NETZERO 2050 WITHOUT BIODIVERSITY LOSS

GSR
Global Sea Mineral Resources

Global Sea Mineral Resources NV

GSR is a member of the DEME-Group

www.deme-gsr.com


NETZERO
2050
WITHOUT
BIODIVERSITY
LOSS
Impossible
GSR
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Global Sea Mineral Resources NV
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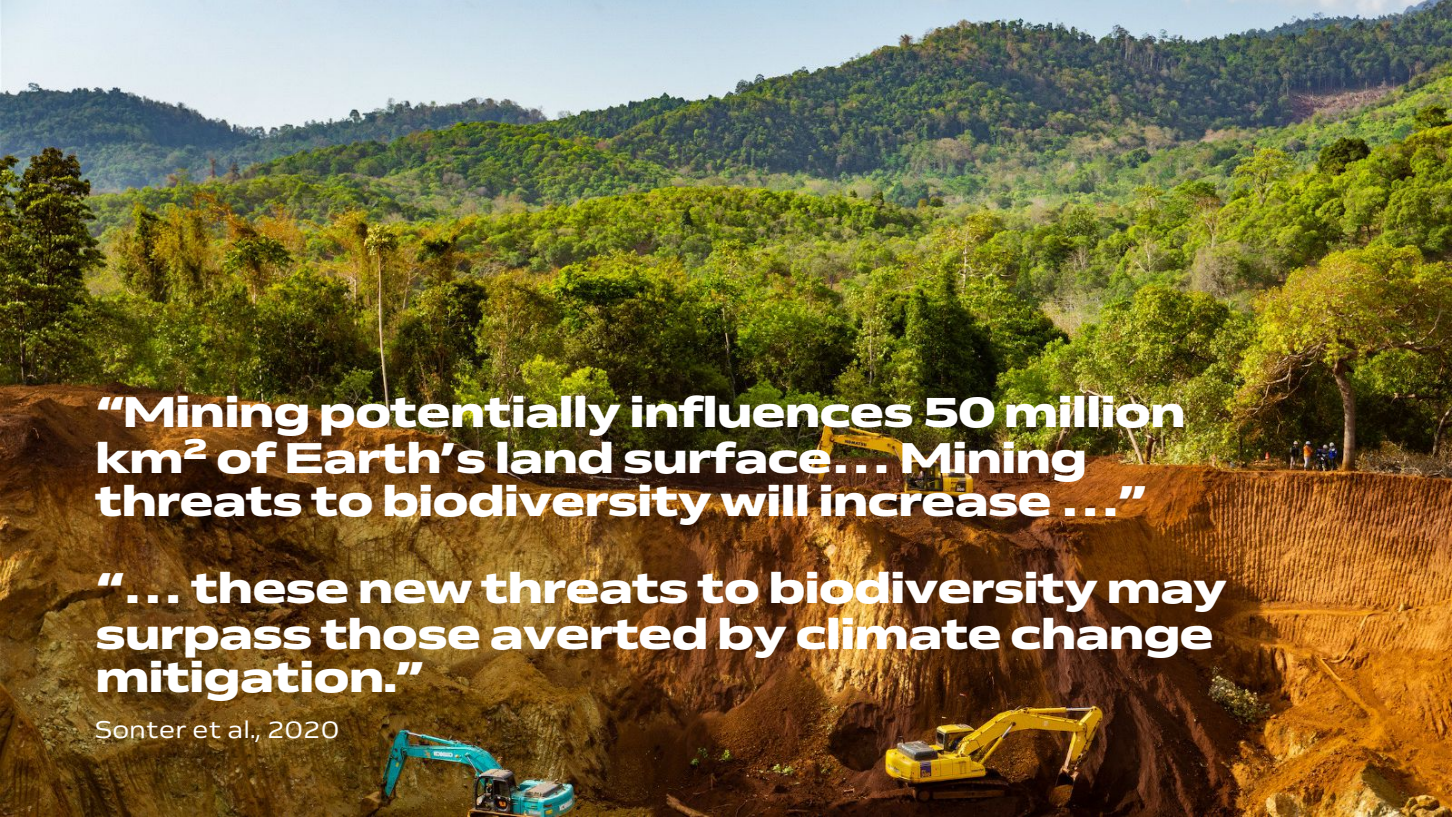
SUSTAINABILITY PARADOX

The problem is also the solution

Need for responsible mining solutions

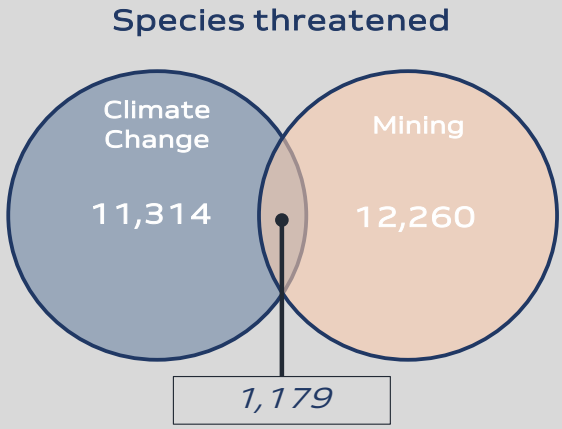

“Mining potentially influences 50 million km² of Earth’s land surface… Mining threats to biodiversity will increase …”
“… these new threats to biodiversity may surpass those averted by climate change mitigation.”
Sonter et al., 2020

HOW TO FUEL AN ENERGY TRANSITION WITH ECOLOGICAL RESPONSIBLE MINING?

