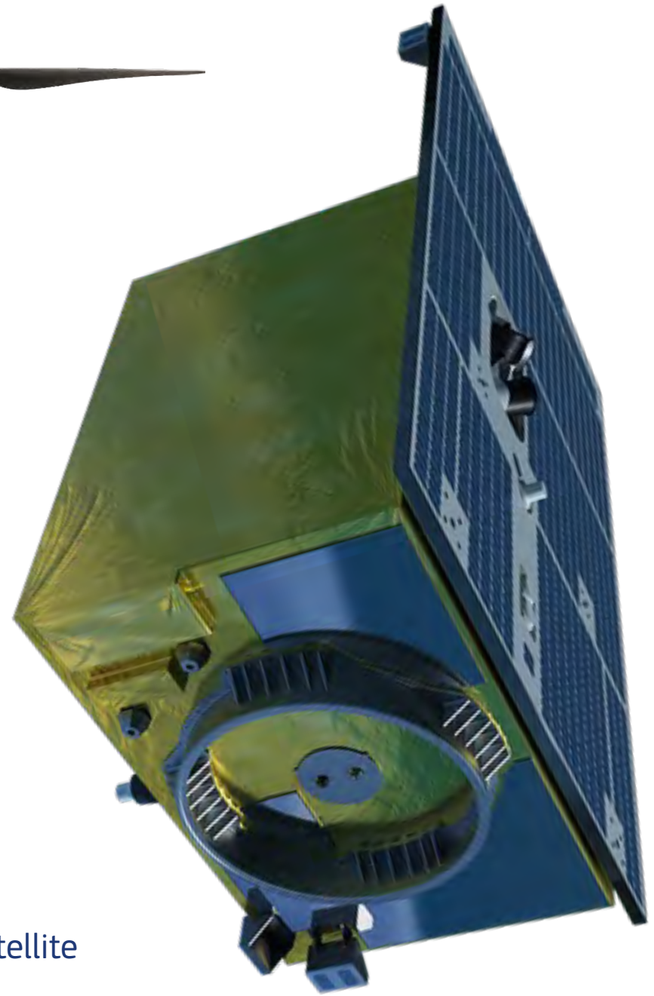
Greece – Active carbonate-hosted bauxite mine

Republic of Cypress – Pyrite mine tailings (rehab, AMD)

Norway – Rapid prototyping and quarry testing

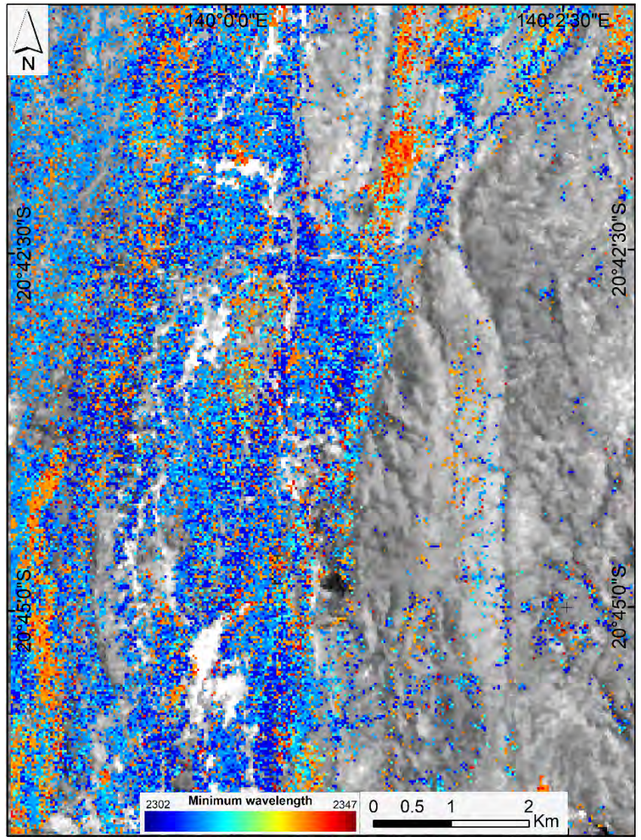


HySpex Mjolnir VS-620 drone
hyperspectral imaging



EnMAP satellite

Demo: Mary Kathleen, Australia – REE-U Satellite



Variations in the minimum wavelength of Mg-OH feature

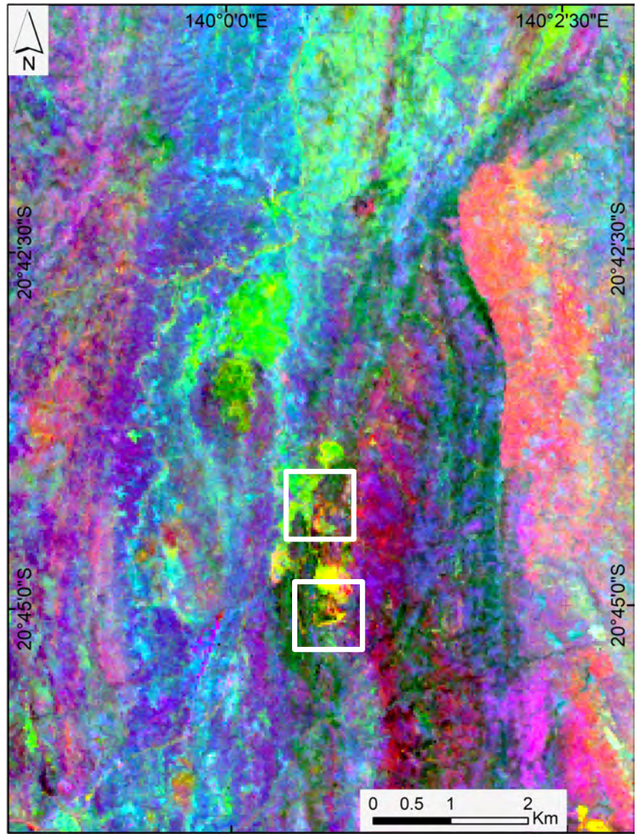
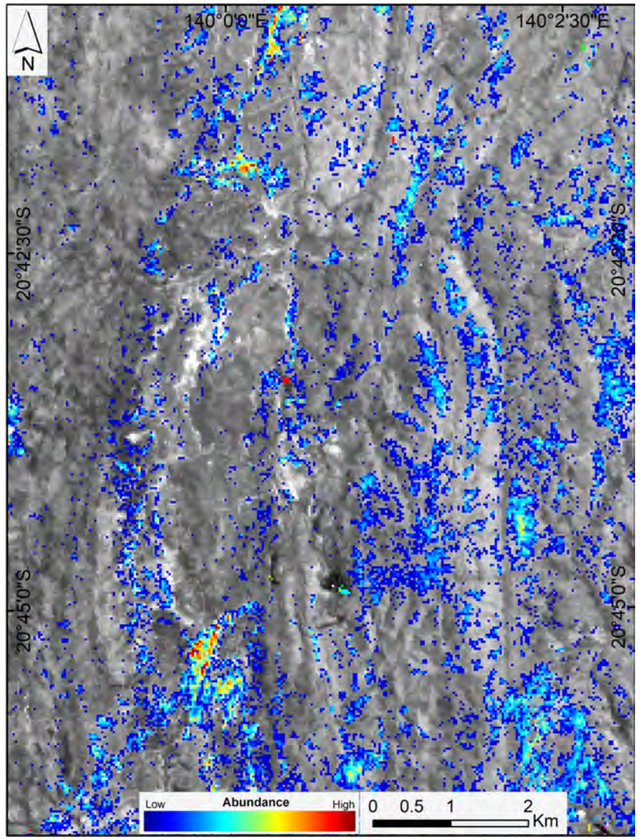
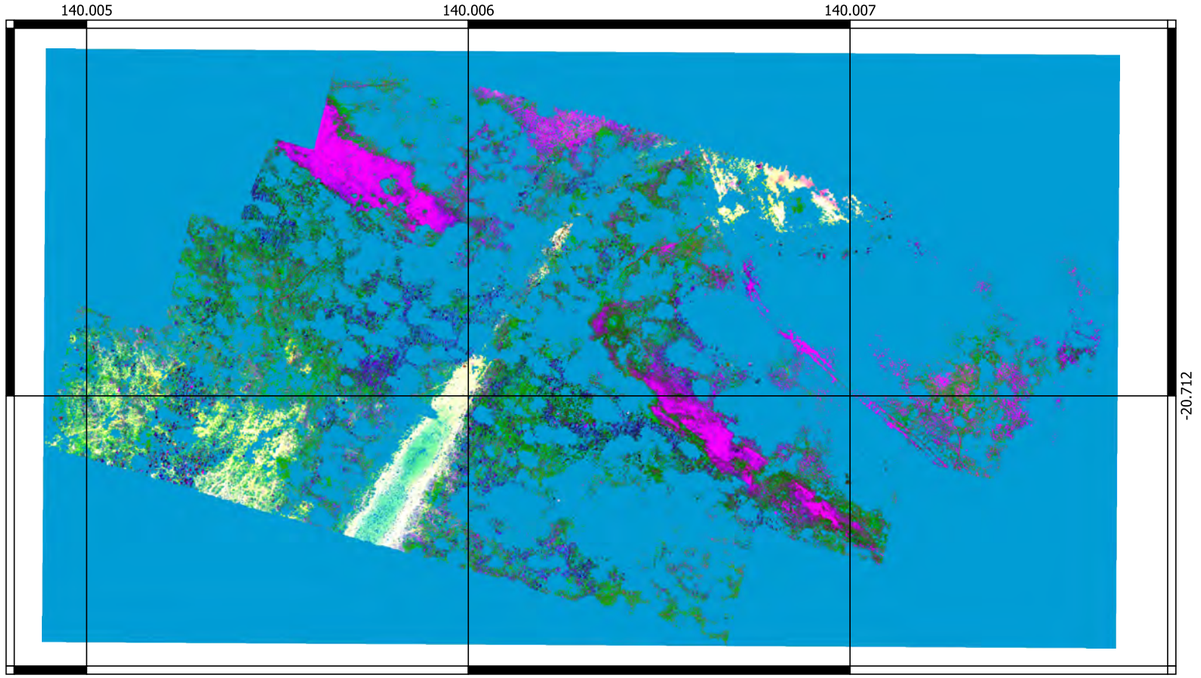


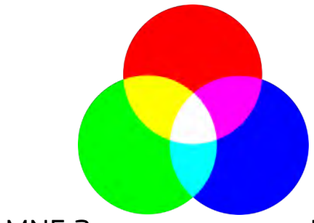
Image enhancement using Minimum Noise Fraction (MNF) transform



Hematite abundance map: spectral unmixing

Minimum noise fraction





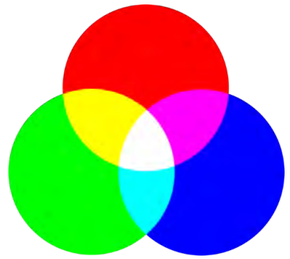
Band 01: MNF Band 1
Band 02: MNF Band 2
Band 03: MNF Band 3

Demo: Mary Kathleen, Australia – REE-U

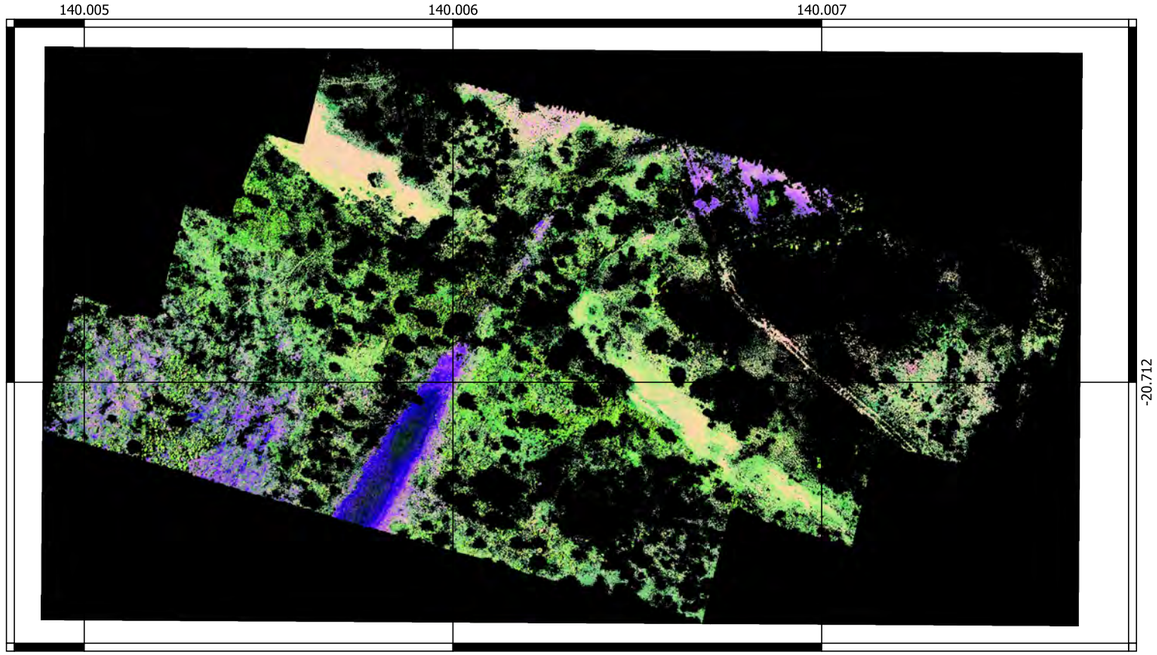
Drone (scoping near real-time visualization)

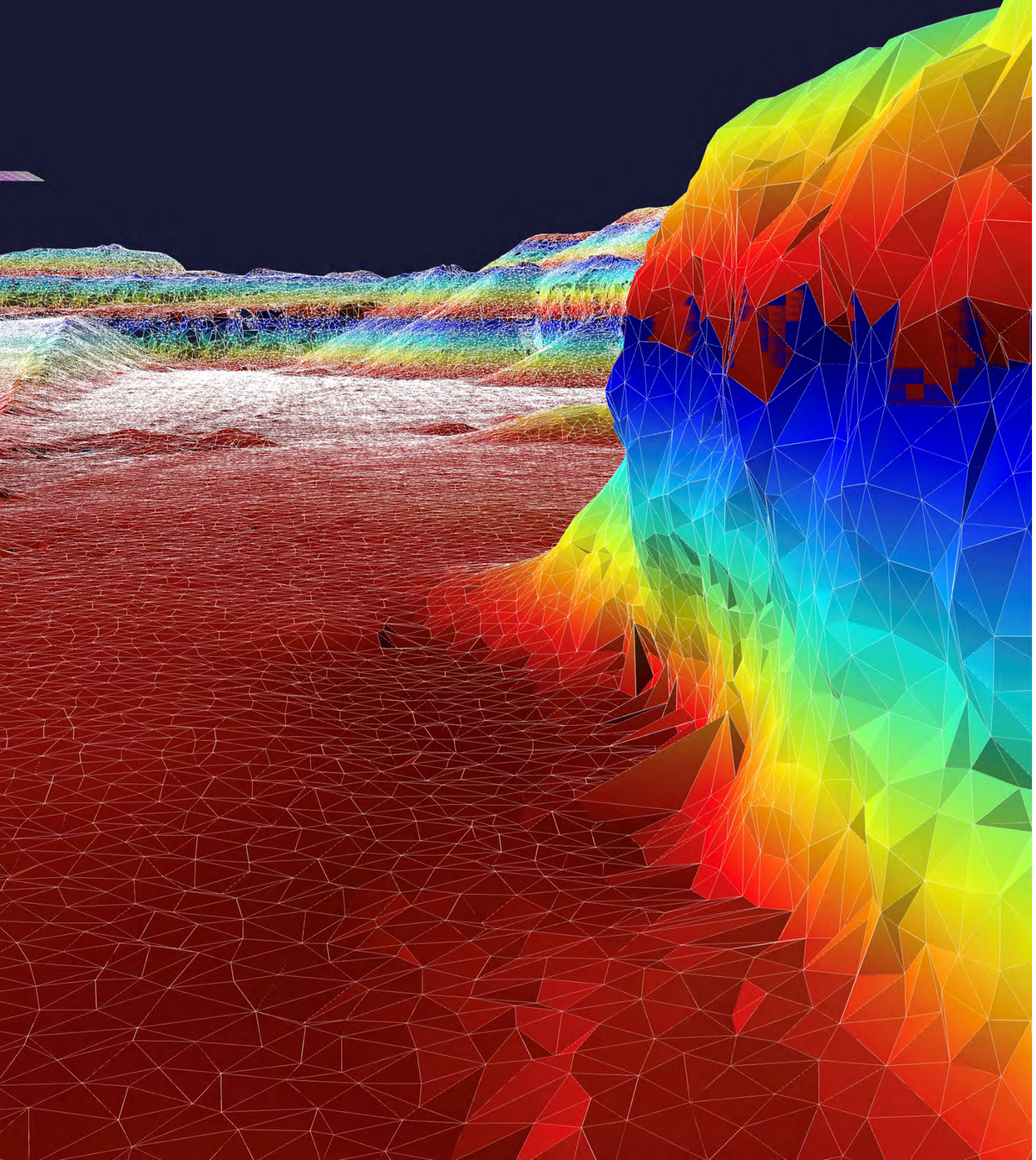
Vegetation masked

In-field data QAQC



SAM





Real-time R&D results

- 258 seconds recording from a drone
- 66 million points
- Point density of 260k per sq meter.
- Meshing took ~10 seconds
- True 3D

