

CAMMCRM

CENTRE OF ADVANCED MINING AND METALLURGY

CRITICAL RAW MATERIALS

Research and Innovation Actions within CAMM-CRM
Nils Jansson, Director

LULEÅ
TEKNISKA
UNIVERSIT

LULEÅ
UNIVERSITY
OF TECHNOLOGY

Supporting resilient and circular value chains for critical and strategic raw materials



-  >15 industry partners
-  >30 research projects
-  >40 researchers
-  >15 PhD students

EIGHT CORE RESEARCH TOPICS

- MINERAL SYSTEMS
- EXPLORATION METHODS
- GEOMETALLURGY
- MINERAL PROCESSING
- PROCESS METALLURGY
- ENVIRONMENTAL ASPECTS
- SECONDARY RESOURCES
- RECYCLING

FOUR RESEARCH PILLARS

RP1



GRAPHITE

RP2



BATTERY METALS

RP3



CRMS IN BASE METAL SYSTEMS

RP4



RARE EARTH ELEMENTS

WORK PACKAGES

- CRM ARENA
- STRATEGIC DEVELOPMENT SUPPORT

Research along the entire value chain



DISCOVERING

ORE GEOLOGY
EXPLORATION GEOPHYSICS



OPERATING

MINING AND ROCK
ENGINEERING



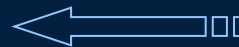
CONCENTRATING

MINERAL PROCESSING
PROCESS METALLURGY
CHEMISTRY

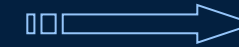


CLOSING

APPLIED GEOCHEMISTRY
SOIL MECHANICS



PROCESS IT
ROBOTICS AND AI
CONTROL ENGINEERING
OPERATION AND MAINTENANCE ENGINEERING
INDUSTRIAL PRODUCTION ENVIRONMENT
HUMAN WORK SCIENCES
ECONOMICS



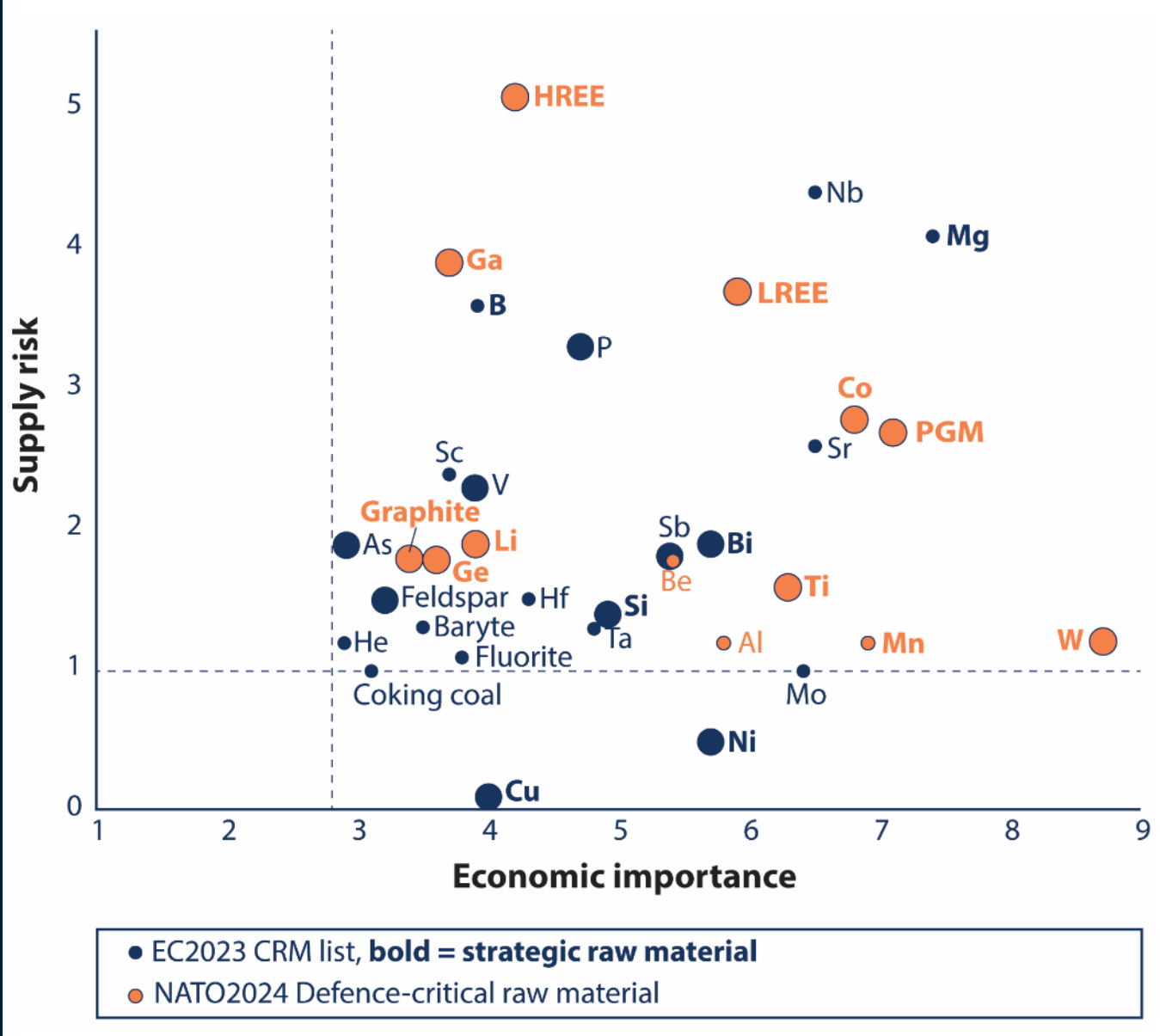
Scan me!

