

MICEDD

DEEPWATER DEVELOPMENT

28 - 30 March 2023 | Millennium Gloucester Hotel | London, UK

ORGANIZED BY



Quest Offshore

World Oil®



Underwater mining: merging offshore and dredging technologies

MCEDD

30-March-2023

Laurens de Jonge

! SAFETY MOMENT !



BECAUSE AN INCIDENT CAN BE LIFE CHANGING

Royal IHC - Ahead since 1642

Vision and mission

OUR VISION:

- Global challenges, including realising sustainable development goals, will have major impact on the maritime industry.

OUR MISSION:

- Royal IHC is determined to play a leading role in making the maritime industry more efficient and sustainable.



Royal IHC > Four main brands



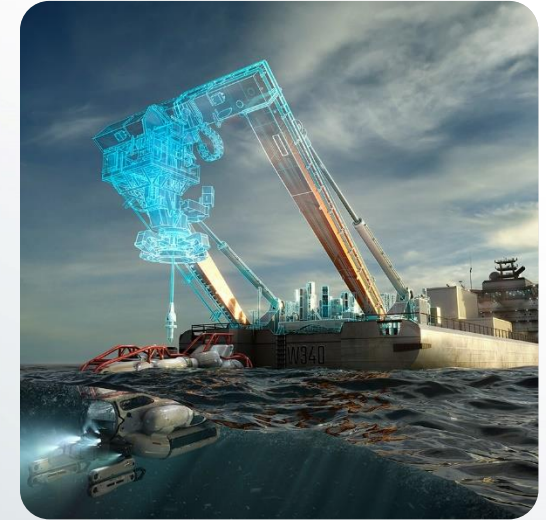
IHC Dredging



IHC Offshore Energy



IHC Mining



IHC Defence



IHC Mining > Unique wet mining know-how



- Serving the mining market with unique know-how in wet mining and mineral separation solutions
- Long-term commitment to develop Marine and Deep Sea Mining technology through research and business development
- Powered by a global team of dedicated and experienced industry professionals
- Leading to sustainable equipment and services throughout the entire mining life cycle

