

- **Exploration overview in the Area**  
**GSR's perspective**



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Tarawa, Kiribati Islands

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**GSR**

Global Sea Mineral Resources



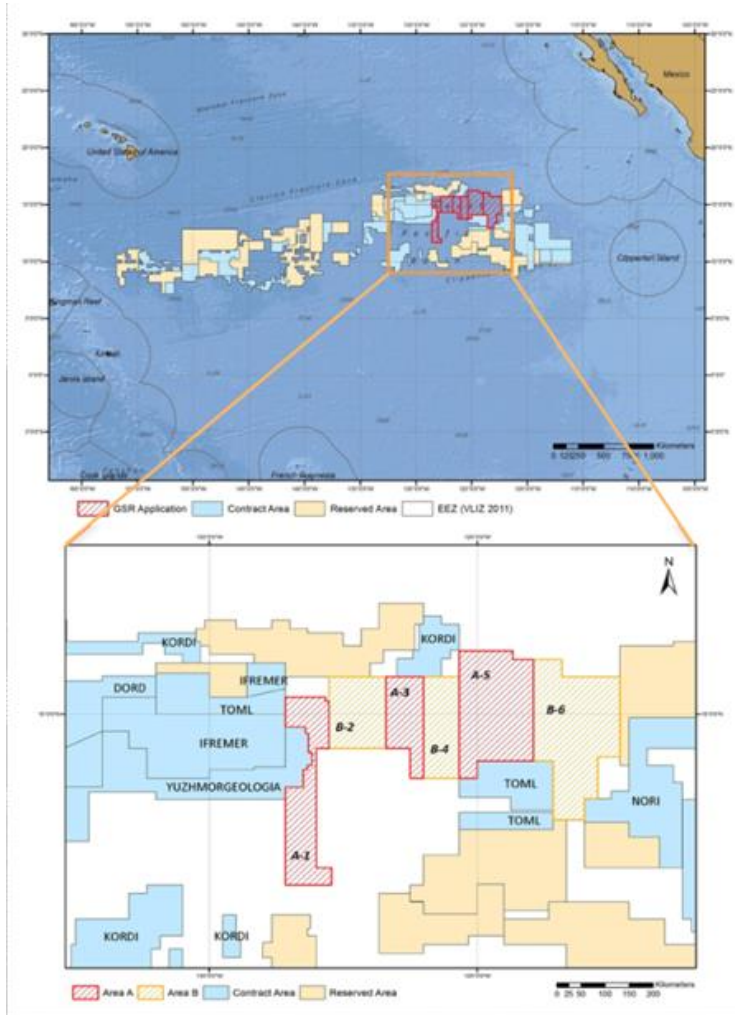
The Group can build on more than 140 years of know-how and experience and has fostered a pioneering approach throughout its history, being a front runner in innovation and new technologies. Although DEME's activities originated with its core dredging business, the portfolio diversified substantially 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](http://www.deme-group.com)

GSR as part of the DEME-Group | The company







- Global Sea Mineral Resources (“GSR”) is a privately owned concessionaire with exclusive control over 75,000 km<sup>2</sup> of seabed located in the Pacific Ocean.
- GSR has exclusive right for exploration over the GSR contract area for a period of 15 years;
- GSR has obtained approval of a plan of work including environmental baseline monitoring, resources definition estimations & technical engineering trials





**GSR**  
Global Sea Mineral Resources

## RESPONSIBLE MARINE RESOURCE HARVESTING

As the world continues to see the devastating impact of global warming, the DEME Group feels that it is vitally important to address this issue by providing pragmatic solutions.

Therefore the company established its in-house, marine resource harvesting specialist Global Sea Mineral Resources (GSR). This pioneering company aims to develop technological and environmental deep sea mining expertise to contribute to the sustainable development of our planet.

**Why do we need to consider marine resource harvesting?**



**DRIVING DEMAND**

The UN states in its 2015 World Population Prospects' Report that by 2050, there will be more than 9.7 billion people on this planet, which represents a 32 % growth in 35 years!



**Phase-out of fossil fuel**

The G7 leaders have agreed to phase out fossil fuel by 2100. WWF promotes 100 % renewable energy by 2050. Today renewables make up 9.57% of the global energy mix.