Conclusion: Achieved real-time calculation of 3D topography & DEMs with high precision LiDAR.

www.m4mining.eu

Talk to Steven Micklethwaite at PDAC
https://www.linkedin.com/in/steven-micklethwaite-83145177/

Or reach out to our project management office
pmo-m4mining@norceresearch.no

Visit our partner NEO

#m4mining

Funded by
the European Union

m4mining is funded by the European Union's Horizon Europe programme under Grant Agreement ID 101091462

Nexgen SIMS

Jan Gustafsson
Project Coordinator
Epiroc

Niclas Dahlström
Outreach & Communication
LTU Business

Funded by
the European Union

NEXGEN SIMS

Next Generation Carbon Neutral Pilots
for Sustainable Intelligent Mining Systems

Project duration
1 May 2021 – 30 April 2024

Budget
€16 000 000 EU contribution

TRL level
5-7

Our vision: Sustainable and Efficient Mine Production

Competitive technology advantage leading to unlocking substantial reserves of new or today unexploited resources within the EU

Minimized environmental impact

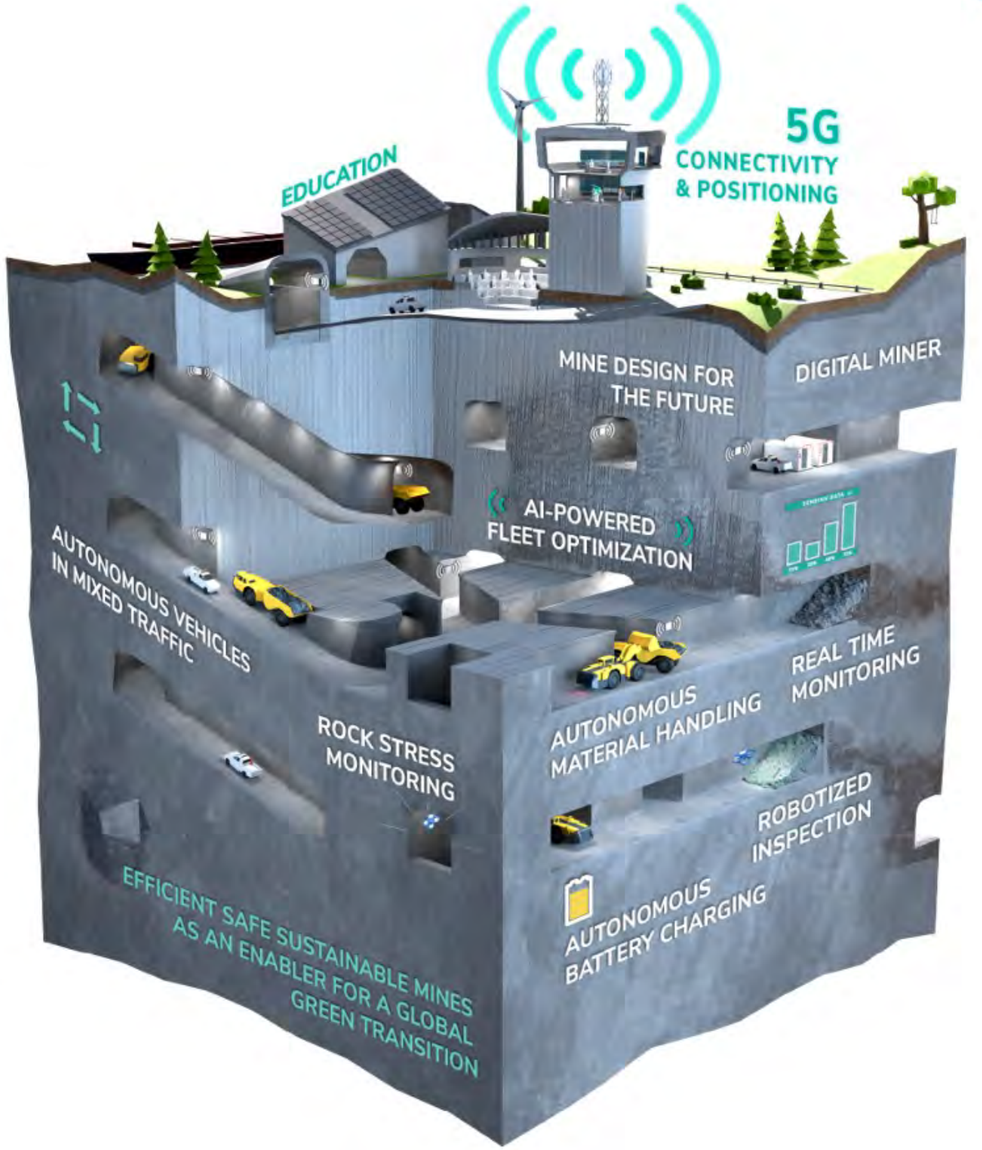
Operation efficiency

Safety & job creation

A more sustainable and efficient production of raw materials, resulting in economic growth and minimized environmental impact, supporting the next production paradigm shift of the mining industry.

Focus areas

Enablers to reach the impacts



The next mine production paradigm shift

Piloting and Demonstration in European Mines

Scale-ups demonstrating technical performance and health & safety benefits – 8 Pilot Sites

1. Kittilä Mine (Agnico Eagle Finland)
2. LTU Test Mine & VR Lab (Luleå University of Technology)
3. Kankberg and Kristineberg Mine (Boliden)
4. Kvarntorp Test Mine (Epiroc)
5. Werra Mine (K+S)
6. Rudna Mine (KGHM)
7. Lubin Mine (KGHM)

Business value for partners by integrating Go-to-Market strategies that ensure successful exploitation and commercialization of the project results


NEXGEN
SIMS

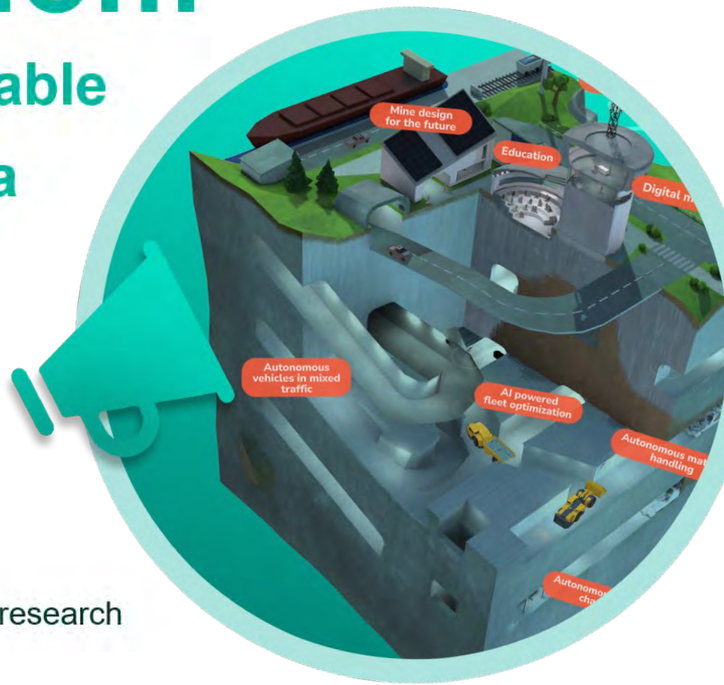
NEXGEN SIMS

Thanks for your attention!

Follow our 3 year journey towards sustainable mining on our website and social media

Twitter LinkedIn

www.nexgensims.eu



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101003591

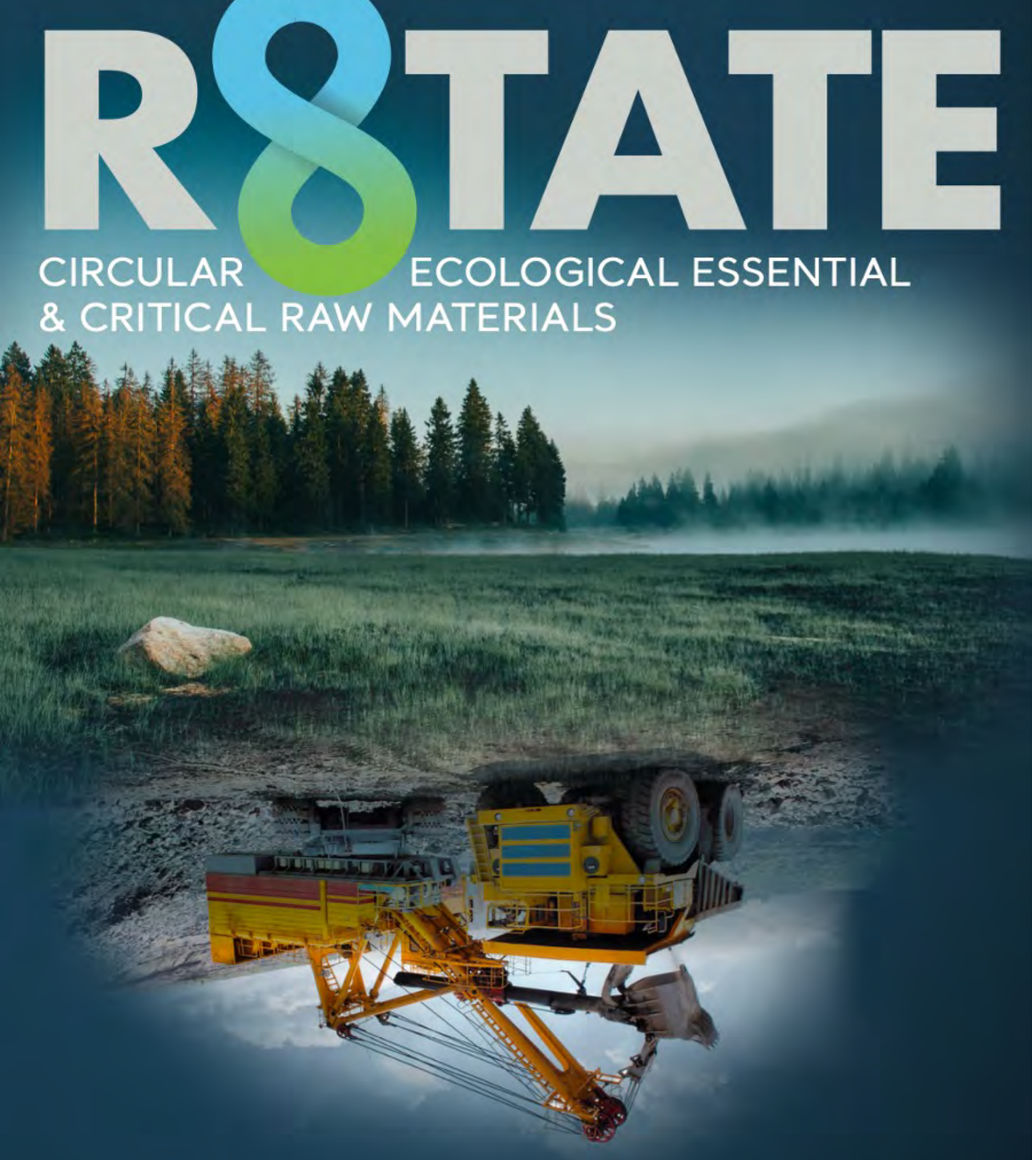
ROTATE

Lorena Viladés

ANEFA

Spanish Aggregates Association, Spain

Funded by
the European Union



Project name

ROTATE

Short description

Circular, Ecological, Essential and Critical Raw Materials

Project duration

1 September 2022 – 31 August 2026

Budget

€14 212 290 (€11 432 610 EU contribution)

TRL level

TRL 5 → TRL7

Technology validated in relevant environment

System prototype demonstration in operational environment

Major industrial/research partners

Asociación Nacional de Empresarios Fabricantes de Áridos – ANEFA

Advanced Mineral Processing

AGREPOR – CIMPOR

AKKODIS Research

Investigación Centro Tecnológico del Mármol, Piedra y Materiales

Canteras Industriales

Velde Industri AS

Chalmers University of Technology

CITEPA

Danish Teknologisk Institut

Fundación Tormes-EB

Gate2Growth

Hormisoria

Vlaamse Instelling Voor Technologisch Onderzoek Nv (VITO)