Content

1. Why?

Critical Raw Materials

2. What?

Marine Resources

3. Where?

Deep and Far

4. How?

Dredging and Offshore Technology

Why? People and mining > Daily use of Raw Materials



Pencil – Graphite
Also important for batteries



White paint – Titanium oxide
Also used in toothpaste and
sunscreen

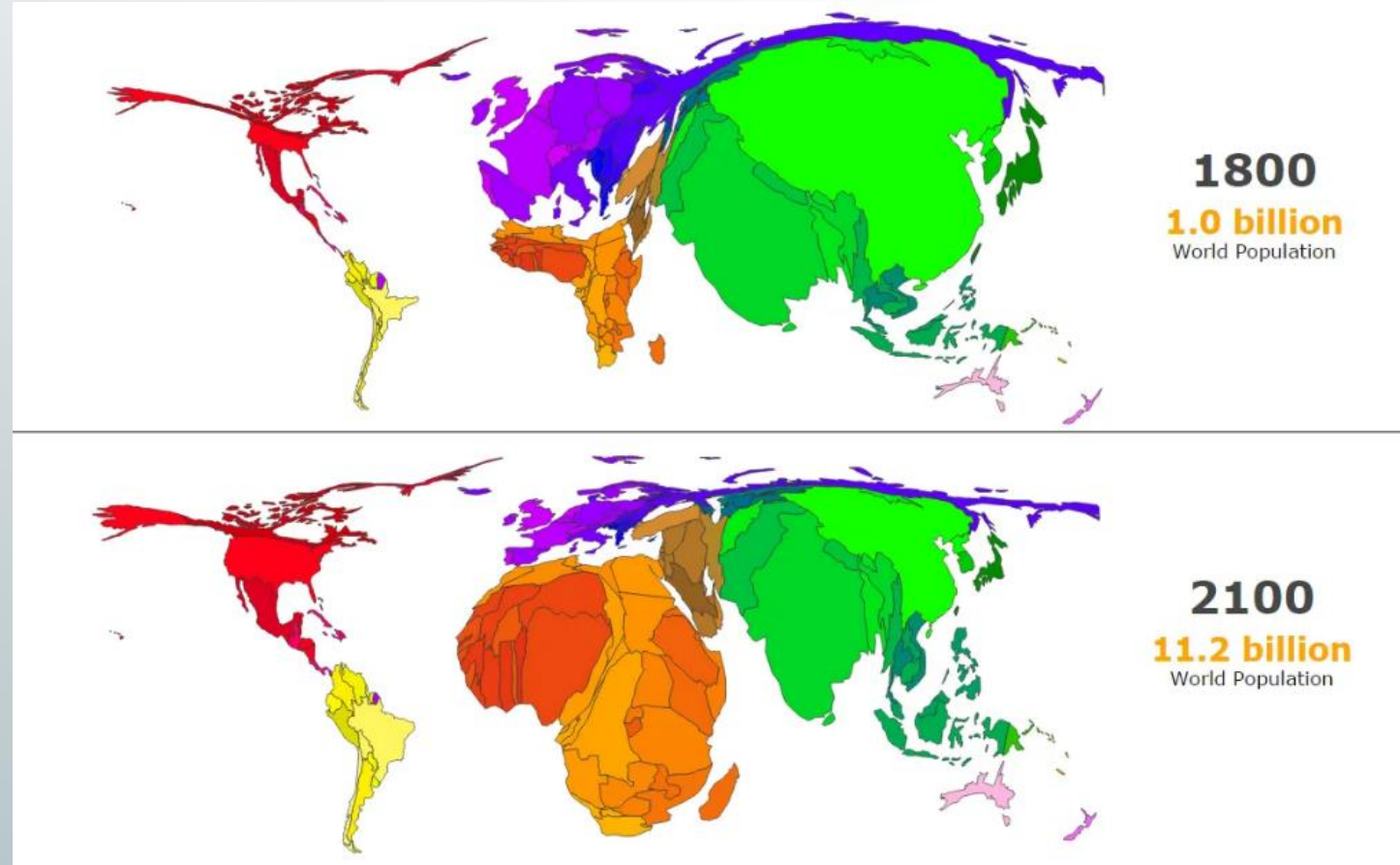


Fertilizer – Phosphates
For our everyday food

If it is not grown it's mined

Why? People and mining > Daily use of Raw Materials

- NO aspect of our daily lives would be possible without Raw Materials



Why? The Green Dilemma > Energy Transition

- Raw materials are crucial for the
 - Energy Transition
 - Digital Transformation



A BREAKDOWN OF THE CRITICAL METALS IN A SMARTPHONE

Some vital metals used to build these devices are considered at risk due to geological scarcity, geopolitical issues or trade policy. This infographic details the critical metals that you carry in your pocket.

TOUCH SCREEN
It contains a thin layer of indium (in oxide, highly conductive and transparent, allowing the screen to function as a touch screen).

DISPLAY
The display contains several rare earth elements. Small quantities are used to produce the colors on the liquid crystal display. Some give the screen its glow.

MICROPHONE, SPEAKERS, VIBRATION UNIT
Nickel is used in the microphone diaphragm that vibrates in response to sound waves. Alloys containing neodymium, praseodymium and gadolinium are used in the magnets contained in the speaker and microphone. Neodymium, terbium and dysprosium are used in the vibration unit.

ELECTRONICS
Nickel is used in electrical connections. Gallium is used in semiconductors. Tantalum is the major component of micro capacitors, used for filtering and frequency tuning.

CASING
Nickel reduces electromagnetic interference. Magnesium alloys are superior at electromagnetic interference (EMI) shielding.

BATTERY
The majority of smartphones use lithium-ion batteries.

Source: University of Birmingham

ELEMENTS
elements.visualcapitalist.com

The Earth's natural resources power our everyday lives. VC Elements breaks down the building blocks of the universe.

We live in a material world.