PNAS 2023 – GROWING THREATS

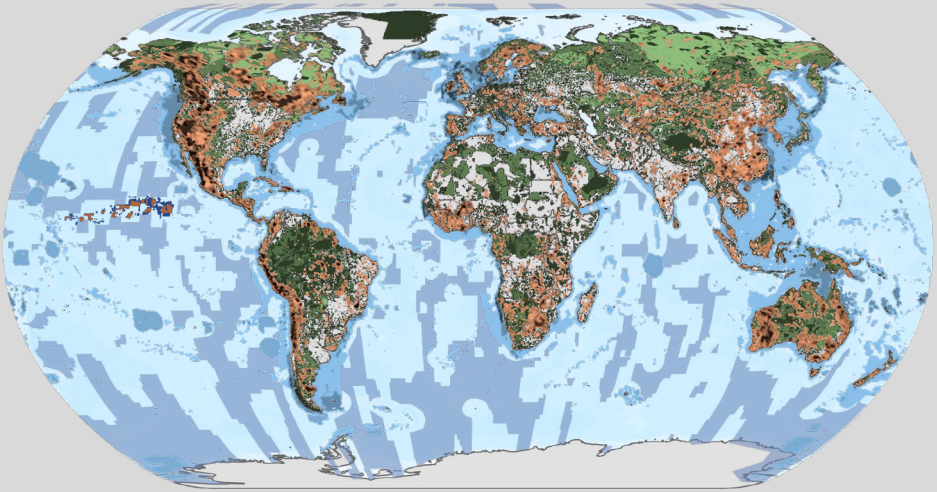
"Mining currently threatens a similar number of species as climate change (11,314 species vs. 12,260 species, respectively). Given that only 1,179 species (5%) are threatened by both, **minimizing the harm from mining and climate change together would be a huge win for conservation**. However, we are far from this trajectory."

Sonter et al. 2023



GLOBAL TRADE-OFFS | SOCIETAL CHOICES

Reversing biodiversity loss & stabilizing Earth's climate



- Renewable energy production will exacerbate mining threats to biodiversity, Sonter et al. (2020)
- A "Global Safety Net" to reverse biodiversity loss and stabilize Earth's climate, Dinerstein et al. (2020)
- Protecting the global ocean for biodiversity, food and climate, Sala et al. (2021)
- 30x30: A Blueprint for Ocean Protection, Greenpeace (2019)
- Exploration contract areas in the Clarion Clipperton Fracture Zone, ISA (2020)
- Exploitation potential (50%)

HOW TO FUEL AN ENERGY TRANSITION WITH ECOLOGICAL RESPONSIBLE MINING?

PNAS 2023 – KEY STEPS

"Since threats and impacts of mining vary geographically, **avoiding development in biodiverse places that are important for conservation could have a huge impact on outcomes. Mining nickel outside of the world's remaining old-growth tropical forests**, for example, could **reduce** total biodiversity losses **10-fold.**"

Sonter et al. 2023

"To make the necessary progress, the conservation community must prioritize **development of new tools to identify the sites most important for biodiversity conservation**, including irreplaceable sites that cannot be recovered (e.g., old-growth forests) and the facets of biodiversity that we cannot afford to lose (e.g., habitat critical for species persistence)."

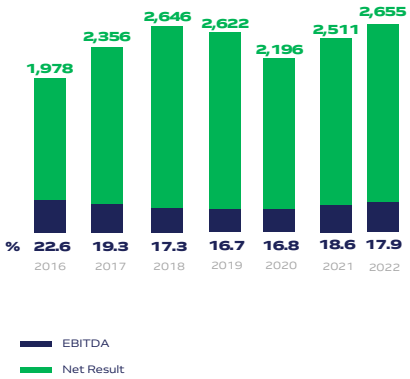
RESPONSIBLE DEEP SEABED MINING

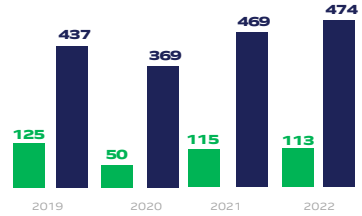
Project Development

- Introduction DEME
- Responsible deep seabed mining
  - Geological
  - Technical
  - Environmental
  - Regulatory
  - Economic
- Strategy and Schedule

The Group can build on more than 145+ years of know-how and experience and has fostered a pioneering approach throughout its history, being a front runner in innovation and new technologies. Although DEME's activities originated with its core dredging business, the portfolio diversified substantially over the decades. DEME's vision is to work towards a sustainable future by offering solutions for global, worldwide challenges: rising sea levels, climate change, the transition towards renewable energy, polluted rivers and soils, growing population and the scarcity of natural resources.