Imperial College London

LafargeHolcim Francia

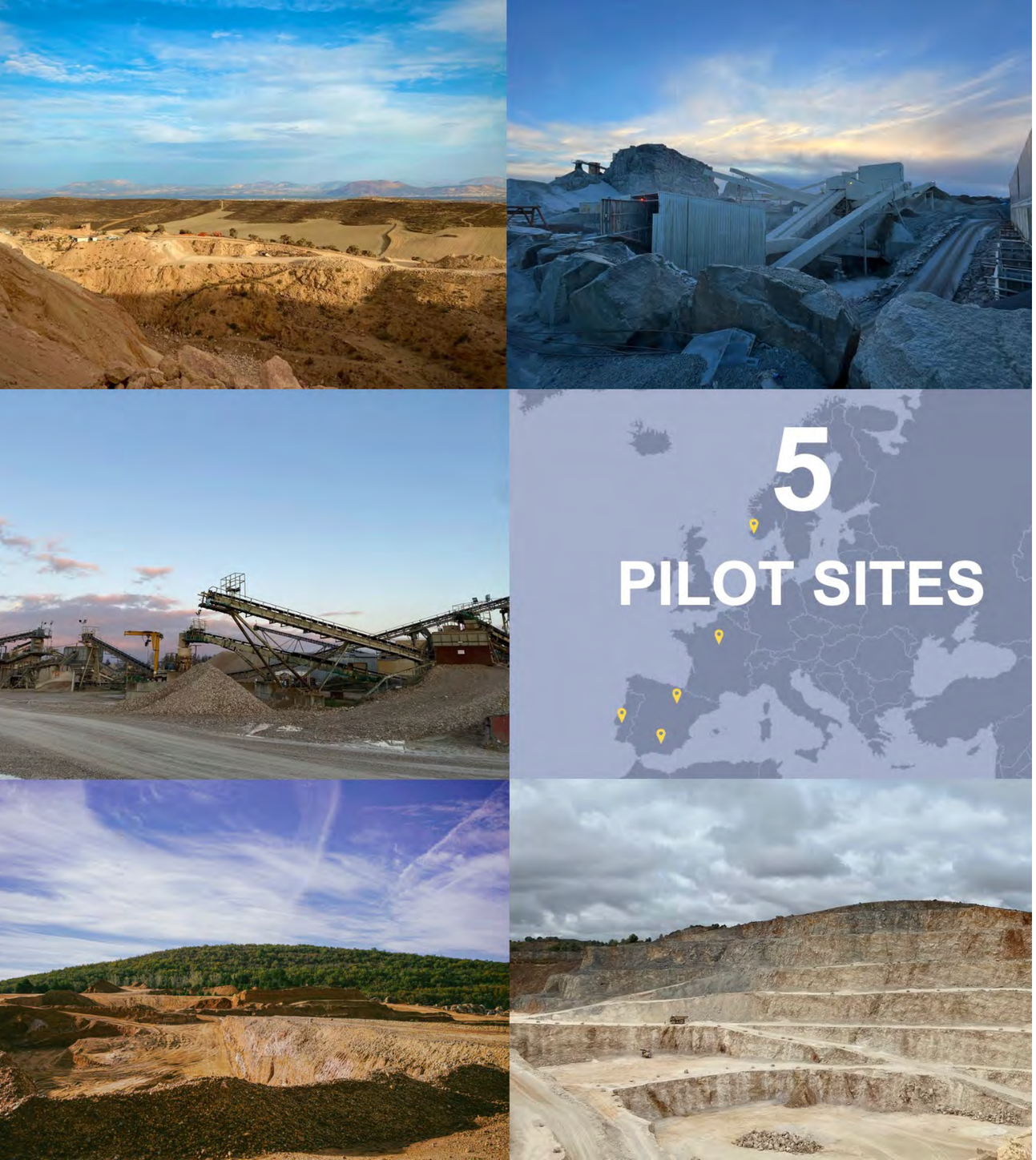
Metso

Roctim AB

Université de Liège

UPM Universidad Politécnica de Madrid

Zabala Innovation Consulting



Pilot sites

- Celestite mine – Granada, Spain.
- Granite quarry – Sandnes, Norway.
- Sand and gravel pit – Fontainebleau, France.
- Sand and gravel pit – Soria, Spain.
- Limestone quarry – Lisbon, Portugal.

Core R&I targets

- Extraction and processing improvement
  zero emissions, materials, resources and consumption efficiency.
- Circularity, industrial symbiosi and waste valorisation.
- Environmental footprint
  assessment, management and monitori
- Social engagement.

Session 2:
Mineral exploration

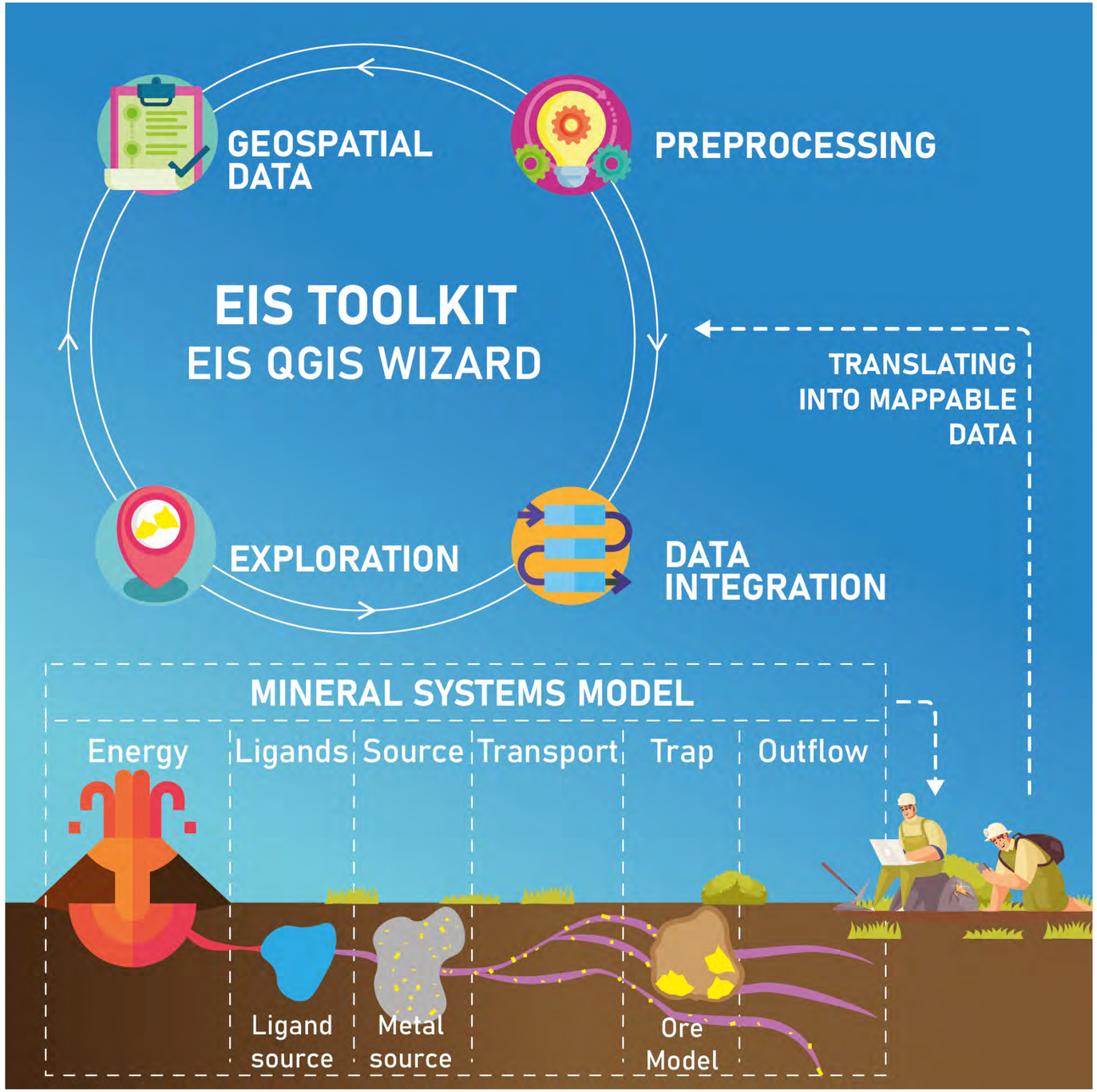
European Commission

EIS - Exploration Information System

Making mineral exploration better

Hafsa Ahmed Munia
Geological Survey Finland,
Espoo, Finland

Funded by
the European Union



EIS
Exploration Information System

Project name

EIS

Short description

New innovative exploration concepts and data analysis tools to enhance the probability of finding new sources of critical raw materials (CRM) for the EU's economy.

Project duration

1 May 2020 – 31 March 2025

Budget

€7,497,035.00

TRL level

5

EIS
Exploration
Information
System

Major industrial/research partners

Partners

17

GTK

beak

hrnm

DEUTSCHE LITHIUM

LULEÅ TEKNISKA UNIVERSITET

CSIC
Consejo Superior de Investigaciones Científicas

SGU Geological Survey of Sweden

GP GOLDEN PET SRO
A Canadian Palladium Company

KELIBER

LGI
sustainable innovation

GISPO

CLC
Cobre Las Cruces, S.A.U.

talga

UFS

UNIVERSITY OF TURKU

UNIVERZITA KARLOVA

UNICAMP

DEVELOP INNOVATIVE
EXPLORATION TOOLS

REDUCE EXPLORATION
AND MINING FOOTPRINTS

RAISE AWARENESS
TO THE GENERAL PUBLIC

EIS
Exploration
Information
System

Project name

EIS

Objective 1

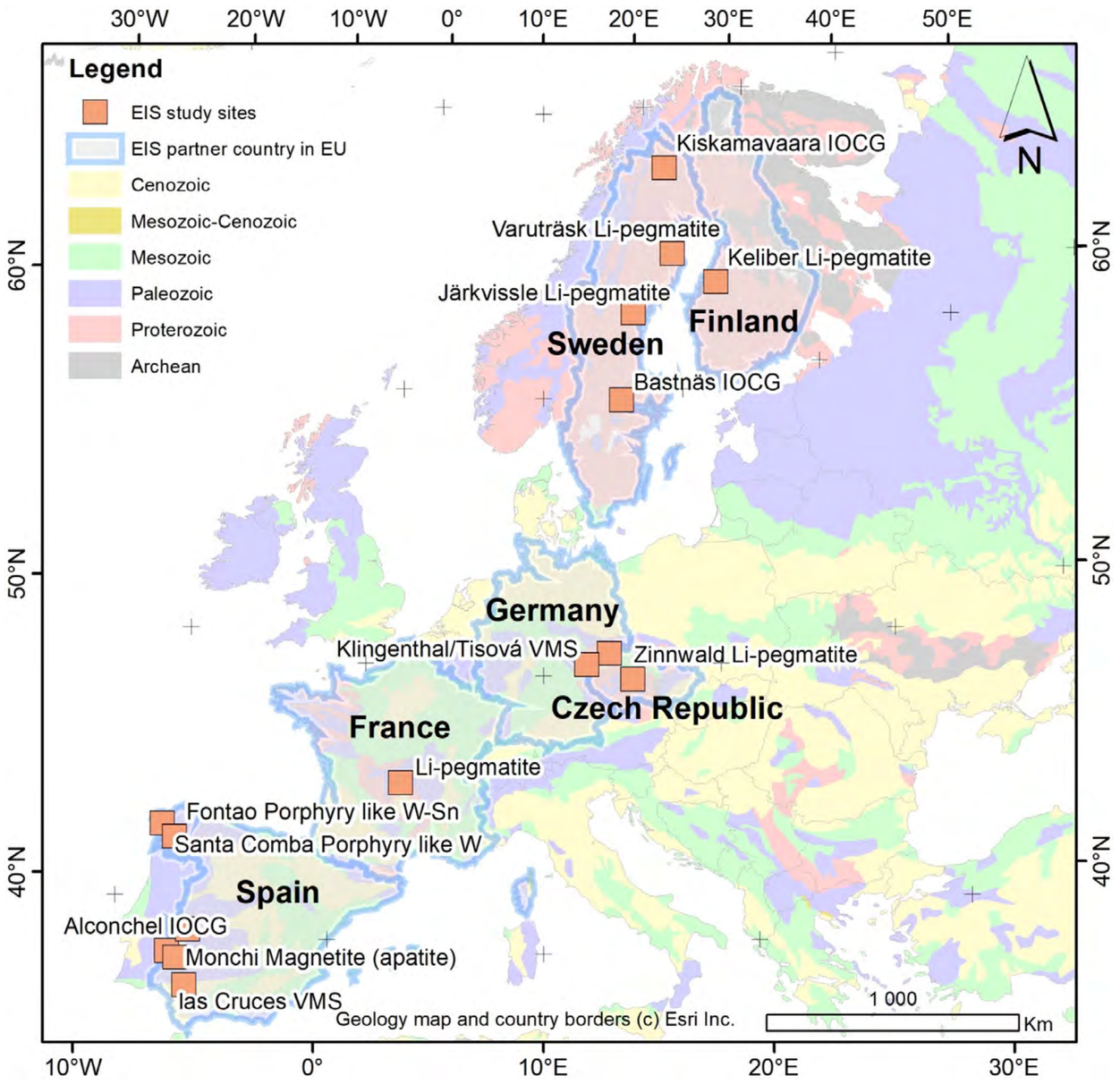
EIS will develop the “EIS Toolkit” and the “EIS QGIS Wizard”. These tools will be open-source and will provide critical information for the mining sector and geoscientists.

Objective 2

The tools developed by EIS aim to reduce the impact of exploration and mining on nature – making it more sustainable. It will reduce exploration footprints by using the existing exploration data.

Objective 2

EIS will raise awareness of the importance of critical raw materials to the EU’s transition, economy, and welfare.



EIS
Exploration Information System

Project name

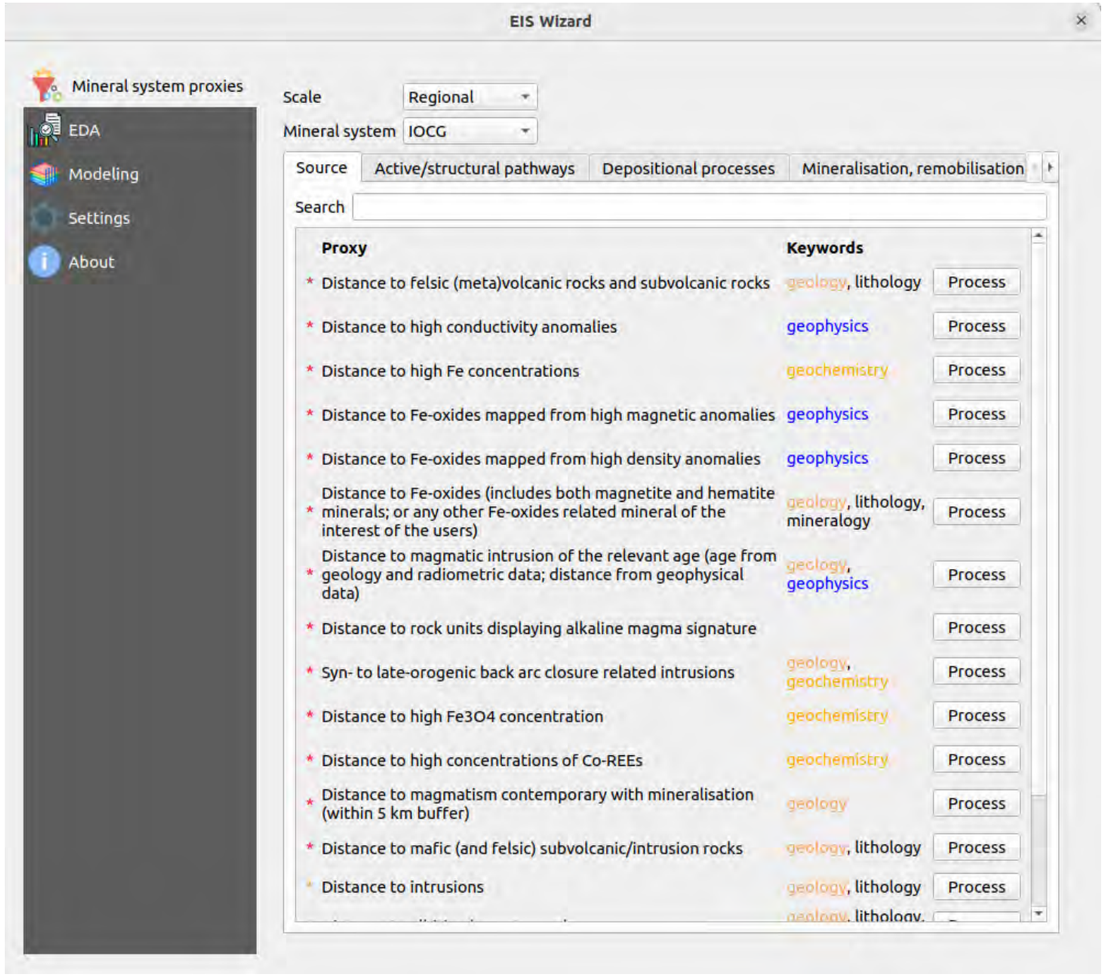
EIS

Test / Demonstration Sites

Nr.	Study site	other deposits to be studied	partners	commodities
Cobalt minerals potential VMS system				
1	Tisová /Klingenthal		Golden PET, Beak, CU	Co, Cu
2	Las Cruces		CSIC, Cobre LC	Cu
Lithium-tin-tantalum-tungsten minerals potential granite/pegmatite-related system				
	Study site	**other deposits to be studied**	**partners**	
3	Keliber		Keliber, GTK	Li
4	Granite-related deposits W Iberia		CSIC	Li, W, Sn, Ta
5	Zinnwald/Cinovec		Beak, DLi, LTU	Li
6		Järkvisle/Varuträsk	SGU, LTU	
7		Li-pegmatites in France	BRGM	
8		Li-pegmatite in Czech republic	CU	
Rare earths-cobalt minerals potential IOCG system				
	Study site	**other deposits to be studied**	**partners**	
9	Kiskamavaara/Nunasvaara		LTU, SGU, Talga	Co, C, Cu, Au
10	Bastnäs REE		SGU	REEs
11		Burguillos-Alconchel	CSIC, LTU	Co, REE, Cu

In addition, project also has reference study sites in South Africa (Orange River pegmatite belt) and Brazil (Carajás IOCG province).