The EC2023 classification

Critical Raw Materials Act 2024 EU Goals for 2030:

- $\geq 10\%$ Extraction
- $\geq 40\%$ Processing
- $\geq 25\%$ Recycling
- $\leq 65\%$ Dependency
- Speed up strategic projects
- De-risk CRM supply chains
- Promote circularity & sustainability

Sweden has the potential to supply many of the CRMs, and many have a very long research history at LTU



RMIS - Critical and strategic materials



Mineral systems project



Geometallurgy project

Mineral processing project



Process metallurgy project



Secondary resources project

Recycling project

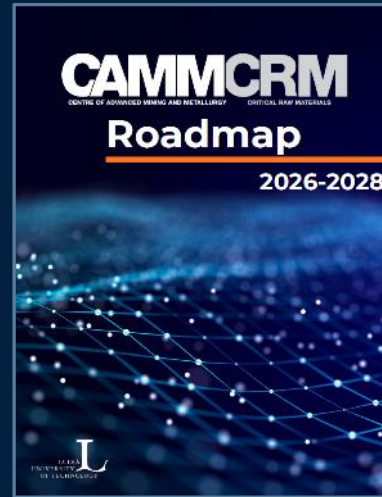


Siloed efforts slow down progress and lead to suboptimization

CAMM-CRM counteracts fragmented CRM research through focused research pillars

Research pillars for focused efforts and integrated solutions

- Mineral systems project
- Exploration methods project
- Geometallurgy project
- Mineral processing project
- Process metallurgy project
- Environmental aspects project
- Secondary resources project
- Recycling project



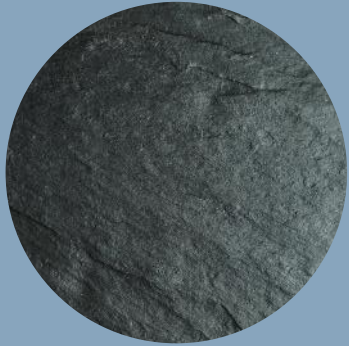
- Project generation
- Integration strategy

- Goals
- Deliverables
- KPIs
- Direction

Research pillars for focused efforts and integrated solutions



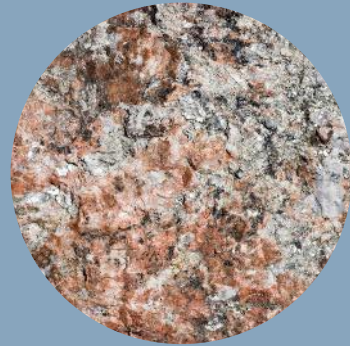
CAMM-CRM Research pillars



RP1: GRAPHITE

Lead: Medhi Parian

Sustainable Swedish graphite value chain from exploration to recycling.