www.deme-group.com





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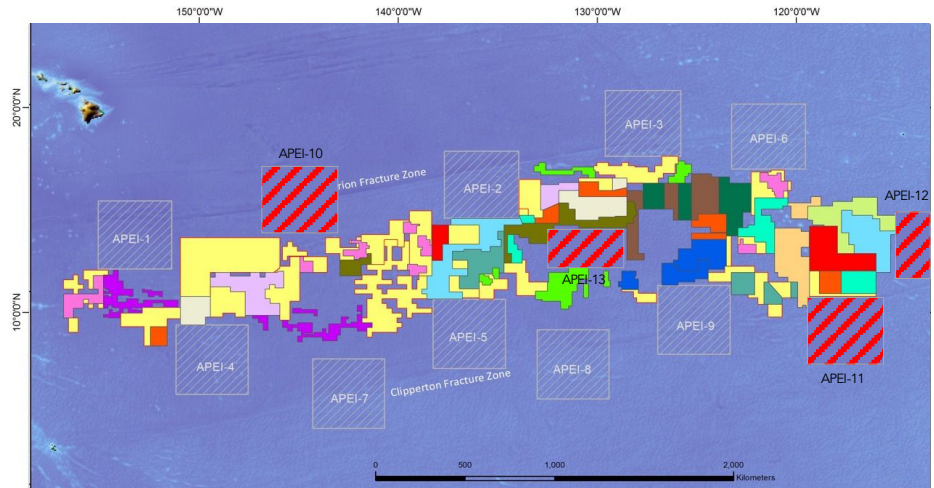
POLYMETALLIC NODULES

“Nodules in the Pacific Ocean contain more Mn, Ni, Mo and Co than the entire global terrestrial reserve base for those metals.”

Hein et al., 2020

CLARION-CLIPPERTON FRACTURE ZONE EXPLORATION AREAS FOR POLYMETALLIC NODULES



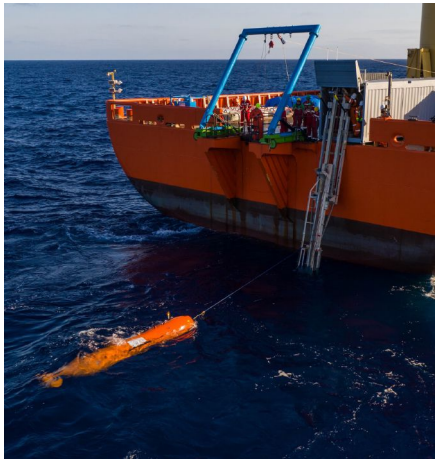
- Federal Institute for Geosciences and Natural Resources of the Federal Republic of Germany (BGR; Germany)
- Cook Islands Investment Corporation (CIIC; Cook Islands)
- China Minmetals Corporation (CMC; China)
- China Ocean Mineral Resources Research and Development Association (COMRA; China)
- Deep Ocean Resources Development Co. Ltd. (DORD; Japan)
- Global Sea Mineral Resources NV (GSR; Belgium)
- Government of the Republic of Korea
- Interoceanmetal Joint Organization (IOM; Bulgaria, Cuba, Czech Republic, Poland, Russian Federation and Slovakia)
- Blue Minerals Jamaica Ltd. (BMJ; Jamaica)
- Institut Français de Recherche pour l'Exploitation de la Mer (IFREMER; France)
- Marawa Research and Exploration Ltd (Kiribati)
- Nauru Ocean Resources Inc. (NORI; Nauru)
- Ocean Mineral Singapore PTE Ltd. (OMS; Singapore)
- Tonga Offshore Mining Limited (TOML; Tonga)
- UK Seabed Resources Ltd. (UKSRL; UK-I, UK-II)
- Yuzhmorgeologiya (Russian Federation)
- Reserved Areas
- Areas of Particular Environmental Interest (APEI)

Map Background Sources: Marineregions.org. Accessed at http://www.marineregions.org on 1 March 2016.
Oset Garcia, P., Souza Dias, F., Claus, S., De Hauwere, N., Vanhoorne, B., Hernandez, F., Mees, J. (2017). A new version of the Maritime Boundaries Geodatabase (Flanders Marine Institute).

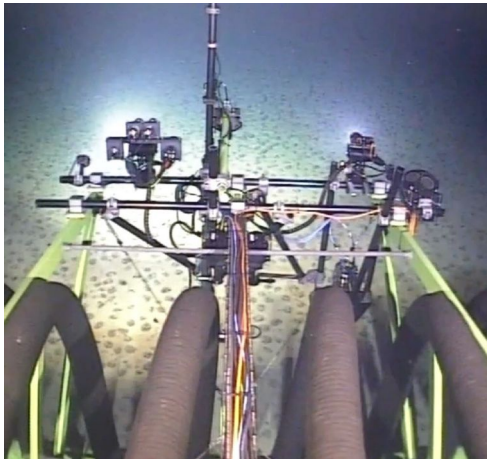
https://isa.org.jm/files/files/documents/ISBA_26_C_43-2110787E.pdf

OFFSHORE OBJECTIVES

Resource definition



Engineering Data

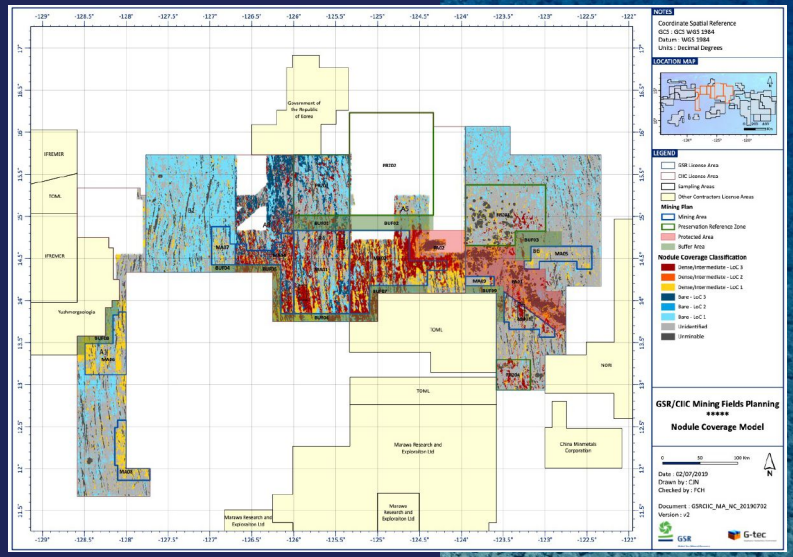


Environmental Baseline

AUTONEMOUS UNDERWATER VEHICLE

DATA INTEGRATION

- Areas of interest have been identified from the GSR and CIIC Concession and processed with ArcGIS software to generate the map for potential nodule fields
- Targeted areas represent 29,250 km² (20% of 150,000km²)
- Both GSR and CIIC concessions