EIS
Exploration
Information
System



Project name

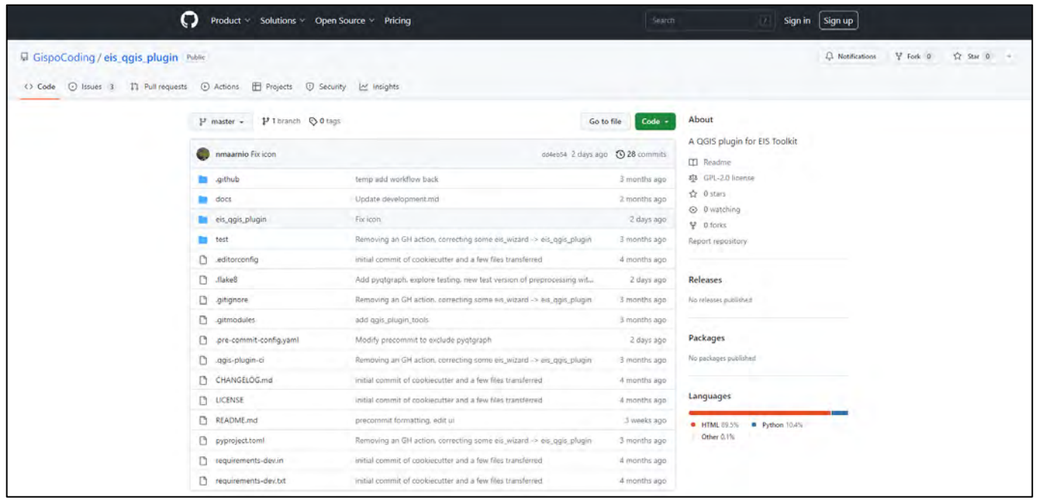
EIS

Key Results

Mineral Systems Developed

Open-Source EIS Toolkit

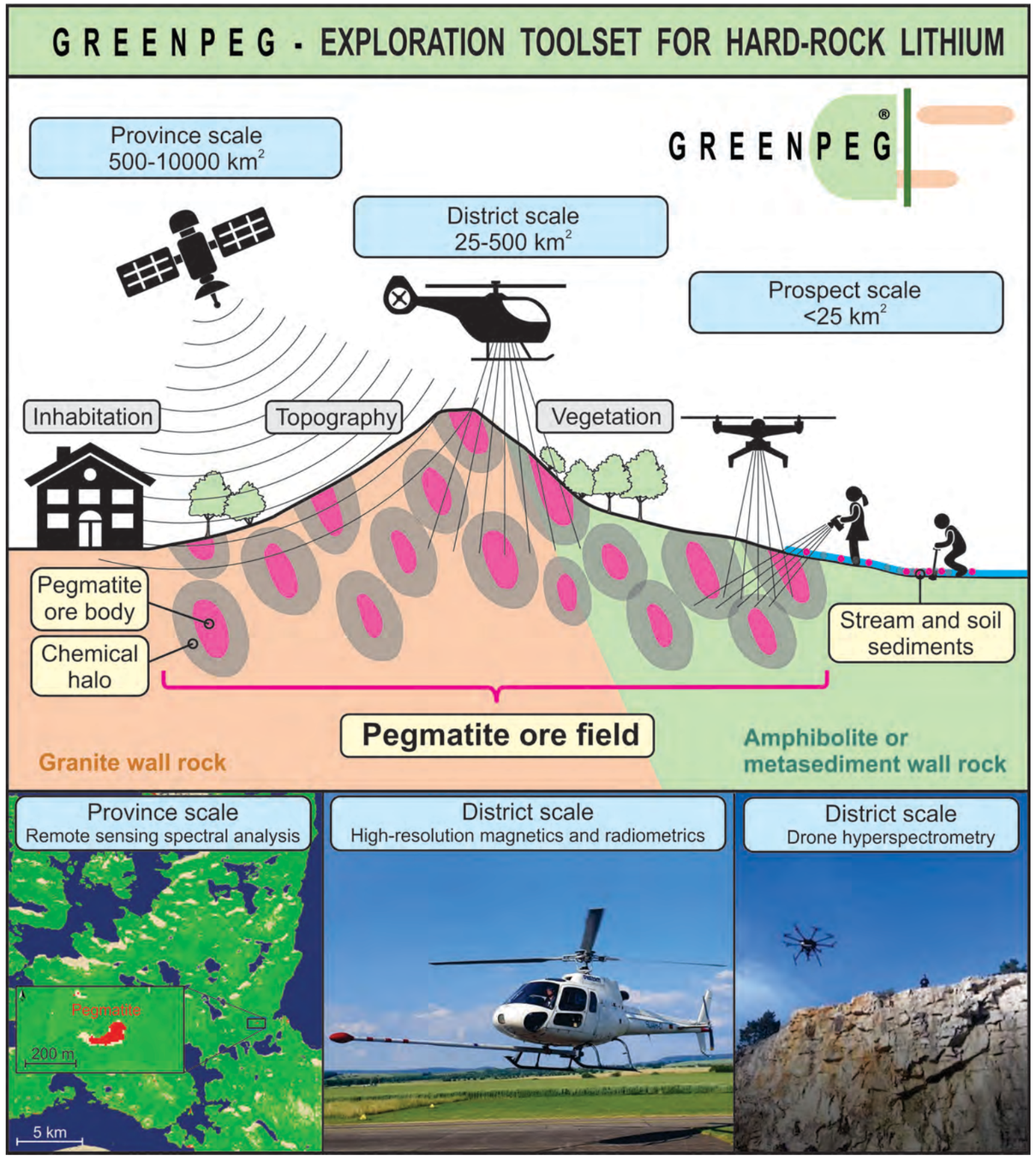
Open-Source EIS QGIS Plugin / Wizzard



GREENPEG

Axel Müller
Natural History Museum,
University of Oslo, Norway

Funded by
the European Union



Project name

GREENPEG

Short description

New Exploration Tools for European Pegmatite Green-Tech Resources

Project duration

1 May 2020 – 31 October 2024

Budget

€9 250 230 (€8 325 292 EU contribution)

TRL level

6-7

Major industrial/research partners

- European Lithium AT
- Blackstairs Lithium Ltd
- Felmica Minerais Industriais
- Terratec Geophysical Services GmbH
- Geological Survey of Norway
- University of Oslo

Demonstration sites

- Tysfjord, Norway
- Wolfsberg, Austria
- South Leinster, Ireland

Pilots

- Piezoelectric seismograph
- EASA-certified, helicopter-compatible nose stinger magnetometer/radiometer
- Drone-borne hyperspectral imaging system (acousto-optical monochromator)

Databases

- Spectral library of pegmatites and their host rocks
- Petrophysical database of pegmatites

Core R&I targets/results

- Toolset for pegmatite exploration to enhance European exploration success and secure CRM supply chain
- Innovative exploration technology and approaches for sustainable exploration with minimal environmental and social impact
- Supported by ESG best practice methodology for societal acceptance

VECTOR

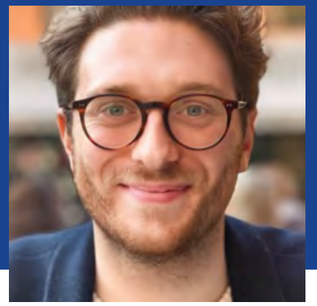
Tina Pereira

Helmholtz Institute Freiberg for Resource Technology,

Helmholtz-Zentrum Dresden-Rossendorf, Germany

Sarah Gordon

Satarla



Chris Stockey

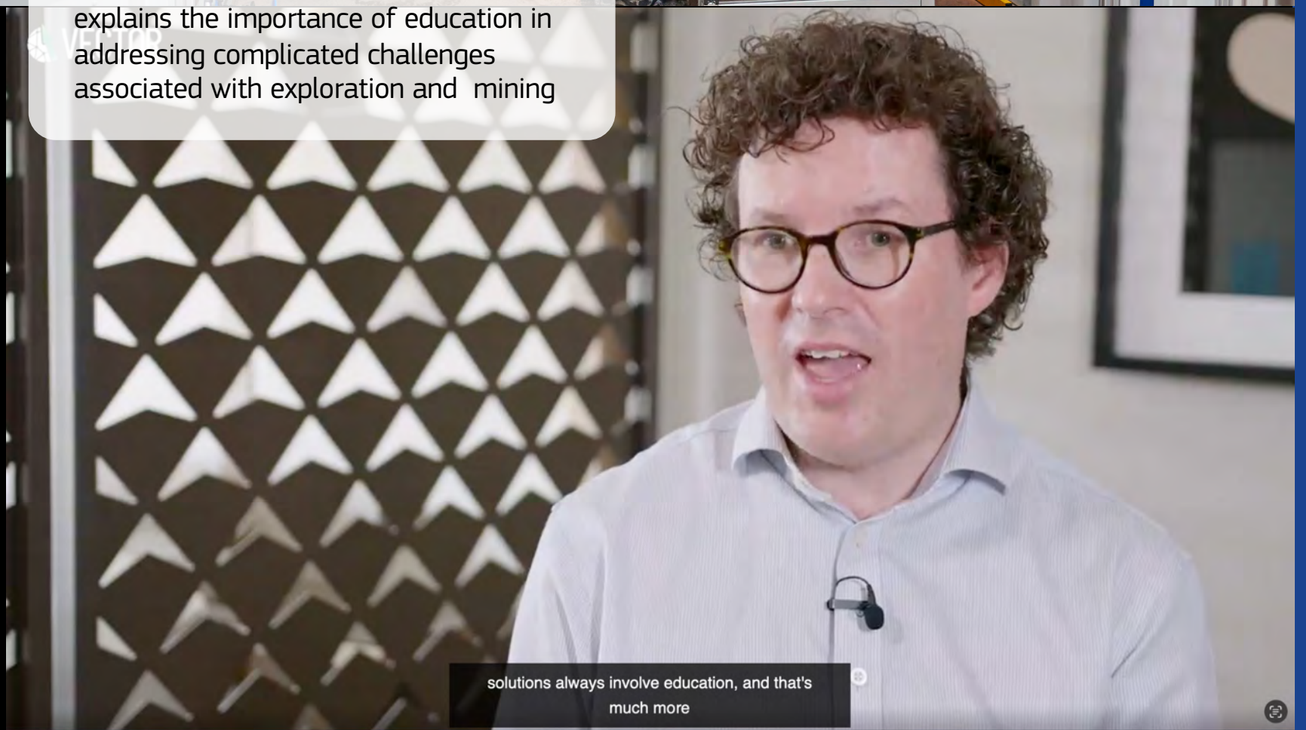
Satarla

Funded by the European Union

What do you consider to be the key challenges in exploration and mining projects?

Above: VECTOR drill-core scanning campaign.

Below: VECTOR researcher Shane Bergin explains the importance of education in addressing complicated challenges associated with exploration and mining



Geological pilot sites

- Irish Midlands, Ireland
- Kupferschiefer, Germany
- Jadar, Serbia (analysis of historic data only)

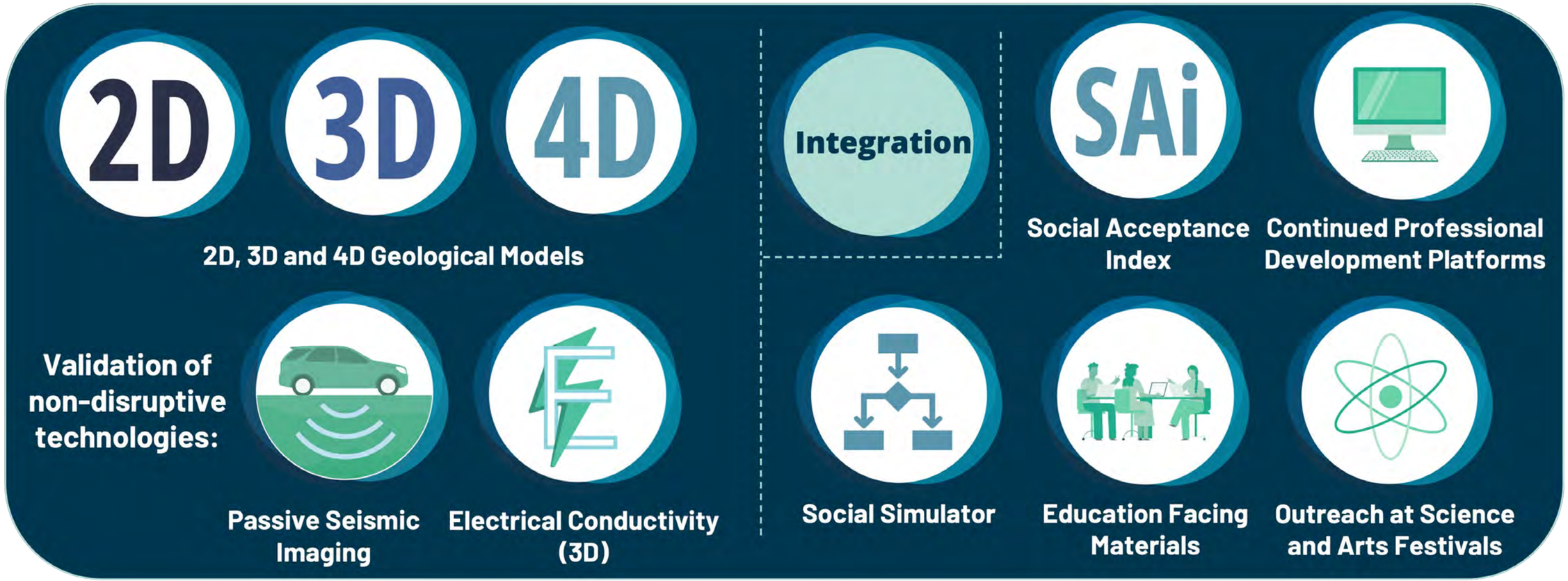
Core R&I targets/results

VECTOR's delivers evidence-based and accessible knowledge that integrates geoscience and social science pathways, to develop sustainable and responsible mineral exploration and mining.

Goals:

- A geological prospectivity toolkit based on a novel workflow using machine learning-based integration of less invasive geological, geochemical and geophysical measurements.
- Identification of how differences in societal values impact attitudes towards mining projects.
- An integrated toolkit that considers both geological exploration potential, social and environmental factors.