**Rise in renewable energy infrastructure and storage**

Decreasing the world's dependence on fossil fuel increases dependence on minerals. A 2017 World Bank Report highlights those minerals expected to see heightened demand include (amongst others): cobalt, copper, manganese, nickel and molybdenum. Exponential demand for electrical cars will put an enormous pressure on nickel-manganese-cobalt (NMC) batteries.



**Declining land-based mineral resources & more expensive extraction**

Meanwhile, conventional land-based mining deposits have been exploited for decades, if not centuries. The quality of ore on land is declining, thereby increasing the amount of energy and water required for exploitation. Future land-based deposits will be more difficult and expensive to extract.

## THE DEME VISION

Introducing GSR, 'Global Sea Mineral Resources'

One approach to mitigate the impact of these challenges is to explore the potential of deep sea mineral resources.

In 2013, the International Seabed Authority (ISA) and GSR signed a 15-year contract for the prospecting and exploration for polymetallic nodules. Under the contract, GSR has exclusive rights to explore 76,728 square kilometers of seabed in the Central Pacific Ocean.

As GSR will require a minimum nodule abundance to obtain commercial quantities of minerals, the mining of nodules will be initiated as a precautionary measure to safeguard local ecosystems and provide sources for local regeneration.

GSR is supporting the development of the regulations for responsible seabed mining, including environmental impact assessments and an acceptable financial payment to the International Seabed Authority (ISA) and its member states.

It is DEME's belief that responsible seabed mining has the potential to contribute to future metal demand and eliminate the worst performing land-based mines, reducing humankind's footprint on the planet. As future seabed mining will be carried out in an operationally controlled, monitored and environmentally responsible way, DEME believes it can make a significant contribution to the global challenges we face in maintaining balanced and healthy ecosystems.



**GSR**  
Global Sea Mineral Resources



**DEME**  
Dredging, Environmental & Marine Engineering

Creating land for the future

*“Using Best Available Techniques (BAT) and the highest scientific standards, GSR aims to be a global leader in the responsible exploration and exploitation of polymetallic nodules, contributing to the sustainable development of the planet.”*

DEME Proprietary Information | Commercial in confidence (see last page)



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## Purpose of Exploration

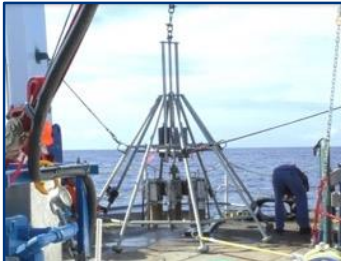






## Resource definition

Geospatial variability of nodule abundance & metallurgical content



## Environmental studies

Environmental baseline, Environmental effects assessment, mitigation possibilities, etc.



## Engineering data

*In situ* data gathering required for the mining system development



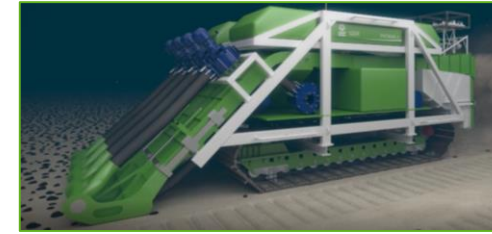
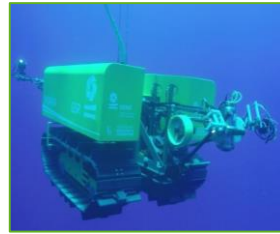


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## Timeline of Exploration



## > Phase I Exploration



2013

2015

2017

2019

2014

2016

2018

2020

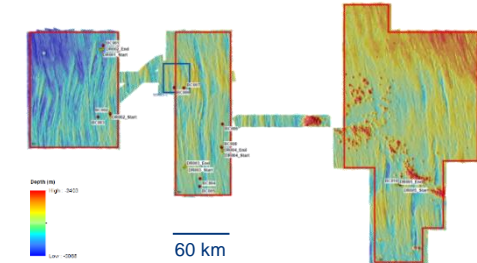




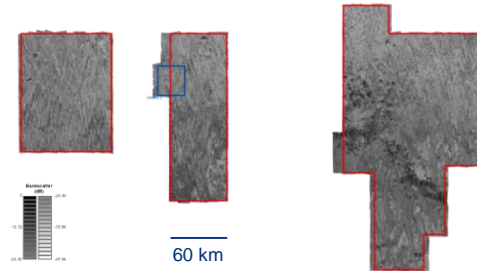
### ► Large scale exploration

- Multibeam [bathymetry], Backscatter and slope survey
  - › horizontal resolution: ~70m
  - › vertical resolution: ~50m
  - › Surface covered: 81,678 sq. km (~x 2.5 Belgium)
- Geological boxcore & dredges for initial RD estimates
- Biological boxcore for preliminary biomass estimates