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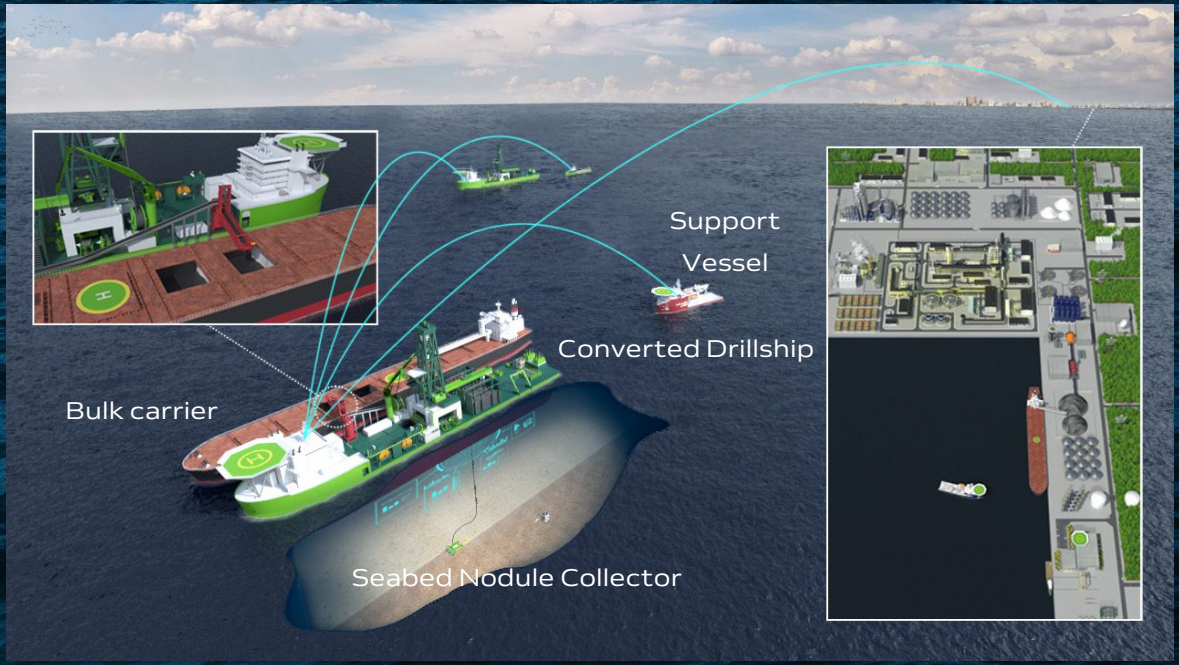
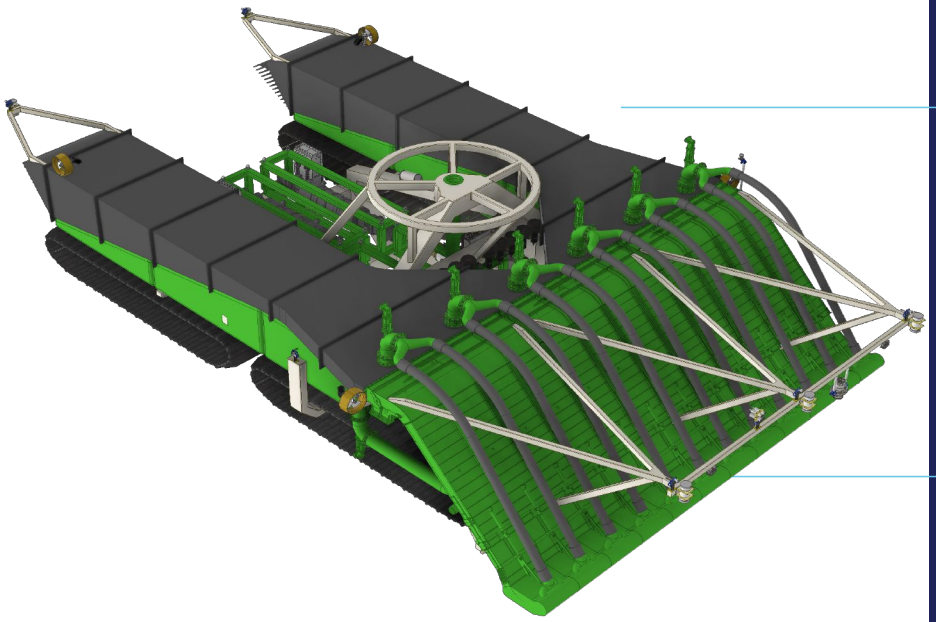
CONCEPT OF OPERATIONS



PROJECT OBJECTIVES PROCAT & COMPASS



- Propulsion System Design
- Auto-adaptive Steering System
- Collector Head Design