Project Outputs



Vectors to Accessible Critical Raw Material Resources in Sedimentary Basins

VECTOR

Co-funded by the European Union

UK Research and Innovation

Project name

VECTOR

Short description

Vectors to Accessible Critical Raw Material Resources in Sedimentary Basins

Project duration

1 June 2022 – 31 May 2025

Budget

€7,474,006 (€5,606,679 EU contribution)

TRL level

6

Major industrial/research partners

Teck, Boliden, Rio Tinto, Natural History Museum, Terranigma, iCRAG Irish Centre for Research in Applied Geosciences, UCD Dublin, HZDR Helmholtz Zentrum Dresden Rossendorf, Group Eleven Resources Corp., GFZ Helmholtz Centre Potsdam, Institut za izsledvane na promyanata, Clave Asistencias Técnicas, srk exploration, KSL, Satarla, CSIC Consejo Superior de Investigaciones Científicas, Sazani Associates, eit RawMaterials, Terranta

Session 3:
R&I networks & communities

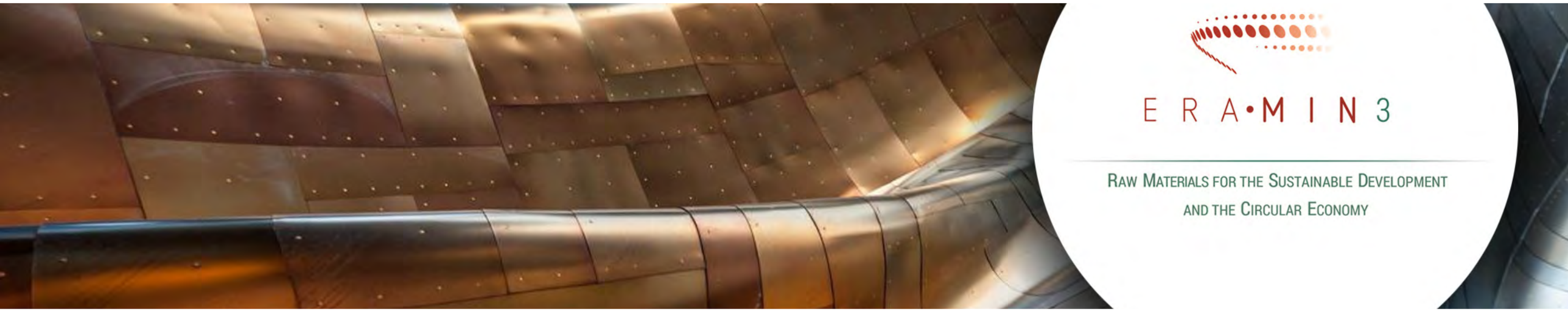
European Commission

ERA-MIN3

Dina Carrilho
Foundation for Science and Technology, Portugal

Funded by the European Union

A new R&I Agenda towards a pan-European partnership on raw materials for the green and digital transition



Dina Carrilho – ERA-MIN3 project coordinator
Foundation for Science and Technology (FCT) - PORTUGAL

PDAC 2024, 3-6 March – Toronto, Canada

Co-funded by the Horizon 2020 programme of the European Union

ERA-MIN3 - pan-European network of research funding organisations (2020-2025)

Co-funded by the Horizon 2020 programme of the European Union

ERA•MIN3

Raw Materials for the Sustainable Development and the Circular Economy

Participating countries and regions

The countries and regions of funding organisations participating in ERA-MIN, ERA-MIN 2, and ERA-MIN3 Calls by providing financial support to the R&I projects, as well as associated partners participating with own funds, are:

15
EU Member States Countries

- Bulgaria
- Czech Republic
- Estonia
- Finland
- France
- Germany
- Hungary
- Ireland
- Italy
- Poland
- Portugal
- Romania
- Slovakia
- Slovenia
- Spain

8
EU Member States Regions

- Belgium-Flanders
- Belgium-Wallonia
- Belgium-Brussels
- France - Nouvelle Acquitaine
- Italy- Calabria
- Spain- Asturias
- Spain – Basque country
- Spain-Navarra

6
non-EU countries

- Argentina
- Brazil
- Canada-Québec
- Chile
- Perú
- South Africa

3
EU Associated Countries

- Norway
- Turkey
- United Kingdom

Eu Contribution
11,5 M€

Total Public funding
68 M€

Total Project costs
93 M€

Duration
14 years (2011-2025)

Funded Projects
88

ERA-MIN is fully aligned with the Critical Raw Materials Act

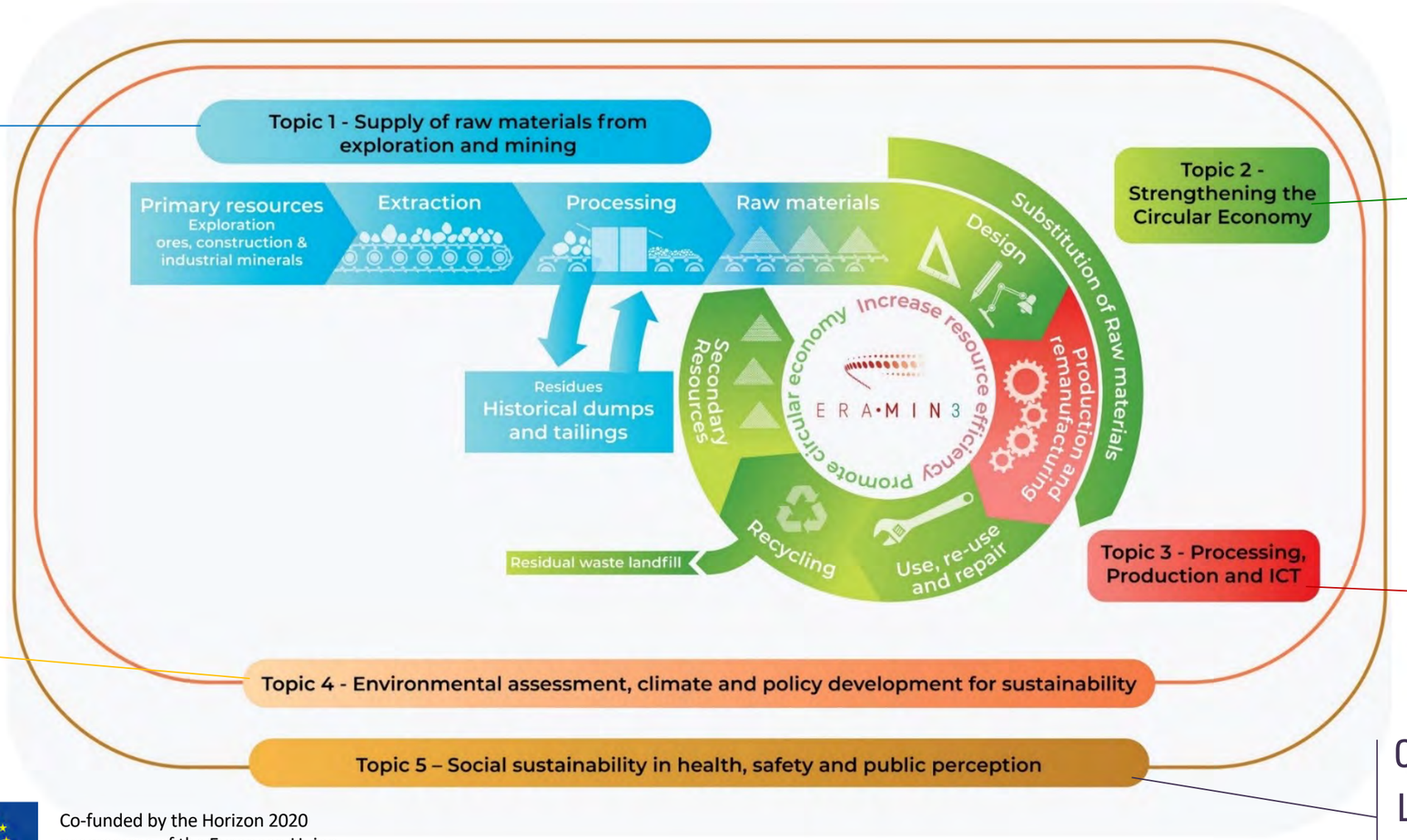
International, mutually supportive partnerships

Global engagement with reliable third countries

Research and innovation

National R&I programmes

Extraction
Geological resources
Economic resilience
Processing
Sustainable supply chains
Permanent magnets



Circularity
Recycling
Sustainable supply chains
Refining
Processing
Substitution
Permanent magnets

Green and digital ambitions

Simplify permitting procedures

Sustainability

Conflict resolution
Labour and human rights
Skills partnership

Co-funded by the Horizon 2020 programme of the European Union

ERA-MIN 3

Raw Materials for the Sustainable Development and the Circular Economy

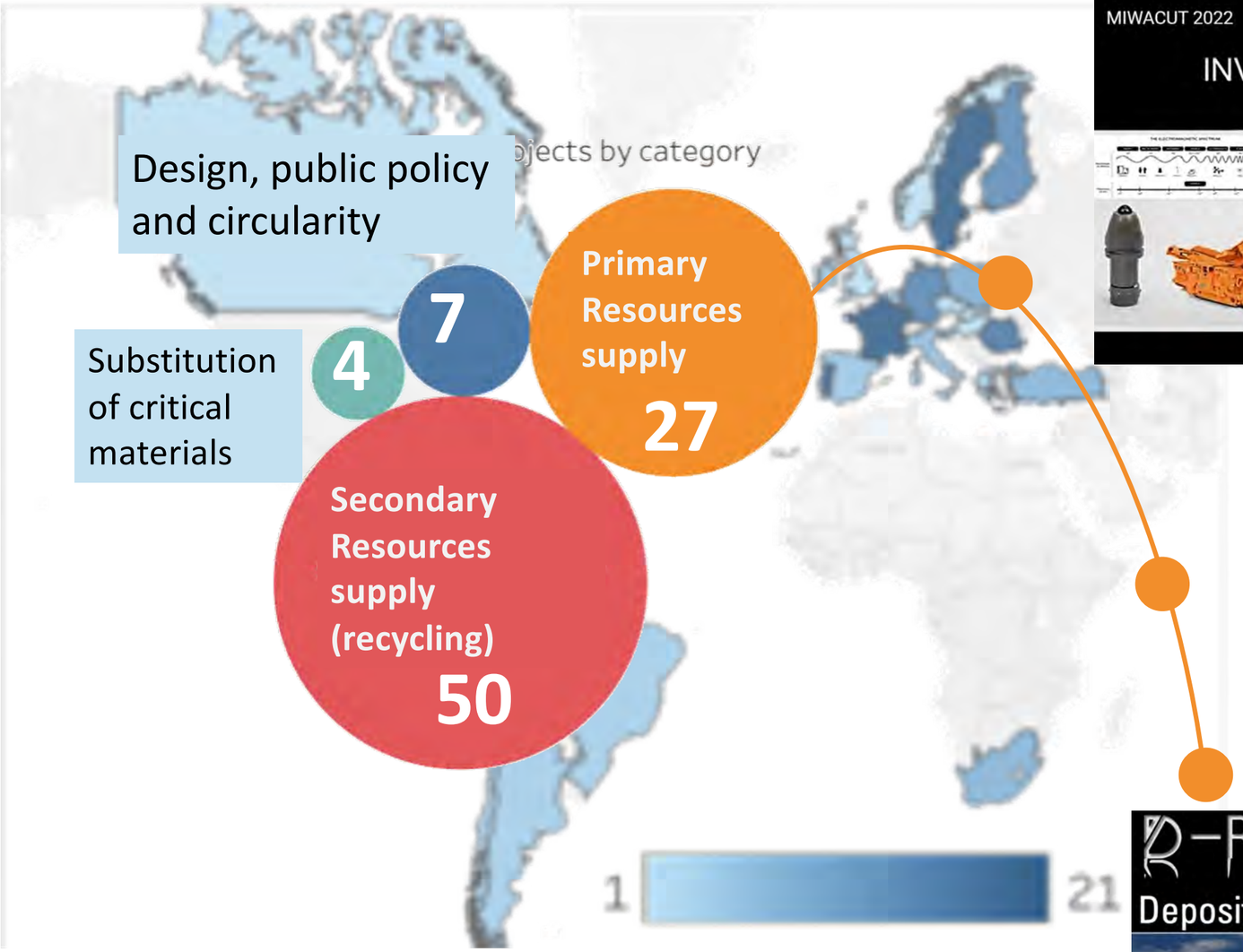
"**ERA-MIN**

is an excellent way to start international collaboration in research!"

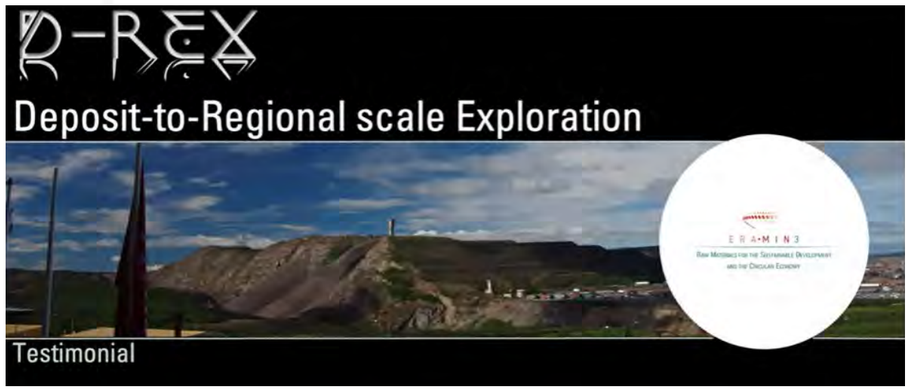
Co-funded by the Horizon 2020 programme of the European Union

ERA-MIN Dashboard

Examples of transnational R&I projects (2013-2023)



ERA-MIN 3
Raw Materials for the Sustainable Development and the Circular Economy
YouTube



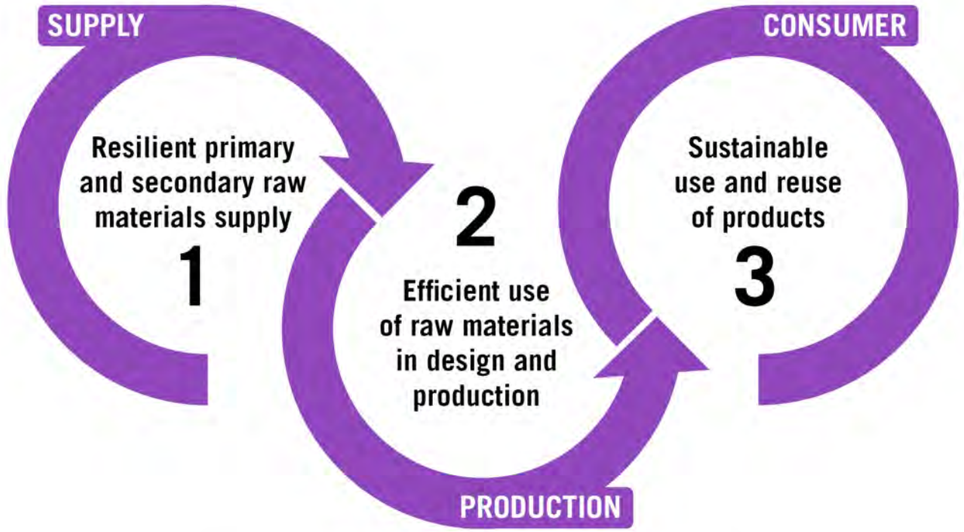
Co-funded by the Horizon 2020 programme of the European Union

New European Strategic Research and Innovation Agenda for Sustainable Use and Supply of Raw Materials (non-fuel, non-food)

