

# **Technology Royalties & Metals Circularity** Valorization of mine tailings and other waste streams

Corporate Presentation – May 2025



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## About Geomega

Developing clean technologies to extract critical & strategic metals Sourcing from primary ores, mine tailings and industrial waste Founded in 2008 > \$23M investments in R&D since 2015 Growing IP Portfolio Technology licensing model - Royalties

Strong Technical Team Demo Plant Under Construction



## Analytical & Piloting Facilities









# Geomega's approach & its Core Technologies





# Where are the technologies being applied?

# End-of-life NdFeB magnet scraps (TRL - 7 to 8) Industrial Processing secondary feeds **Bauxite residues (TRL - 5 to 6)** Mining Sulphide tailings (TRL - 3 to 4)



#### Every new tonne of aluminum metal results in about 4 to 5 tonnes of bauxite residue<sup>1</sup>.



<sup>1</sup> International Aluminium Institute, 2022. Sustainable bauxite residue management guidance.

• <sup>2</sup> 2.55 t<sub>BR</sub>/t<sub>AI</sub> and 3% usage rate

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# **BR - Opportunity Overview**



\* Between 100 to 400 USD/t value depending on the bauxite ore used

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• www.geomega.ca • TSX.V: GMA • OTC: GOMRF



# **Complete BR valorization**

## **Advantages**

- Significant volume reduction (>80%)
- Maximize revenue
- Distribute environmental impacts and costs
- Mitigate market price fluctuations (Sc/REE)

## Challenges

- Reach 1<sup>st</sup> marketable products
- Minimize processing steps
- Lower OPEX and CAPEX

## **Benefits**\*

- Each 1Mt plant can generate around \$10M/yr in royalties
- Payback to client up to 4 years
- Target market penetration 10 to 20% of global annual production

<sup>1</sup> Based on internal techno-economic assessments and royalty estimates, supported by bench and piloting studies performed on BR of 6 clients from around the world



## **BR - Project development**

- Advancing the technology to licensing readiness
- Full ownership of the Intellectual Property by Geomega

- One of the most versatile solutions on the market
- Technology being vetted by several major global alumina producers

#### Timeline

#### 2020

Initial bench-scale testwork

### 2021

R&D development co-financed by



#### 2022

\$4M piloting and \$1M iron valorization projects launched, co-financed by

# **RioTinto**





2023



Pilot testwork for various clients





# **REE Magnet Recycling**



- Patent pending (provisional PCT application)
- Targeting to license to Western magnet manufacturers
- A growing strategic market

Financing from several organisms:







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#### **Competitive edge** versus other magnet recycling approaches:

Process chemistry and design:

- Readily available, non-aggressive main reagent
- Closed-loop reagent recycling
- Feed agnostic (coated scrap, swarf, etc.)
- Use of standard equipment
- Over 90% REE recovery

Rare Earths · Refining · Recycling







# Pyrrhotite tailings – process overview

- Over 100Mt of material stockpiled worldwide
- Limited technoeconomic potential reached by prior processing techniques

## **Process chemistry and design:**

- Main reagents recycling
- Iron extraction: High product purity and recovery rates
- Sulfur management: flexible commercial strategies as H<sub>2</sub>SO<sub>4</sub> or S elemental
- Process is economical without need for sulfur sales
- Recovery of Ni, Co concentrates
- Recovery of precious metals and PGM concentrates



Nickel concentrate (with other noble metals)

Sulfuric acid or elemental sulfur



# Pyrrhotite tailings - development status

- Technical maturity of different process steps between bench and piloting scales
- Process IP 100% owned by Geomega
- Applicable to sulphide tailings from other base metals mines



One of the winners on the **Pyrrhotite Resource Recovery Innovation Challenge** by Vale Base Metals



24.09.24 • Base Metals, ESG

## Vale Base Metals announces laureates of circular mining innovation challenge

Vale Base Metals is pleased to announce the laureates of the Pyrrhotite Resource Recovery Innovation Challenge, a competition aimed at enhancing the recovery of valuable metals and minerals contained in pyrrhotite.

The challenge invited researchers, innovators, and entrepreneurs to propose novel technological solutions for processing low-grade pyrrhotite tailings, a residue remaining from the mineral processing of sulphide ore. After a thorough evaluation process, three outstanding solutions have been selected as laureates, who will each be awarded a prize of C\$25,000.

"We are thrilled to recognize these innovative solutions that not only unlock value from waste but also contribute to sustainable mining practices," said Adam MacMillan, Director of Research and Innovation for Vale Base Metals. "The ingenuity and dedication demonstrated by the laureates are truly inspiring, and we look forward to seeing the impact of their work on the future of mining."



# Applying knowledge to low-grade ores

## **Montviel**

**REE + Nb Ferrocarbonatite** 



NdFeB magnet scraps

## Industrial **Bauxite residues**

**Sulphide tailings** 



## About the Montviel carbonatite deposit:

Located in Abitibi region, Quebec	82.4 Mt of ore indicated	> 184 Mt ore inferred	<b>1.5 %</b> total REO	<b>0.17 %</b> Niobium
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The **largest** bastnaesite resource in North America

Accessibility to power, logistics infrastructure and local workforce

Strong support from the Quebec government, local communities, and the Cree First Nations





# REE and extraction from bastnaesite

## Key advantages:

- No flotation needed
- Enhanced REE recovery
- Reagent recycling
- Lower water and reagent consumption
- Reduced carbon footprint
- High-grade iron by-product
- Limited or no tailings





## Final remarks



Ressources naturelles Canada









Strong support from industry and governments

Need for bulk & critical metals from secondary sources

Many opportunities in various industries and mining sectors

Advancing the technologies towards commercialization

Evaluating opportunities for our technologies to tap into lost value

Québec 🎽 🏄

RioTinto

SUSTAINABLE DEVELOPMENT TECHNOLOGY CANADA TECHNOLOGIES DU DEVELOPPEMENT DURABLE CANADA





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