RP2: BATTERY METALS

Lead: Edward Lynch

Secure Li-Co-Ni-Mn-Cu supply and recycling



RP3: CRMS IN BASE METAL SYSTEMS

Lead: Lina Hällström

Valorisation of CRMs as by- and co-products from existing operations



RP4: RARE EARTH ELEMENTS

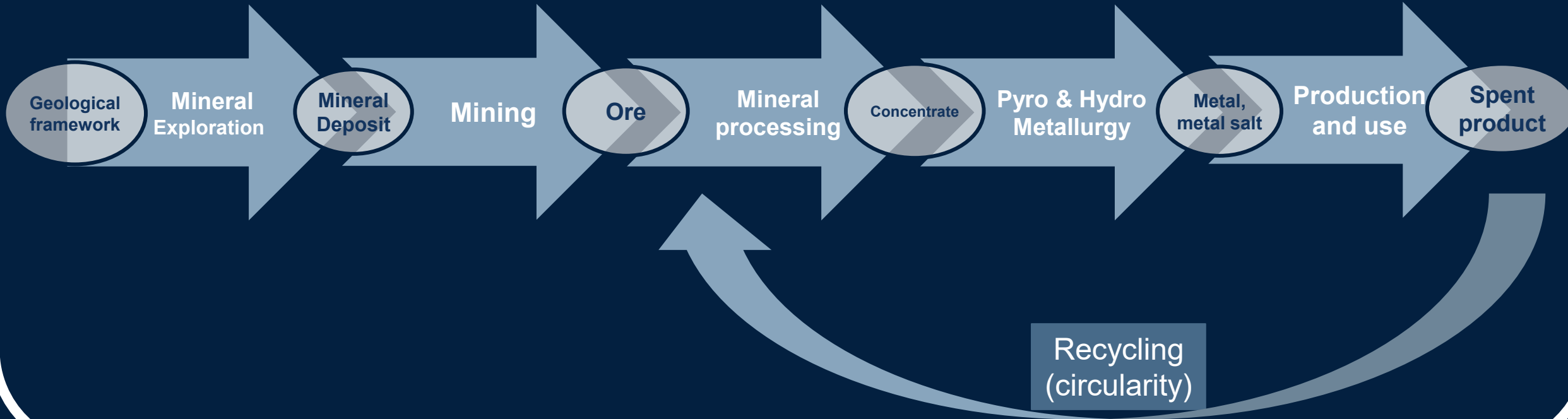
Lead: Lena Sundquist-Öquist

Primary and secondary REE supply chains for renewable energy, electrification, and defense security.