ERA-MIN 3
Raw Materials for the Sustainable Development and the Circular Economy

Public consultation: March 1-15 at www. https://www.era-min.eu/ri-agenda

CORE THEMES

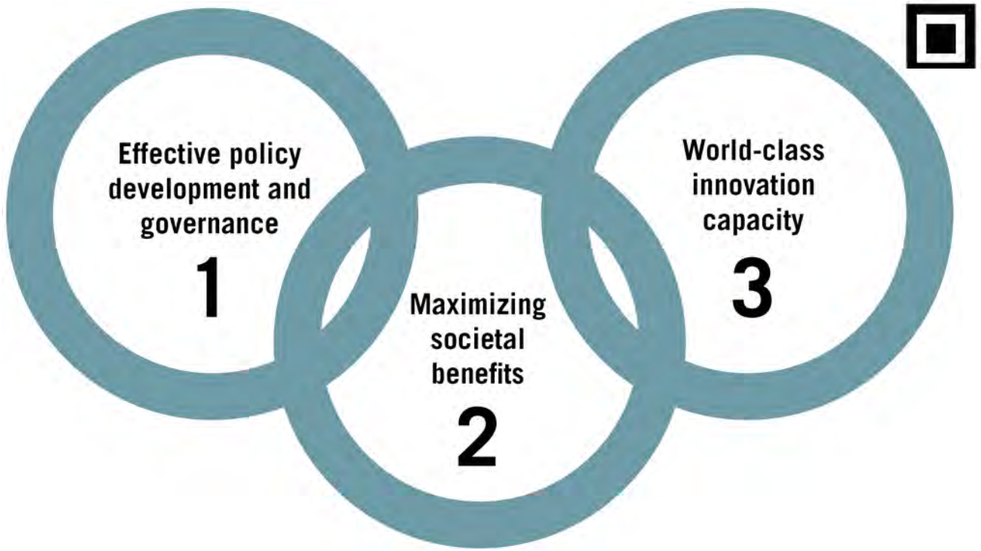


Technical innovation

Close to business

Focus within economic activity

TRANSVERSAL THEMES



Social innovation

Human-centric

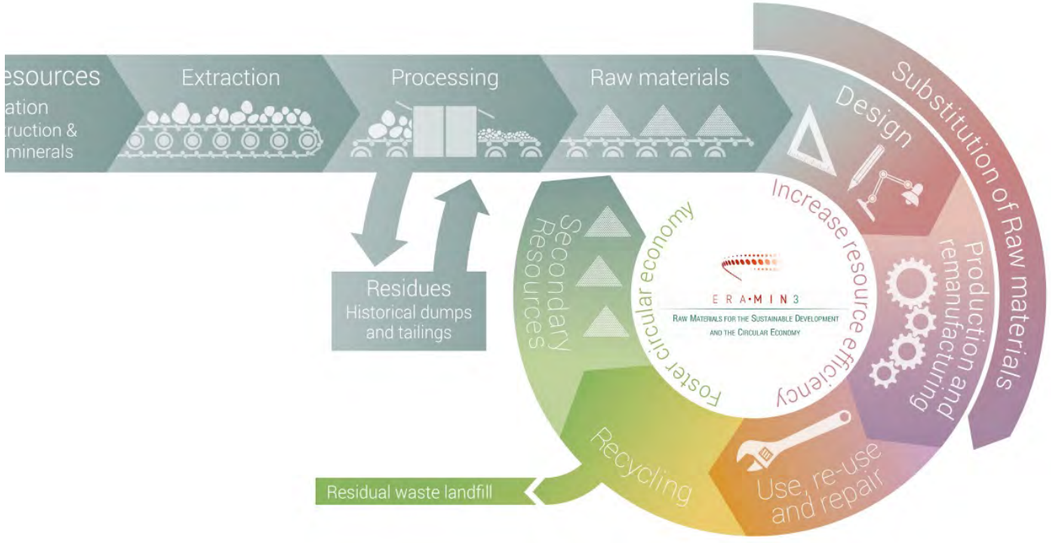
Focus on social and ecological sustainability

Co-funded by the Horizon 2020 programme of the European Union

Towards a pan-European partnership on raw materials for the green and digital transition (2025-2032)

Subscribe Newsletter

https://www.era-min.eu/newsletter



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ERA-MIN3 has received funding from the European Union's Horizon 2020 Research and Innovation Programme under grant agreement No. 101003575

Co-funded by the Horizon 2020 programme of the European Union

EuroGeoSurveys

Patrick Wall
EuroGeoSurveys,
Belgium

Funded by
the European Union

GSEU

GEOLOGICAL SERVICE | FOR EUROPE

EuroGeoSurveys & the GSEU Project – Towards a Geological Service for Europe

Patrick Wall

EuroGeoSurveys

patrick.wall@eurogeosurveys.org

Research & Innovation for mineral exploration and extraction in the European Union

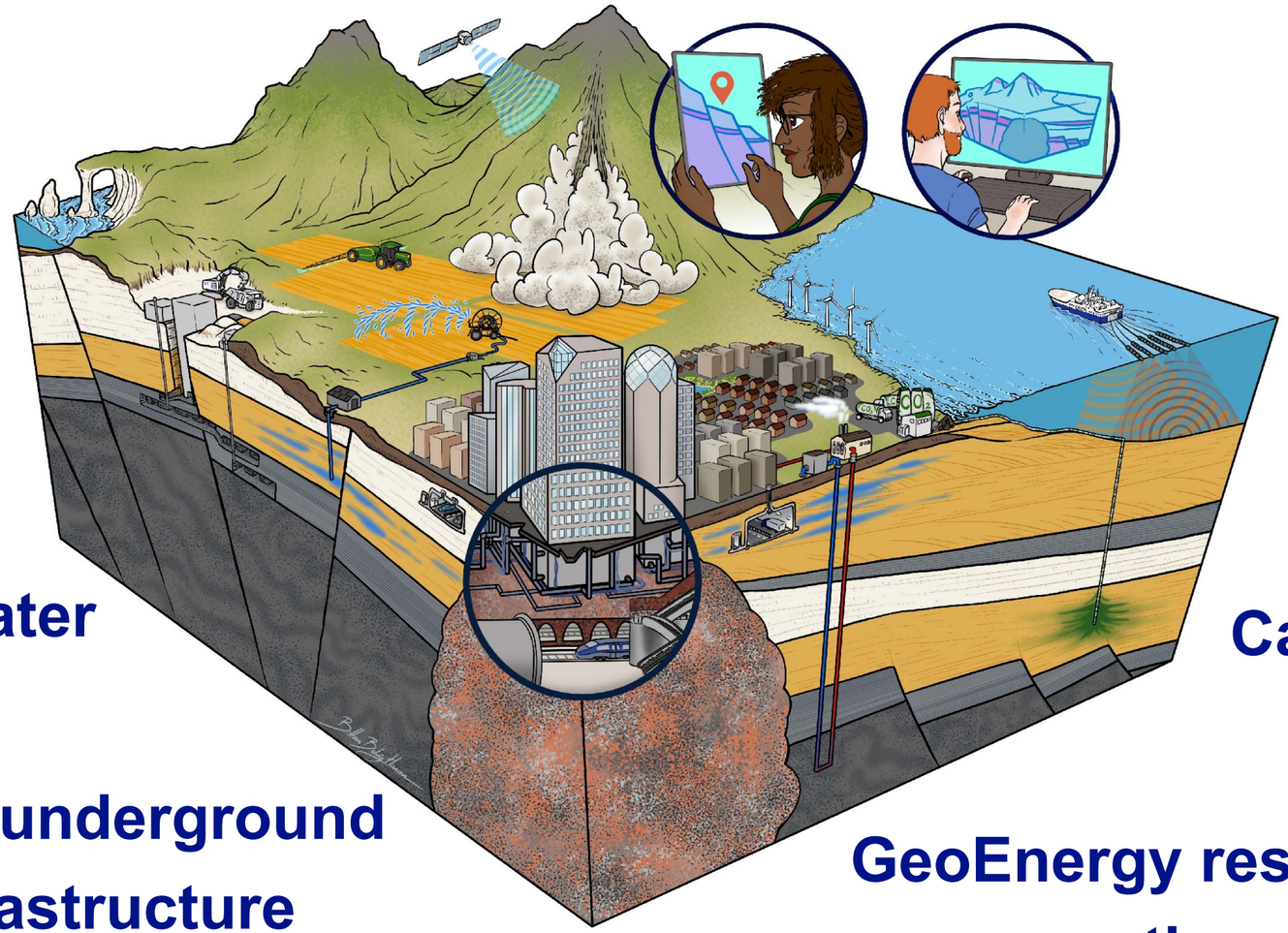
PDAC 2024 | 5th March 2024

Funded by the European Union

EuroGeoSurveys European Geoscience for Society

The Geological Surveys of Europe

Green Deal Policy and Earth systems are interconnected



Critical Raw Materials

Groundwater

Urban underground infrastructure

Onshore / offshore windfarm siting

Hydrogen storage

Carbon capture & storage

GeoEnergy resources – geothermal

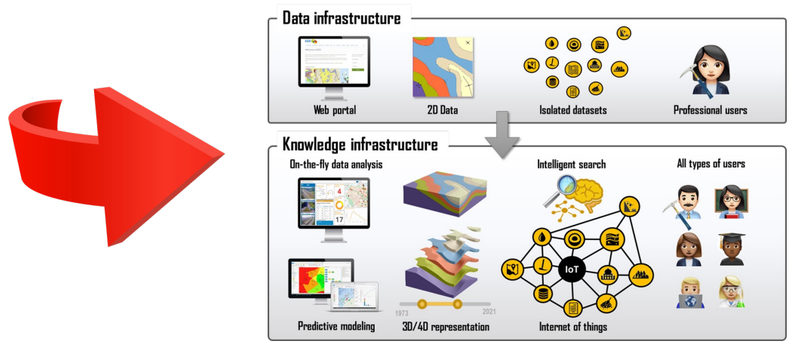
GSEU GEOLOGICAL SERVICE FOR EUROPE

There is a *critical need* for High-Quality Subsurface Data!

Pan-European problems require coordinated pan-European efforts & joint solutions!

GSEU GEOLOGICAL SERVICE FOR EUROPE

There is a *critical need* for High-Quality Subsurface Data!



EGDI

Pan-European problems require pan-European efforts & joint solutions!

We need to zoom out and go beyond national borders.

GSEU
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Why a GSEU?

The overall objective of the **GSEU** project is to establish a **Geological Service for Europe** as a permanent geoscience data, information, and knowledge-based advisory service supporting a sustainable future for Europe.

GSEU will structurally address specific challenges in the **sustainable management of the subsurface** at EU and national level.

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Project Structure

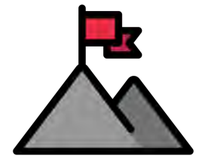
Developing harmonised data & Information service

Developing Information structure

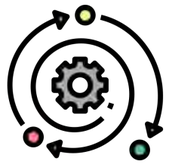
Communication, dissemination, exploitation & outreach

GSEU GEOLOGICAL SERVICE FOR EUROPE

Raw Materials



- Re-evaluate European resources of **primary critical raw materials in on- and offshore fields**
- Create an **International Centre of Excellence on Sustainable Resources Management** (EU ICE-SRM)
- Promote the use of the **United Nations Framework Classification** (UNFC) for resources



- Increase the potential for investment in **new exploration programmes** within Europe
- Increase the **sourcing of critical raw materials in Europe**
- Decrease Europe's dependence on imports

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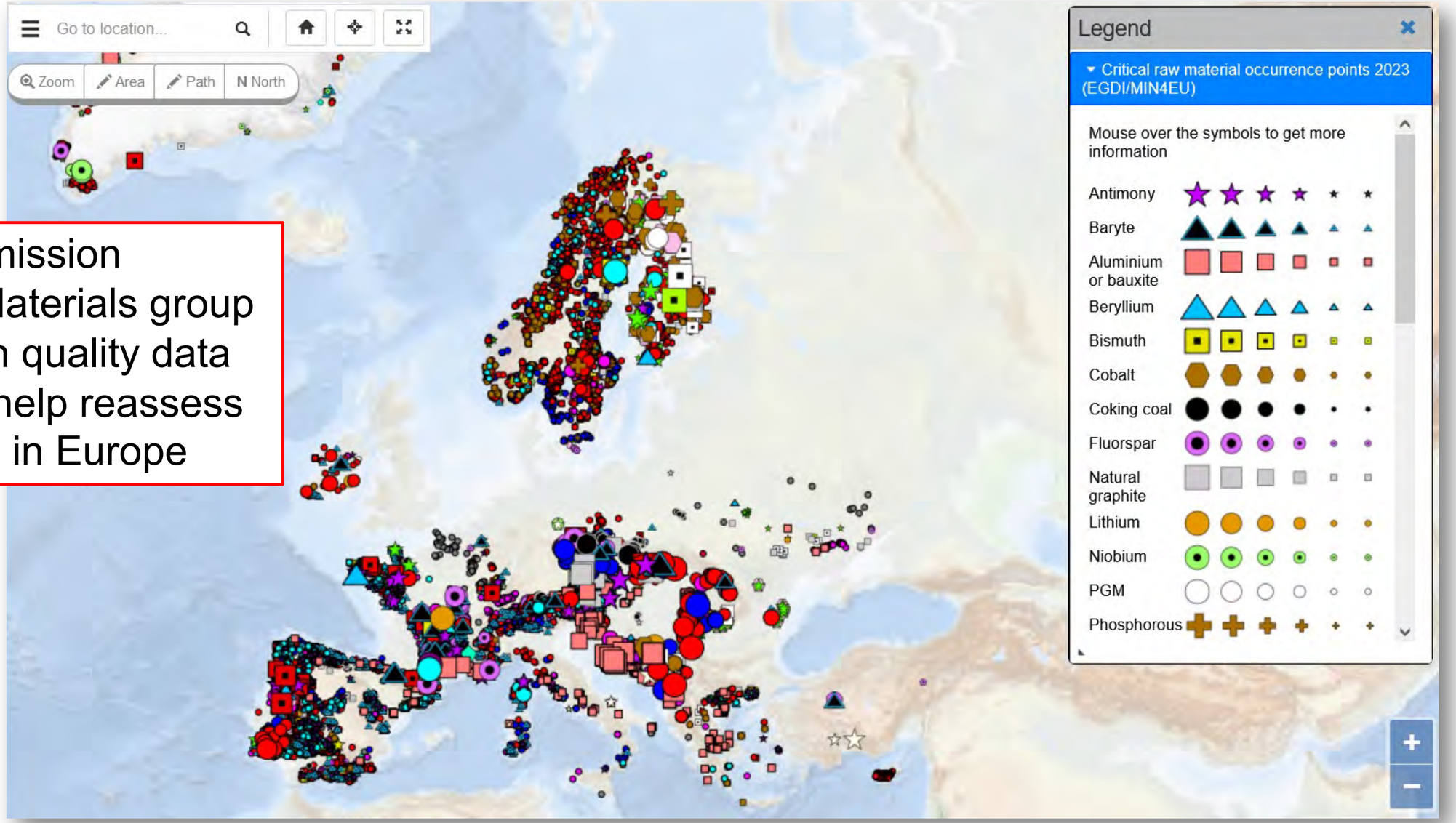
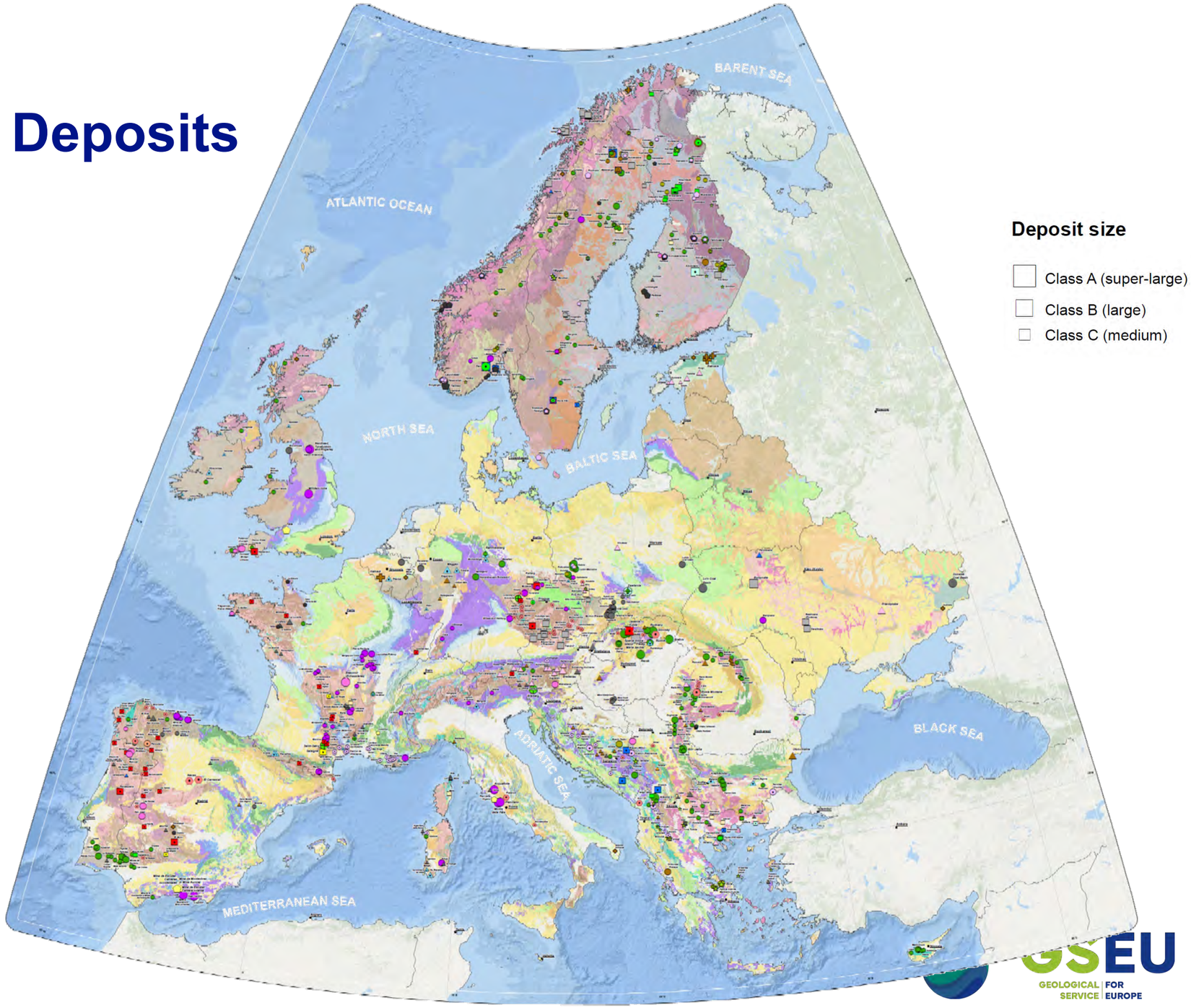
Europe’s potential of CRM deposits