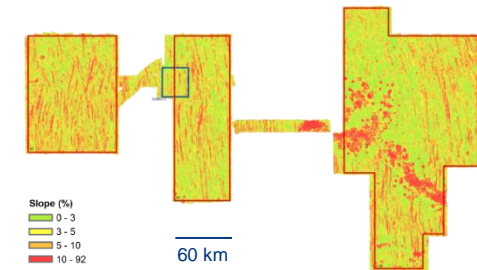
Multibeam map



Backscatter map

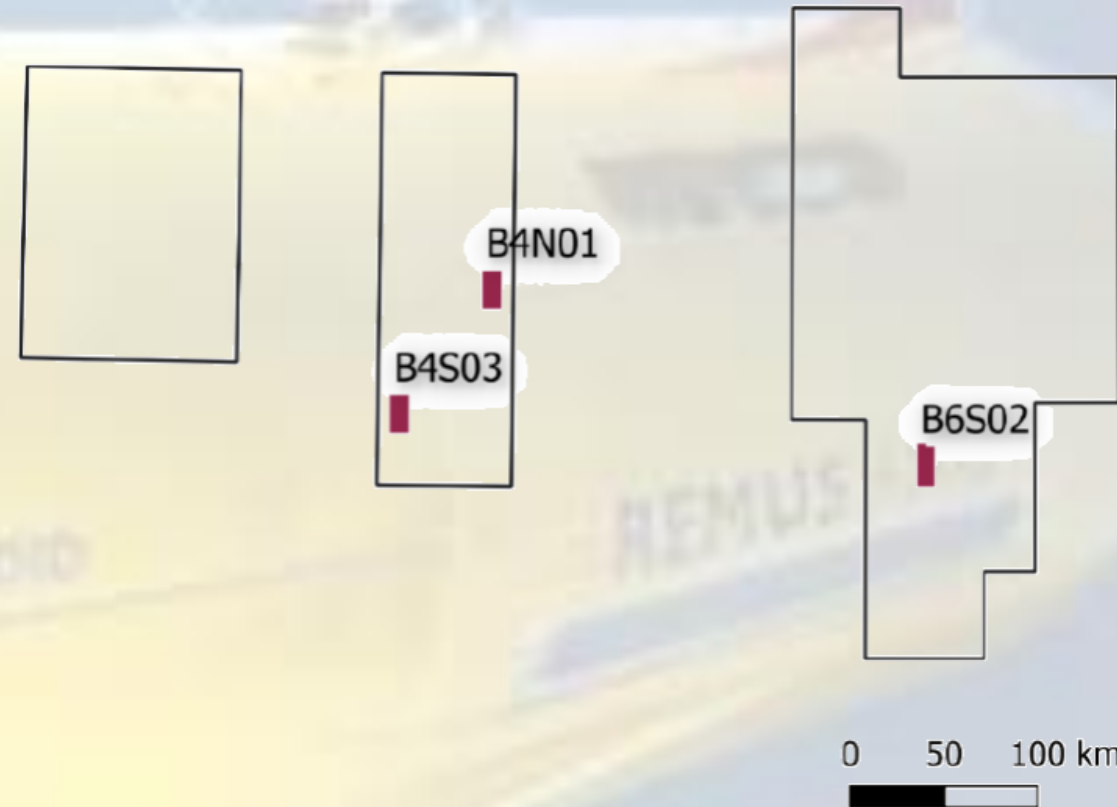


Slope map



► **Detailed exploration**

- Delineation of 3 areas of interest : B4N01, B6S02, B4S03
  - › AUV Bathymetry + Side scan sonar
  - › AUV picture survey
- Geological boxcore – sediment properties
- Biological Boxcore and Multicores – Macro and meiofauna estimates
  - › Similarities/variability between stations remote (60 km, 250 km apart)
- Rosette : water column properties
- Graviprobe - Engineering data