PRECAUTIONARY APPROACH

2017

Tracked Soil Testing Device

2020–21

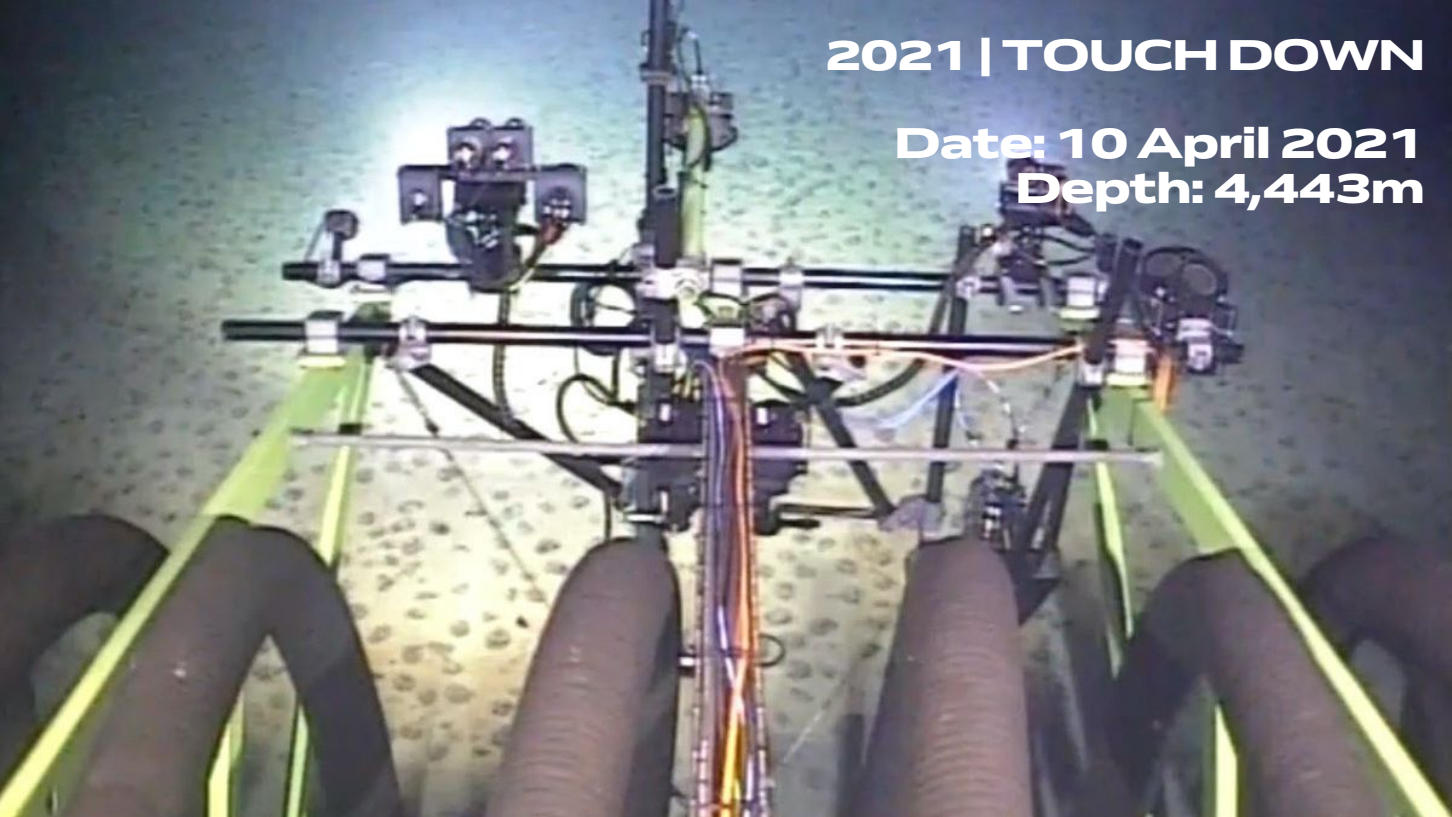
Pre – Prototype Nodule Collector

2024

Prototype Commercial Nodule Collector

GSRNOD21

Date: April – May 2021
Dives: 15


2021 | TOUCH DOWN
Date: 10 April 2021
Depth: 4,443m

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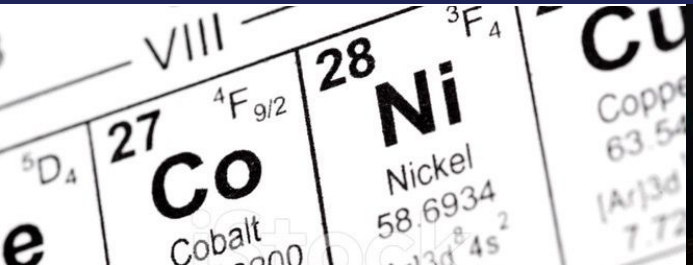
(unless otherwise indicated, for every protection available): ARIPO (BW, GH, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, rasian (AM, AZ, BY, KG, KZ, RU, TJ, L, AT, BE, BG, CH, CY, CZ, DE, DK, B, GR, HR, HU, IE, IS, IT, LT, LU, LV, , NO, PL, PT, RO, RS, SE, SI, SK, SM,

PROCESSING FLOW SHEET

Patentable Closed-loop High yields Zero-waste



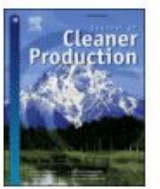
(-) 38% CO_2/KG METAL

Journal of Cleaner Production 330 (2022) 129884

Contents lists available at ScienceDirect

Journal of Cleaner Production

journal homepage: www.elsevier.com/locate/jclepro



Prospective life cycle assessment of metal commodities obtained from deep-sea polymetallic nodules