The core mission of GSEU’s Raw Materials group is to provide high quality data and expertise to help reassess CRM deposits in Europe



CRM Hard Rock Deposits



Commodity

- Aluminium (metal)
- Antimony (metal)
- Arsenic
- Barite ($BaSO_4$)
- Beryllium (BeO)
- Bismuth (metal)
- Borate (B_2O_3)
- Cobalt (metal)
- Coking coal
- Copper (metal)
- Feldspar
- Fluorite (CaF_2)
- Gallium (metal)
- Germanium (metal)
- Graphite
- Hafnium (metal)
- Lithium (metal)
- Magnesite, Magnesium ($MgCO_3$)
- Manganese (metal)
- Nickel (metal)
- Niobium (Nb_2O_5)
- Phosphorous
- Phosphate (P_2O_5)
- Platinum, platinoids group metals
- Rare Earth Elements (REE_2O_3)
- Scandium (metal)
- Strontium
- Tantalum (Ta_2O_5)
- Titanium (metal)
- Vanadium (metal)
- Tungsten (WO_3)

Deposit size

- Class A (super-large)
- Class B (large)
- Class C (medium)

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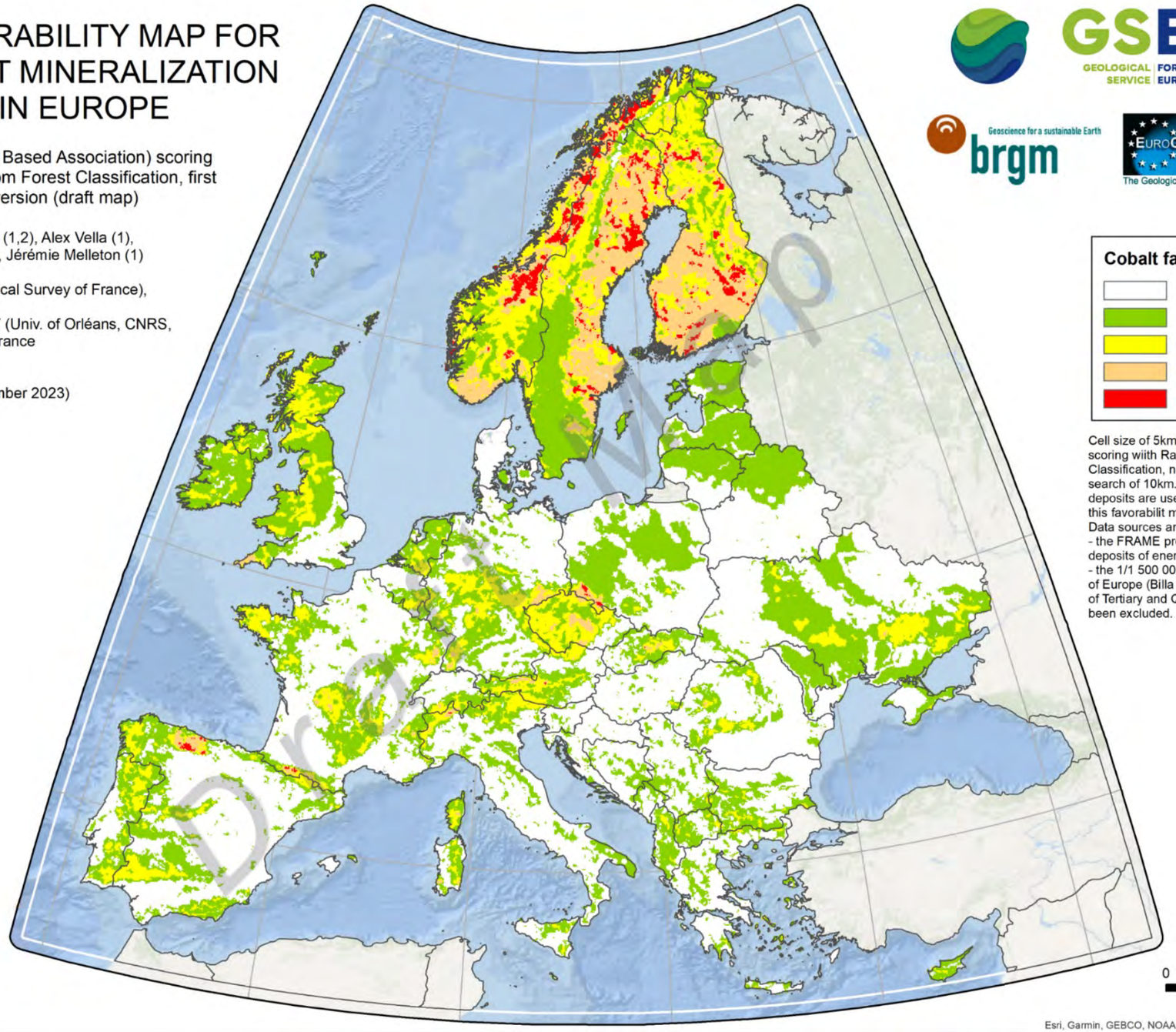
FAVOURABILITY MAP FOR COBALT MINERALIZATION IN EUROPE

DBA (Disc Based Association) scoring with Random Forest Classification, first version (draft map)

Guillaume Bertrand (1,2), Alex Vella (1), Capucine Albert (1), Jérémie Melleton (1)

1 – BRGM (Geological Survey of France), Orléans, France
2 – ISTO UMR7327 (Univ. of Orléans, CNRS, BRGM), Orléans, France

Version 0.1 (September 2023)



Cell size of 5km x 5km. DBA scoring wiith Random Forest Classification, neighbouring search of 10km. Only known deposits are used to produce this favorabilit map.
Data sources are:
- the FRAME project database on deposits of energy critical elements;
- the 1/1 500 000 geological synthesis of Europe (Billa et al., 2008); lithologies of Tertiary and Quaternary ages have been excluded.

CRITICAL RAW MATERIAL OFFSHORE OCCURRENCES OF EUROPE

Based on the 2023 CRM list of the European Commission

GSEU
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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

CSIC IGME

EuroGeoSurveys MREG MGEG

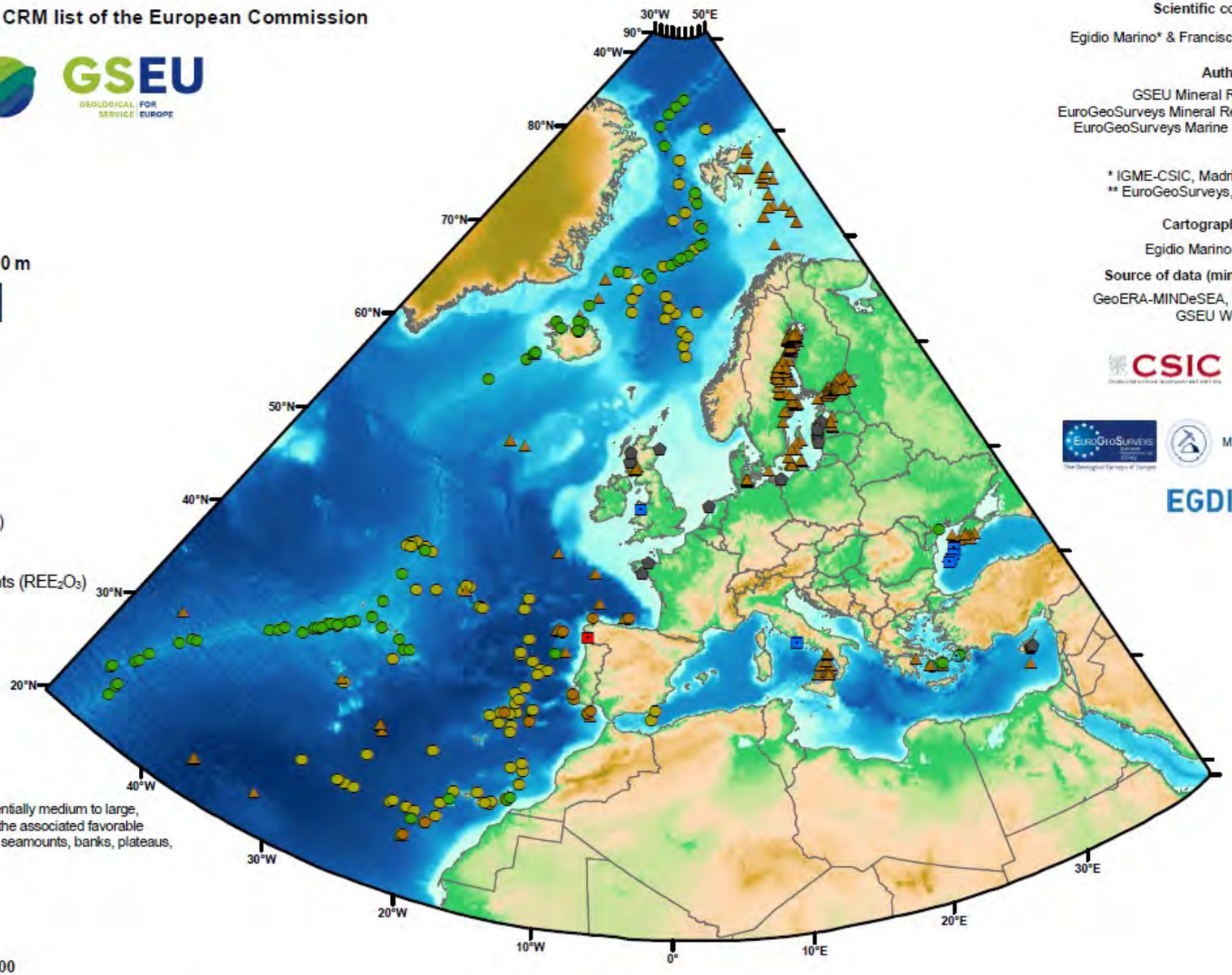
EGDI

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))

Scale 1:50.000.000

0 510 1.020 1.530 2.040 Kilometers

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

Version 2.1 - January 2024

WARNING:
The bathymetric data used for this Mineral Occurrences map of Europe was obtained by the GEBCO Compilation Group (2023) GEBCO 2023 Grid doi:10.5285/f98b053b-0cbc-6c23-e053-6c86abc0af7b)

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EU International Center of Excellence (ICE) on Sustainable Resource Management (SRM)

To provide accurate and high-quality reports, comparable throughout the EU and globally, each EU Member State needs **appropriately trained experts**.

The ICE SRM will support the implementation of the CRMA by establishing and maintaining a **network of experts**.