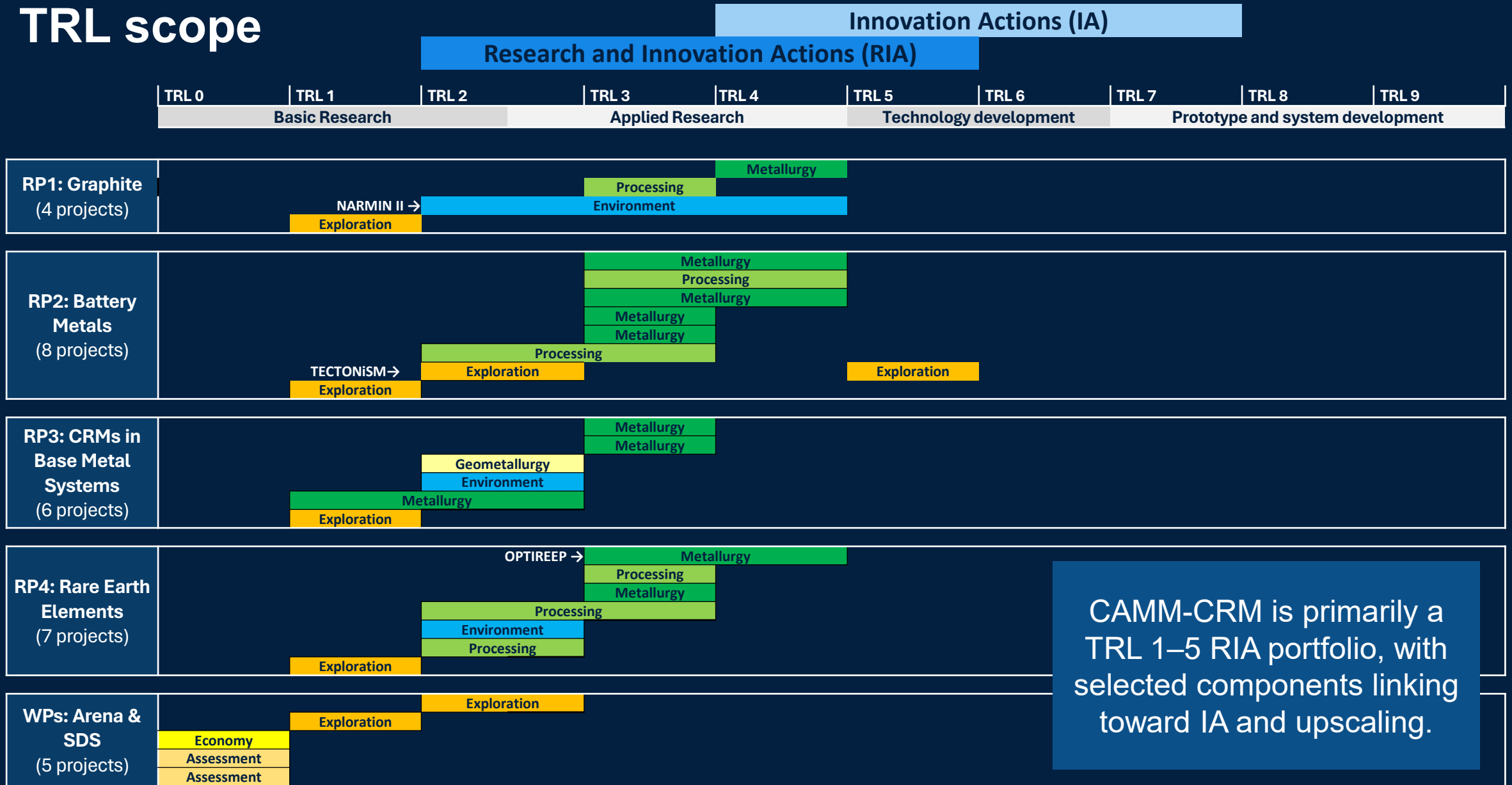
Process development across primary and secondary resources