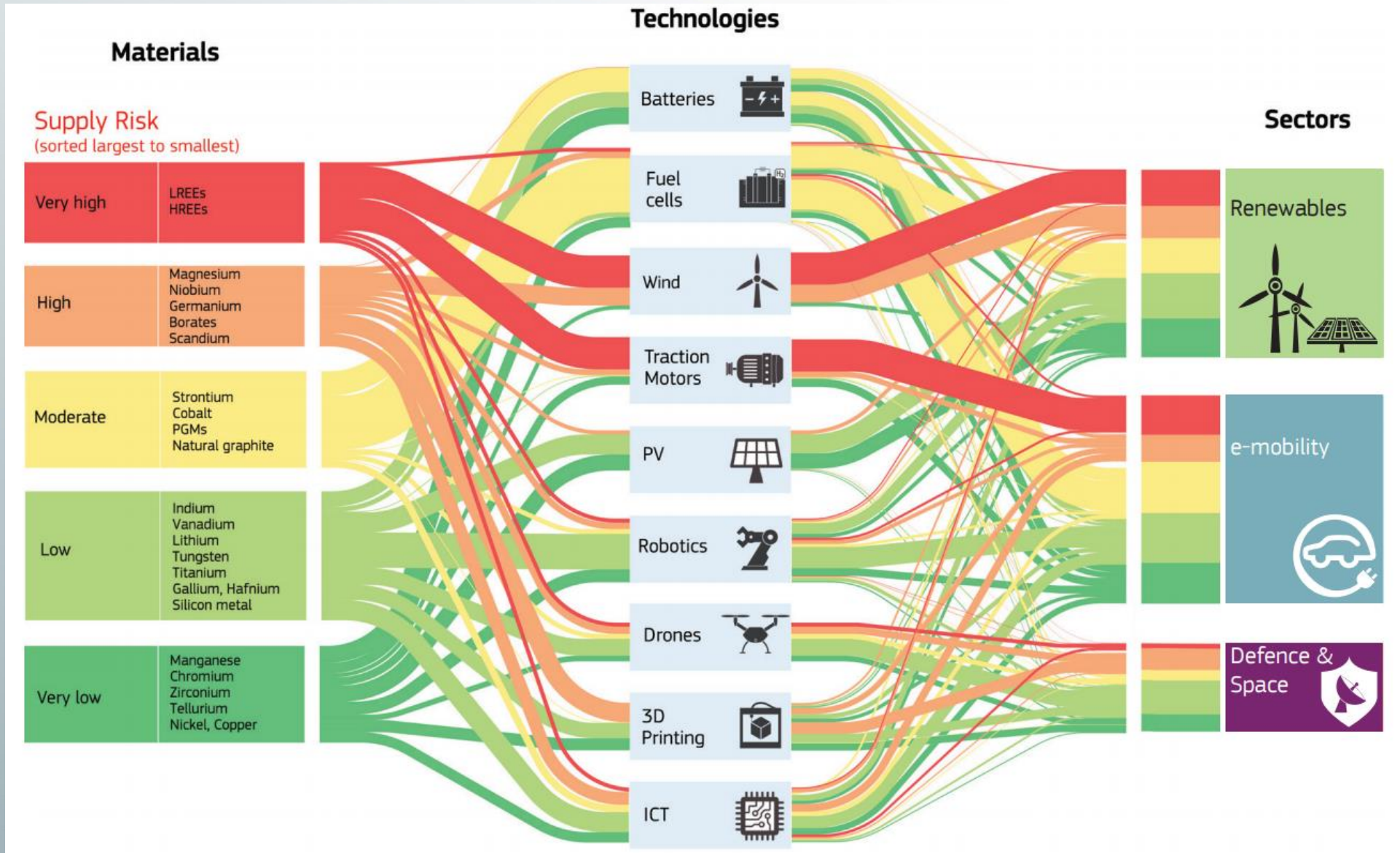
Green Economy



Geo Political Playing Field