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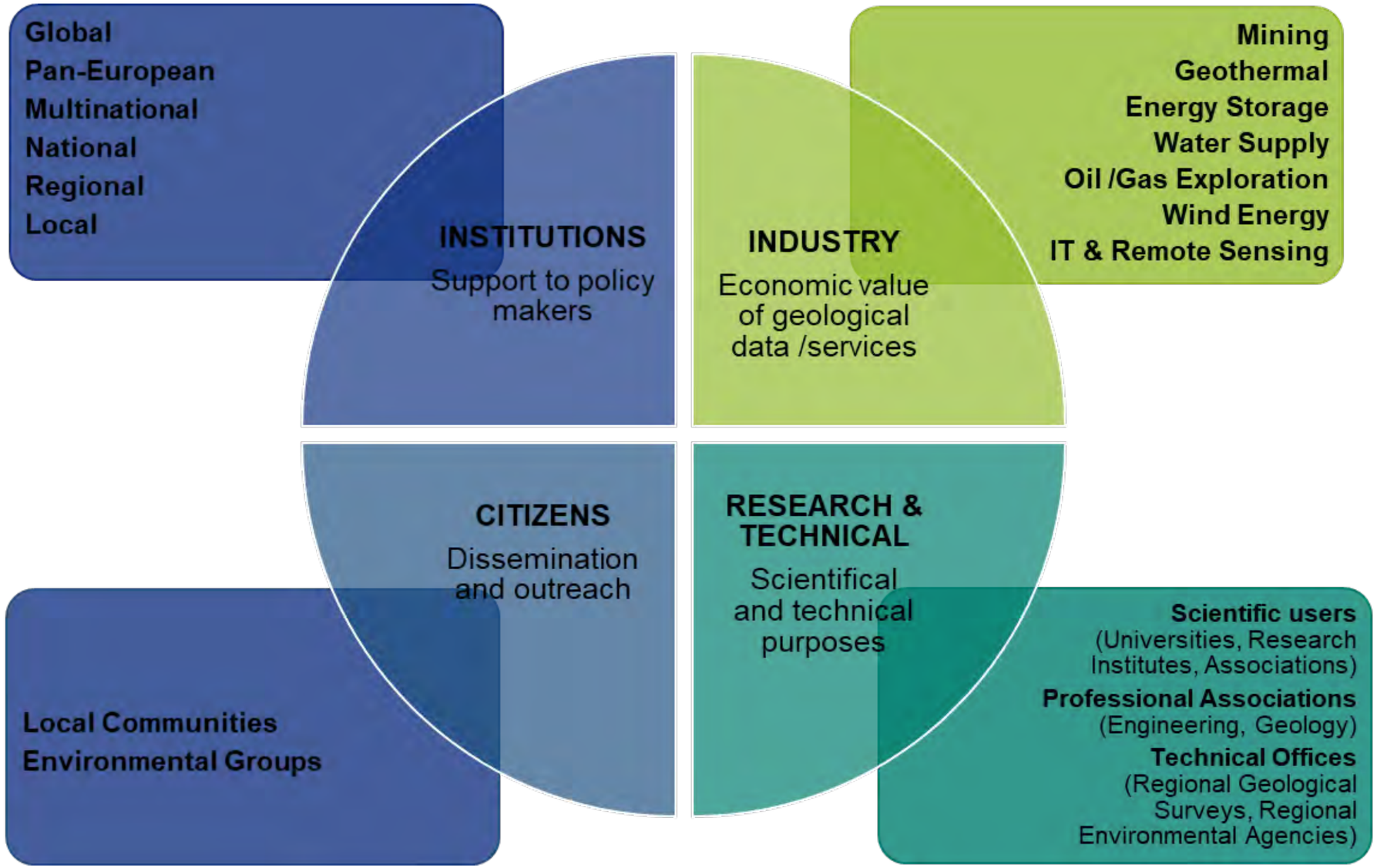
Stakeholder engagement is crucial




PDAC
GSEU

Smart Exploration Research Center

Alireza Malehmir
Uppsala University,
Sweden

Funded by
the European Union

UPPSALA UNIVERSITET

GÖTEBORG UNIVERSITY

LUNDS UNIVERSITET

Stockholm University

Smart Exploration Research Centre

knowledge and innovation for 21ST century mineral exploration

2024-2029

Supported by:
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Knowledge Gap

Focus has mainly been on ferrous and base metals in Sweden hence few studies conducted on CRMs, their fertility indicators, source rocks, carriers, …

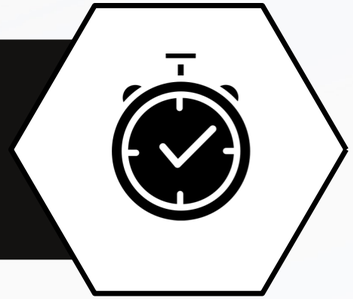
Lithospheric footprints and structures have not been studied like elsewhere and this is needed to bring in new and global players in Sweden and to explore tier 1-2 deposits

Tech solutions and rapid-response to exploration challenges are little developed in Sweden

Where are the new search spaces and why?

A focused knowledge centre on CRMs involving broader expertise and institutions is needed to lead new discoveries and to sustainably supply the Swedish demand and technology!

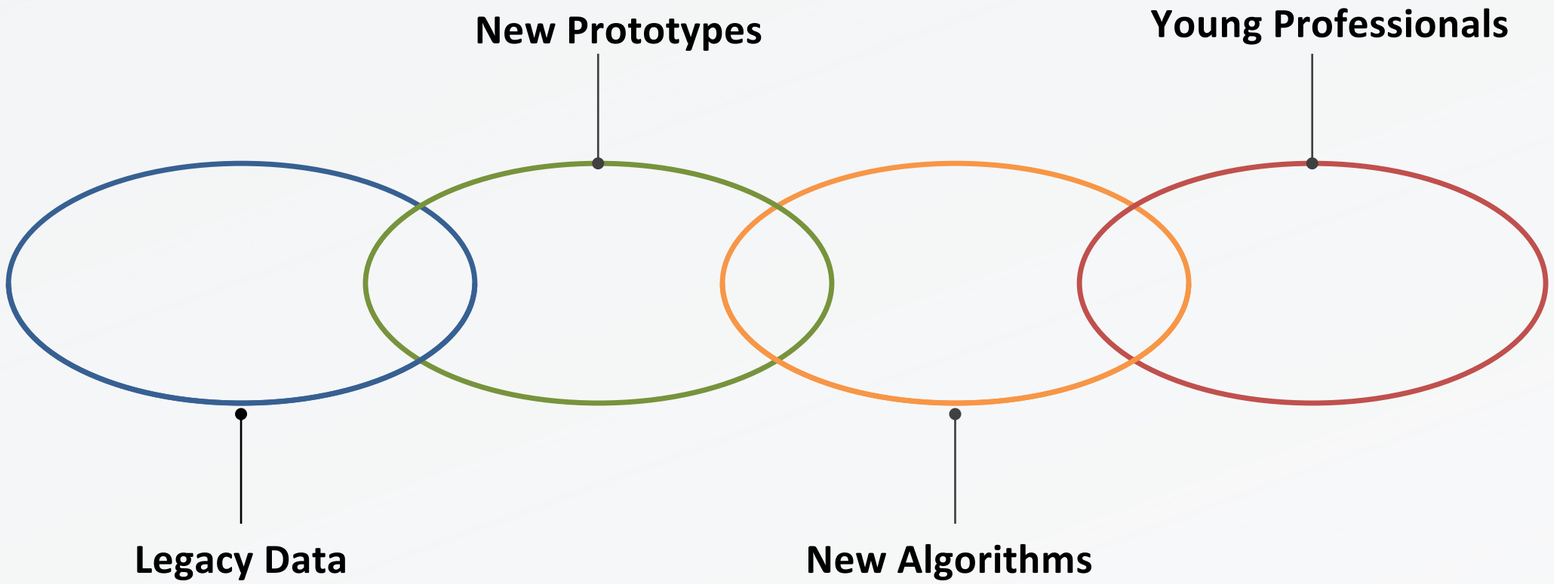
Sweden has the potential to be world-leading in **innovative** exploration solutions for CRMs, now more of a follower …

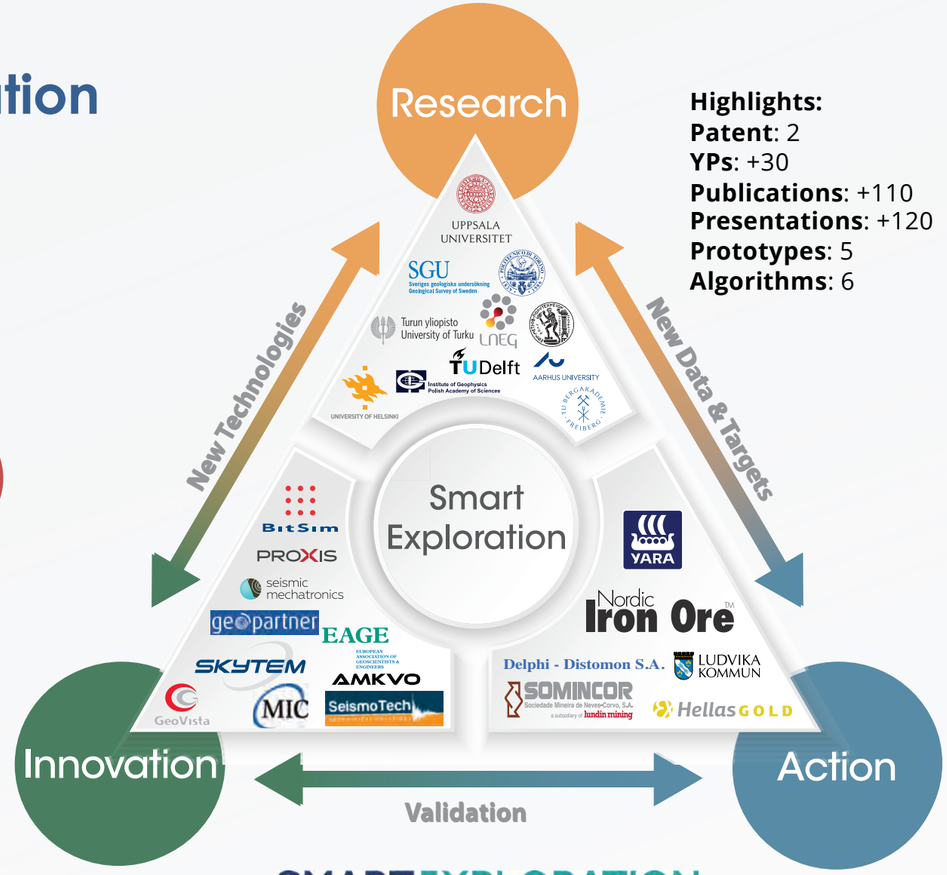


Building on a Legacy

SMART EXPLORATION RESEARCH CENTER

Europe needs more R&D projects like Smart Exploration





Highlights:
Patent: 2
YPs: +30
Publications: +110
Presentations: +120
Prototypes: 5
Algorithms: 6

Connecting the dots …

Research-Innovation and Actions with a focus on also Young Professionals

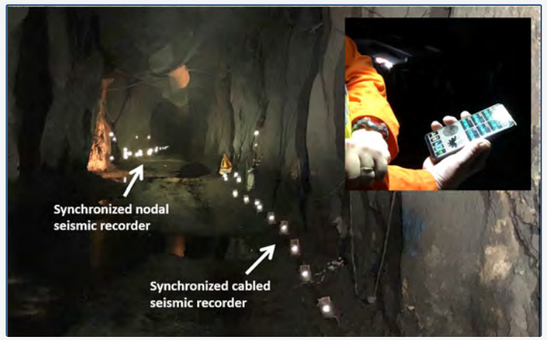
SMARTEXPLORATION
new ways to explore the subsurface

Smart Prototypes

SMART EXPLORATION RESEARCH CENTER

MIC UPPSALA UNIVERSITET

GPS-time transmitter



seismic mechatronics

E-Vib seismic source

SKYTEM

Deep penetrating HTEM

We must continue with hardware solutions …

SMARTEXPLORATION
new ways to explore the subsurface

UPPSALA UNIVERSITET

BitSim

Slimhole-modular system

UPPSALA UNIVERSITET

SGU
Sveriges geologiska undersökning
Geological Survey of Sweden

AMKVO

UAV-Ground Mag/EM system

First Break (August 2020)

Vision

Disruptive ideas and innovation for leading future of CRMs mineral exploration

Synergetic

A pool of four major universities, three tech, three mining, one consultancy and one municipality-associated entity

World-class

A fast-track hub for emerging needs of CRM exploration in Sweden, Nordic region and beyond

Excellence

Highly competent team, with a record number of publications, patents, start-ups, research grants and CRM deposit/mineral discoveries

Innovation

Measurable IPs and commercial solutions from world-class research

A dedicated hub (long-term) for high-profile science and innovation was long due!

SMART EXPLORATION RESEARCH CENTER

Centre Organogram

Hub 1

Green Sensing Technologies

Robotic, slimhole, geochem/petrophysics, UAV-ROV and digital platforms

Hub 2

Mineral systems

Lithospheric endowment & geodynamics
Ore forming processes
Secondary resources

Hub 3

Data analytics

Standardization
Dynamic data and model
Machine-learning solutions
Target ranking and vectors

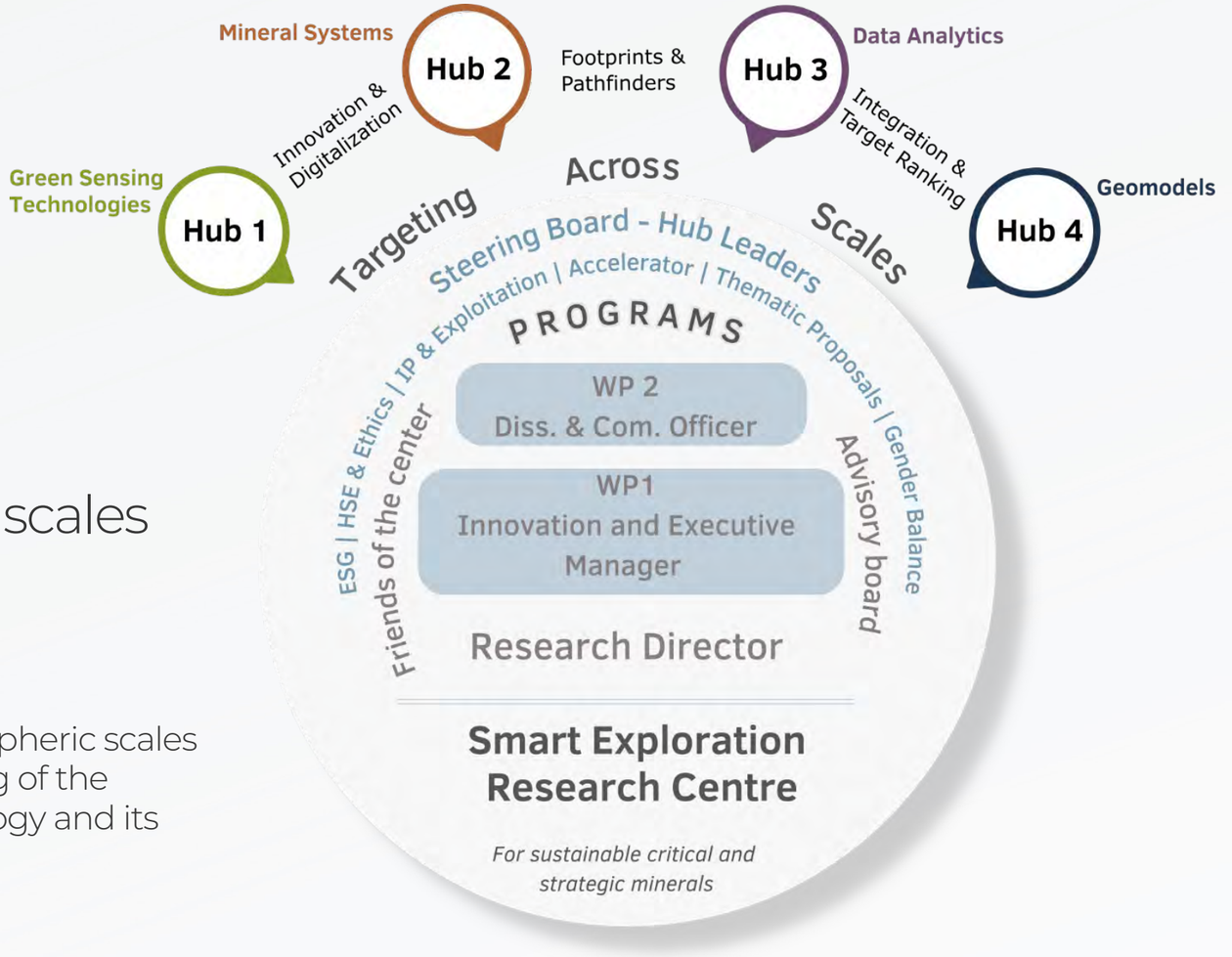
Hub 4

Geomodels

Plugins
Multiphysics & multichemistry
visualization & uncertainty

→ Targeting across scales

Both deposit and also lithospheric scales for improved understanding of the Fennoscandian Shield geology and its endowed mineral system



SMART EXPLORATION RESEARCH CENTER

Swedish Foundation for Strategic Research

THANK YOU!

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