Research questions applied to primary and secondary resources

Holistic Geo-metallurgical approach

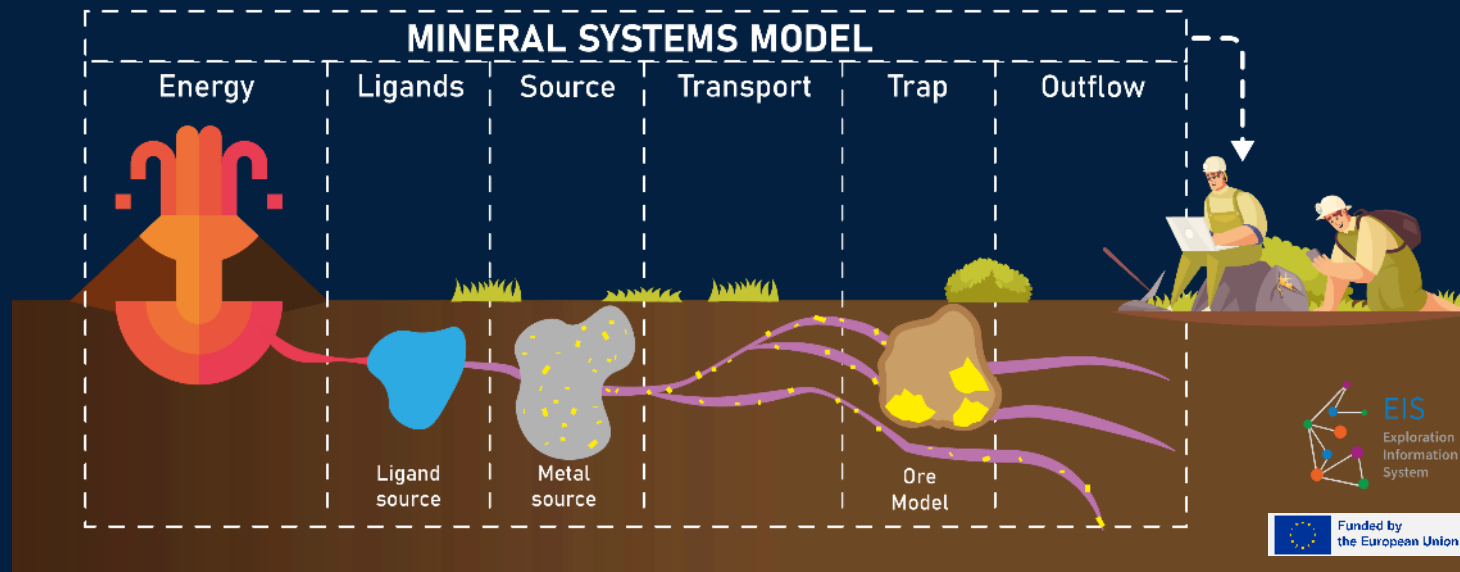


TRL scope



CAMM-CRM is primarily a TRL 1–5 RIA portfolio, with selected components linking toward IA and upscaling.

Mineral Systems Analysis



Improved exploration criteria for critical and strategic raw materials

Deposit types targeted by ongoing projects

- Graphite
- LCT pegmatites
- Rare metal granites
- Orthomagmatic Ni-Cu-PGE
- IOCG
- VMS
- Vein-type deposits

Process development

Both primary and secondary feedstocks

Ongoing projects in all research pillars

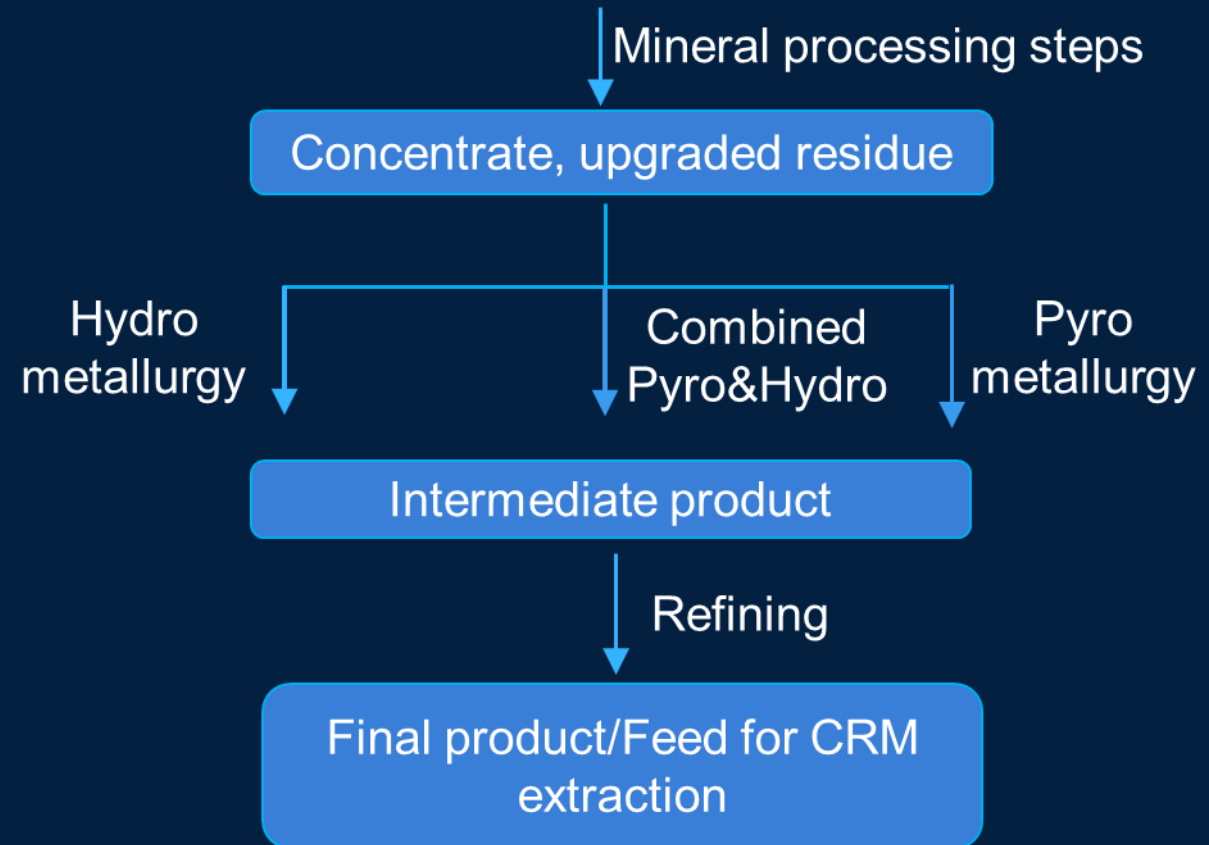
Integrated or stand-alone sustainable process development