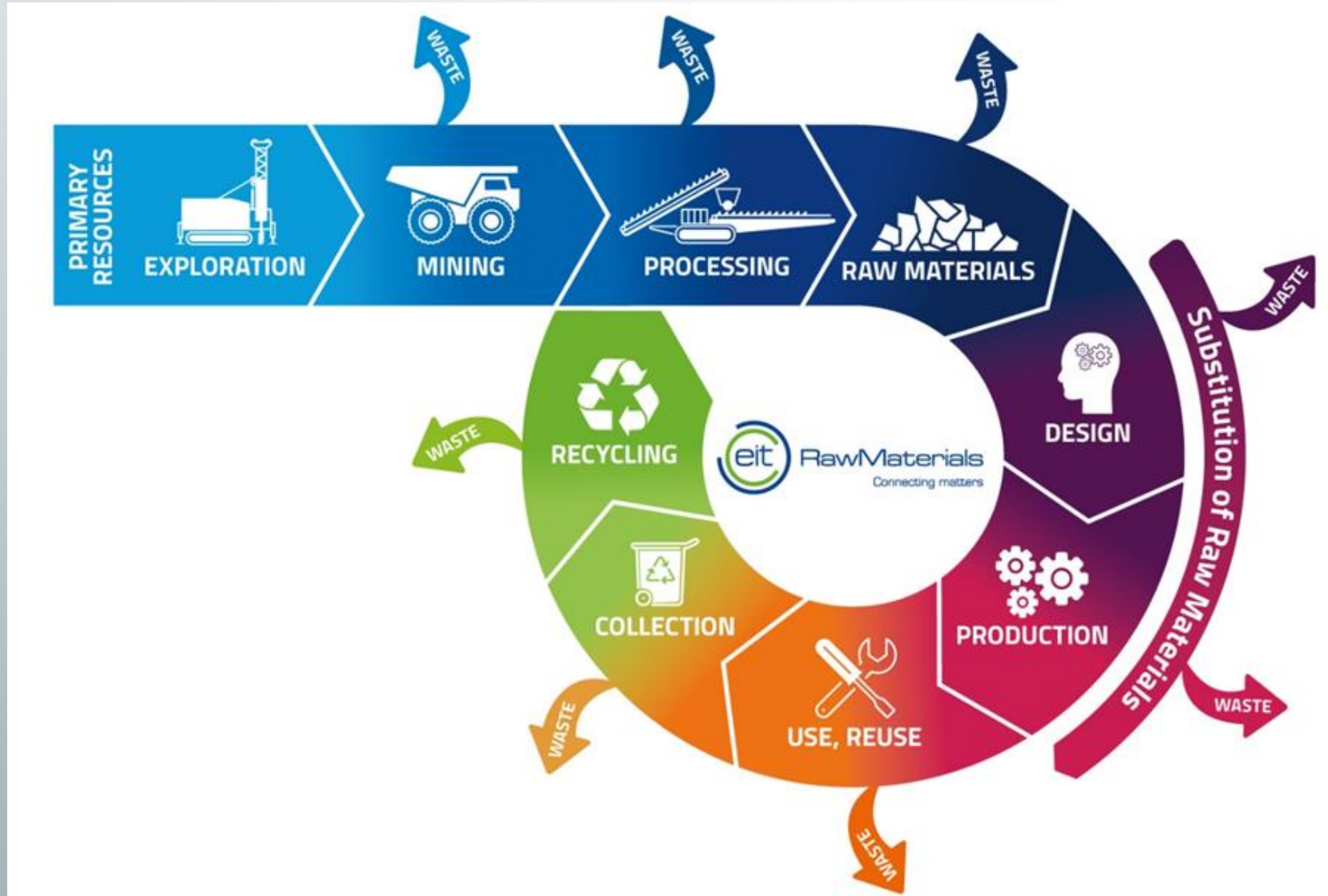
Why?

Critical Raw Materials



Why?