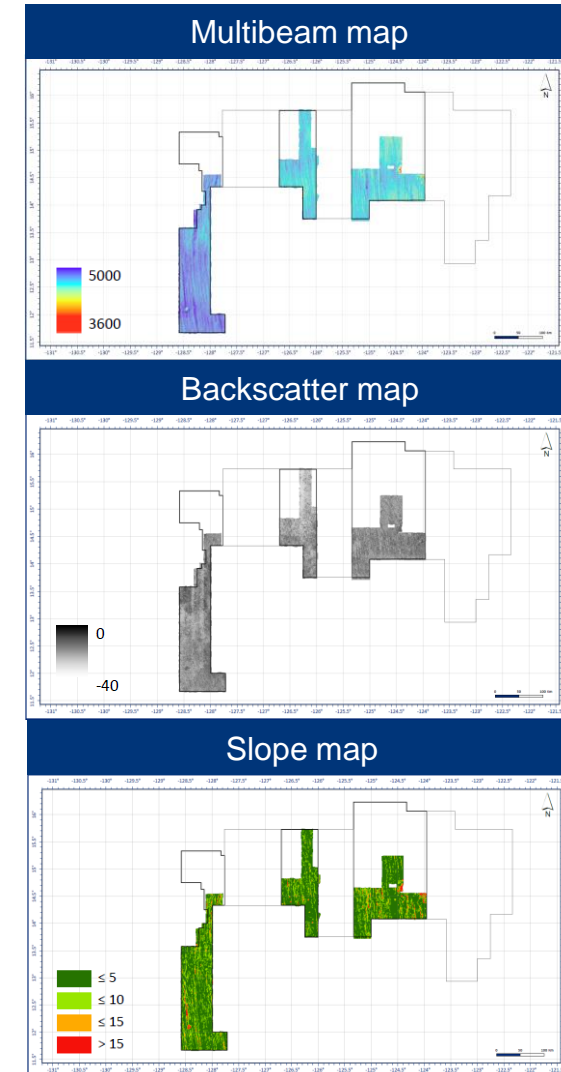
- ▶ ***In situ* trial of the first Tracked system on the seafloor of the CCZ**
  - Engineering data for trafficability, sinkage, slippage, bearing Capacity of Patania
  - Environmental efficiency of the tracks : sediment plume dispersal, visual description, sedimentation
- ▶ **Continued environmental studies**
  - Biological boxcore and Multicores – Macro and meiofauna estimates
    - › Revisit 2015 sites (B4S03 and B6S02) – Temporal variability
    - › Similarities/variability between stations close-by, ≠ habitats (B4S03)
  - Rosette : water column properties – Spatio - temporal variability
  - Geological boxcore : sediment properties / RD
    - › Spatial variability
  - Moorings (4) / CTD : oceanographical characterization of the bottom layer & the whole water column





► **Large scale exploration**

- Multibeam [bathymetry], Backscatter and slope survey
  - › horizontal resolution: ~70m
  - › vertical resolution: ~50m
  - › Surface covered: 41 744 km<sup>2</sup> (> 50 % of the contract area)
- Geological boxcore initial RD estimates & sediment properties
- Biological deep tow imagery : megafauna study
- Mooring recovery & redeployment (3)



- ▶ **In situ validation of the first Pre-Prototype vehicle Patania II**
  - Maneuverability of the tracks & pick-up efficiency of the hydraulic head
  - Environmental efficiency of the PPV (plume, source, noise, ..)
- ▶ **Environmental effects of the PPV – MiningImpact 2**
  - Independent & transparent monitoring by a consortium of 31 partners
  - Two distinct contract areas : BGR & GSR
  - As close as possible of a realistic mining operations
- ▶ **Continued environmental studies**
  - Biological boxcore and Multicores – Macro and meiofauna estimates
    - › Revisit 2015/2017 sites (B4S03) – Temporal variability (3y)
  - Geological boxcore : sediment properties / RD
    - › Spatio - temporal variability




**Postponed, due to technical failure of the umbilical, not the Patania II**



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

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