R.A.F. Alvarenga [a,*], N. Préat [a], C. Duhayon [b], J. Dewulf [a]

[a] Sustainable Systems Engineering (STEN), Department of Green Chemistry and Technology, Faculty of Bioscience Engineering, Ghent University, Coupure Links 653, B-9000, Ghent, Belgium

[b] Global Sea Mineral Resources NV, 8400 Ostend, Belgium

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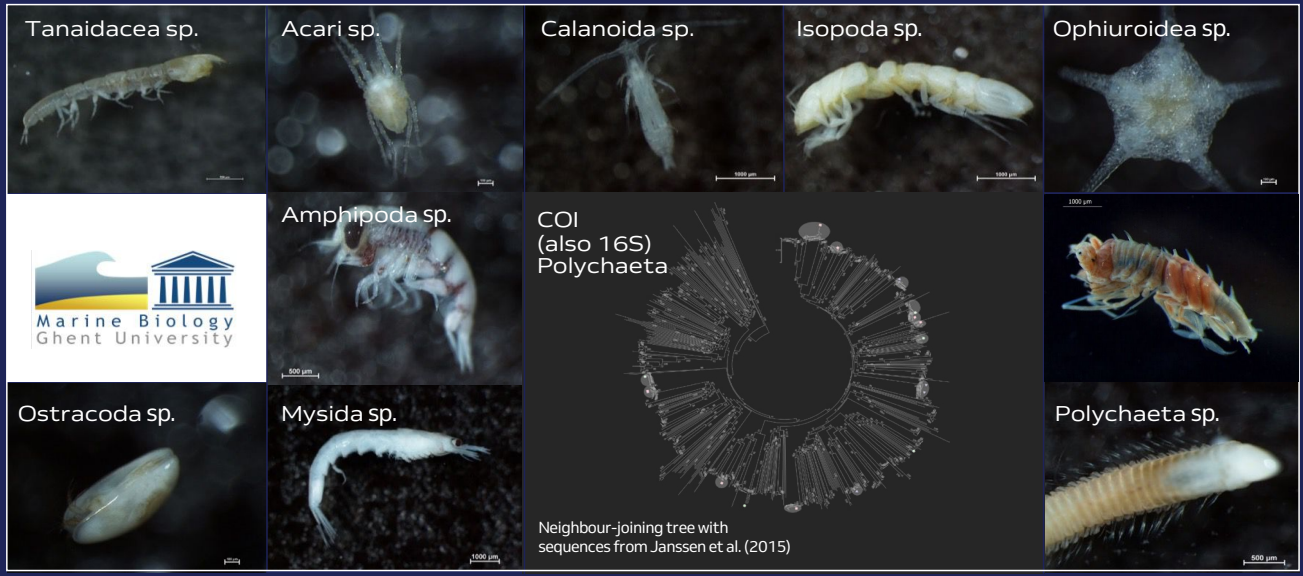
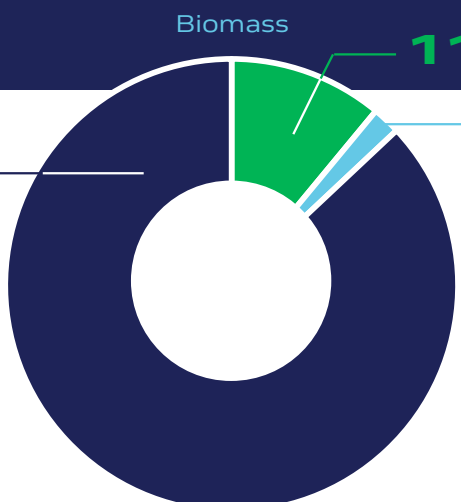
BIODIVERSITY, HABITAT, CONNECTIVITY & ECO-SYSTEM FUNCTION