Processing routes shaped by accompanying elements

Collaboration with industry, agencies and institutes ensure societal relevance and linkage to higher TRL activities



Process mineralogical characterization



Current CAMM-CRM project partners and collaborators



The CAMM-CRM research portfolio is embedded in a broad national network, which is essential for moving from RIA toward future IA and pilot activities

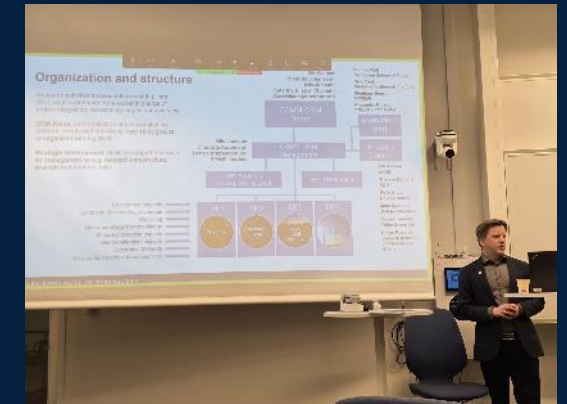
Collaboration



LTU representation at the semi-annual meeting of the **Compel battery initiative**



Joint workshop with social scientists from **SUN – Natural Resources for Sustainable Transitions**



IEA ETSAP CRM workshop with researchers in **Energy Science**



Input to **SGU's** government assignment on test-, pilot-, and demonstration infrastructure for critical raw materials.

Downstream linkage and integration



CAMM-CRM

- Sourcing of raw materials for batteries and other high-tech applications.
- Dedicated research pillars on graphite and battery metals.



RECAT (Research Center for Advanced Battery Technology)

- Sustainable battery materials.
- Process physics.
- Adaptive Manufacturing Intelligence.
- Integrated & Circular Development.



ACE (Arctic Centre of Energy)

- Batteries and battery systems in products & society.



Internationalization



Swedish-South American collaboration
Joel Andersson (LTU) visiting Irene del Real at Pontificia Universidad Católica de Chile.



Workshop of Critical Metals in Orogens, ANR project, Montpellier, France



Mitacs-Horizon Europe International Mobility award for Tarryn Cawood (UBC) and Stefanie Brueckner (Laurentian)



LTU booth at PDAC2026, Toronto, Canada



LTU booth at FEM2025, Levi, Finland

Training the next generation of experts

CAMM-CRM considers PhD and MSc training a critical component in increasing our raw material resilience

Meet our PhD students!



When: May 21, 2026
 Where: A117 LKAB salen
 Registration deadline: May 15
 Questions: sgabaltic.lulea@gmail.com



The SGA Baltic Student Chapter is organizing:
Rare Earth Elements (REE) – short course
 with
Prof. Michael Bau,
Prof. Frances Wall
 and
Prof. Simon M. Jowitt



This course provides an integrated overview of Rare Earth Elements (REE) in the Earth system, covering their role as critical raw materials (CRMs) – including major deposit types, ore-forming processes, and their strategic importance in modern technologies – as well as their use as tracers of environmental and hydrogeochemical processes. It is aimed at MSc students, researchers, and professionals with an interest in REE, CRMs, and geochemistry.

Michael Bau (Professor of Geoscience, Constructor University, Bremen, Germany) focuses on critical metals, particularly rare earth elements and yttrium (REY). His research takes a holistic approach, examining their biogeochemistry, resources, environmental behavior, and the evolution of their biogeochemical cycles throughout Earth history. His team investigates REY transfer within the lithosphere–hydrosphere–biosphere system, including ultralow concentrations in natural waters and organisms. His work identifying anthropogenic La, Gd, and Lu pollution has highlighted the need to consider critical metals in environmental monitoring programs, contributing to a broader understanding of emerging environmental risks associated with modern technologies.



Contact

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