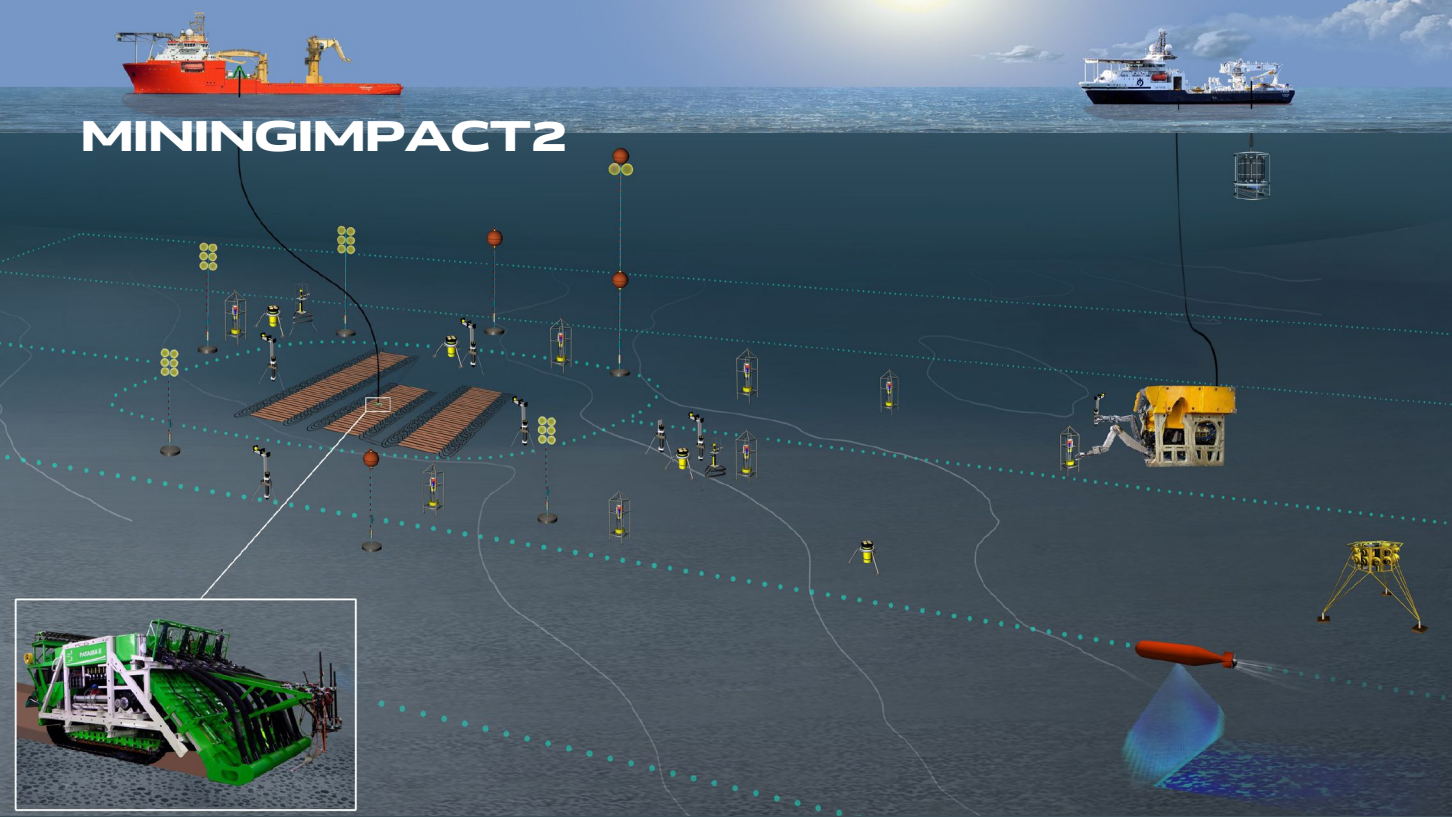
BIOMASS



Megafauna is less than **1%**

Bacteria, not Macrofauna, are the key players in the short-term degradation of Phytodetritus in Abyssal CCZ sediments (Results from the AB01 Cruise), Sweetma, A.K., Smith, C.R., Maillot, B. Schulse.C, Church, M.J., Gooday, A.J.,Moodley, L.

MININGIMPACT2



ONLINE COVER: A deep seabed mining vehicle releases sediment plumes nearly two miles below the surface of the Pacific Ocean. An experimental study investigated the dynamics of sediment plumes released by deep sea mining vehicles. Muñoz-Royo *et al.* examine the in-situ dynamics of the sediment plumes, which could have substantial implications on future plume modeling efforts and our understanding of their impact on the deep-sea environment.

Credit: GSR

21 September 2022: The key take away is that the initial plumes are low lying turbidity currents. On flat terrain, 92-98% of sediment is deposited locally and/or is in suspension below 2m, with suspended sediment concentrations of the order of a few mg/l. This is a very different picture than has been broadly portrayed in the press to date, and the first time this has been established and characterized. A thorough understanding of the initial form of collector plumes is also the foundation for designing approaches to nodule mining that, to the best of their abilities can mitigate the associated environmental impacts.

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REGULATIONS

1878-91
Prof. Alphonse F.Renard

1973-82
Convention
Law of the Sea

Amb.
Tommy Koh

2001
Exploration Contracts

Scientific
Papers

2025
Exploitation Contracts

1872-76
HMS
Challenger

1965
John L. Mero
The Mineral
Resources of the Sea

1967
Amb. Arvid Pardo
UN Assembly

1994
Agreement
& ISA

- China
- Korea
- Russia
- Japan
- France
- IOM
- India
- Germany
- Tonga,
  Nauru
- UK, Belgium
- Singapore
- Jamaica

INTERNATIONAL NEGOTIATIONS

- International Seabed Authority - #168 Member States + the EU
- Negotiations on exploitation code ongoing since 2015; including #11 stakeholder review periods. Draft code delivered in February 2020. Standards & Guidelines and Financial Payment Regime to be finalized.
- Belgium member of the ISA since 1998

Deep-sea mining legislation strengthened for sustainable exploitation of marine resources

14 June 2023

On Friday, the federal government approved a draft law on deep-sea mining to ensure the sustainable exploitation of marine resources. Minister of the North Sea Vincent Van Quickenborne and Minister of Economy Pierre-Yves Dermagne reported this on Wednesday.

The ocean floor contains various valuable minerals, often in the form of polymetallic nodules, sulphides, and ferromanganese crusts. These include copper, nickel, cobalt, manganese and other minerals essential for modern technologies.

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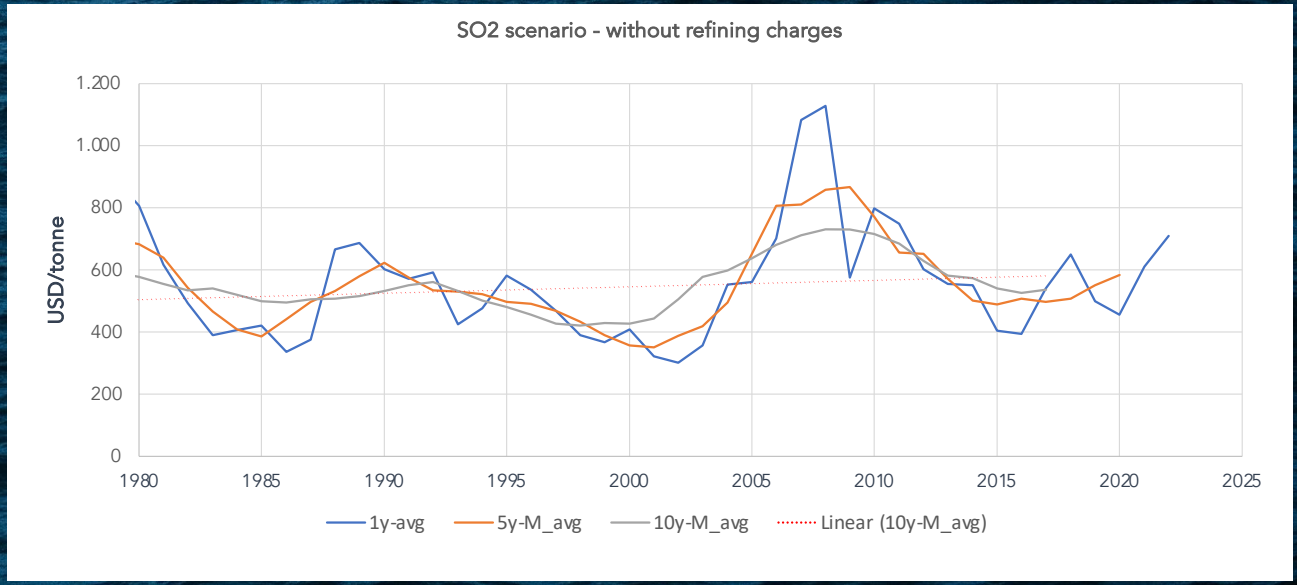
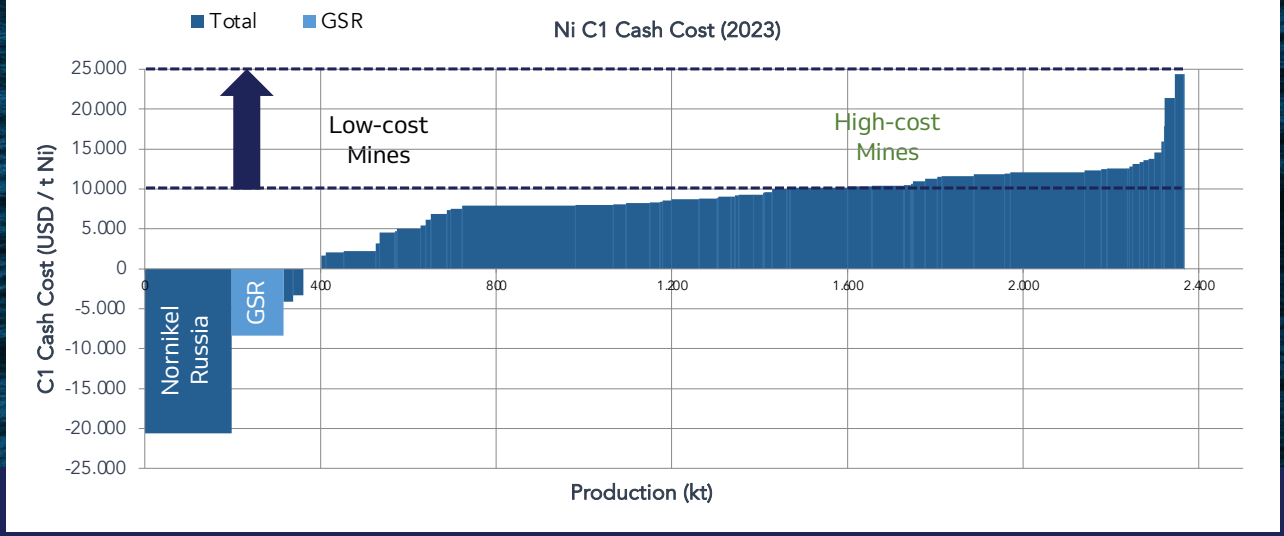
COMMODITY PRICES



OPERATING COST CURVES



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SCHEDULE

2012-13
Licensing
Approval of Plan of Work or a 15-year contract for the exploration of polymetallic nodules by the ISA

2013-2014
Desktop
Establishing the resource, Environmental baseline & Regulatory development towards exploitation regulations

2015-2021
Pre-feasibility
Technology de-risking phase: collector device (Patania I & II) & processing route (Lab & Pilot scale)

2022-2026
Feasibility
Adoption of the Mining Code
Prepare for SIT at full commercial scale (Patania III) & Industrial piloting processing route, whilst finalizing environmental baseline

2027
System Integration Test
Validating collection and processing at commercial scale, including Environmental Impact Statement

2027
Permitting
Transparent, multi-stakeholder permitting stage to obtain a 30-year contract for the exploitation of polymetallic nodules from the ISA

2028
Construction
Surface vessels, subsea infrastructure & onshore processing plant

2030
Production
Start commercial production with two vessels and one dedicated custom-build processing plant


HOW CAN THE WORLD MEET AN INCREASING METAL DEMAND, IN THE MOST ENVIRONMENTALLY RESPONSIBLE MANNER?
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