Shared responsibility -> Filling the Recycling Circle

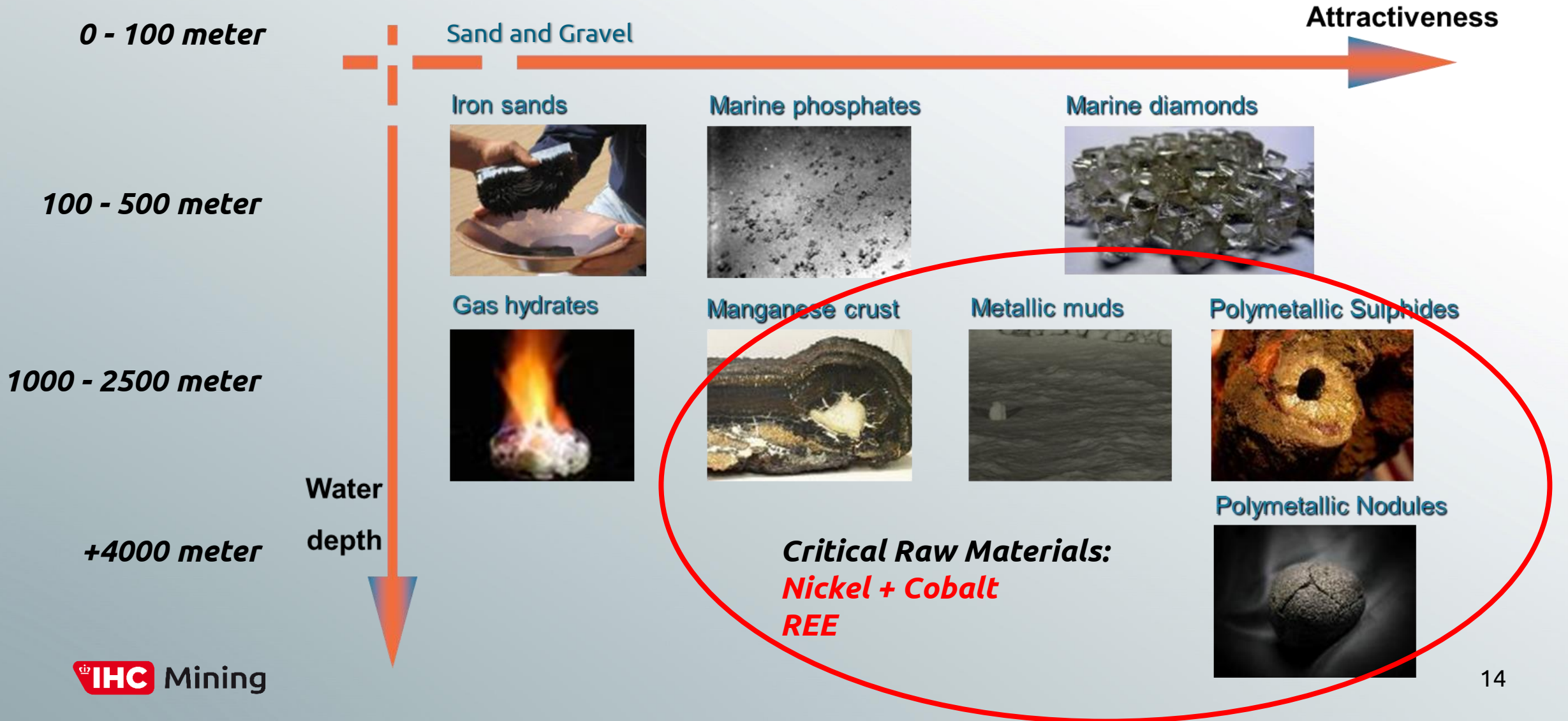


Why? The Challenge: Sustainable use of Raw Materials

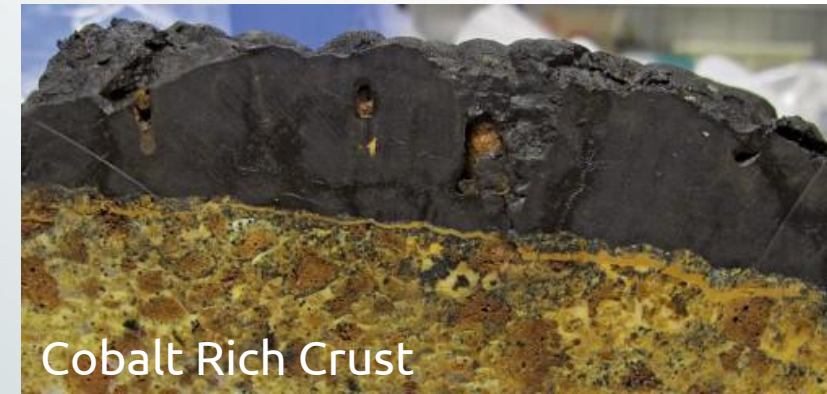
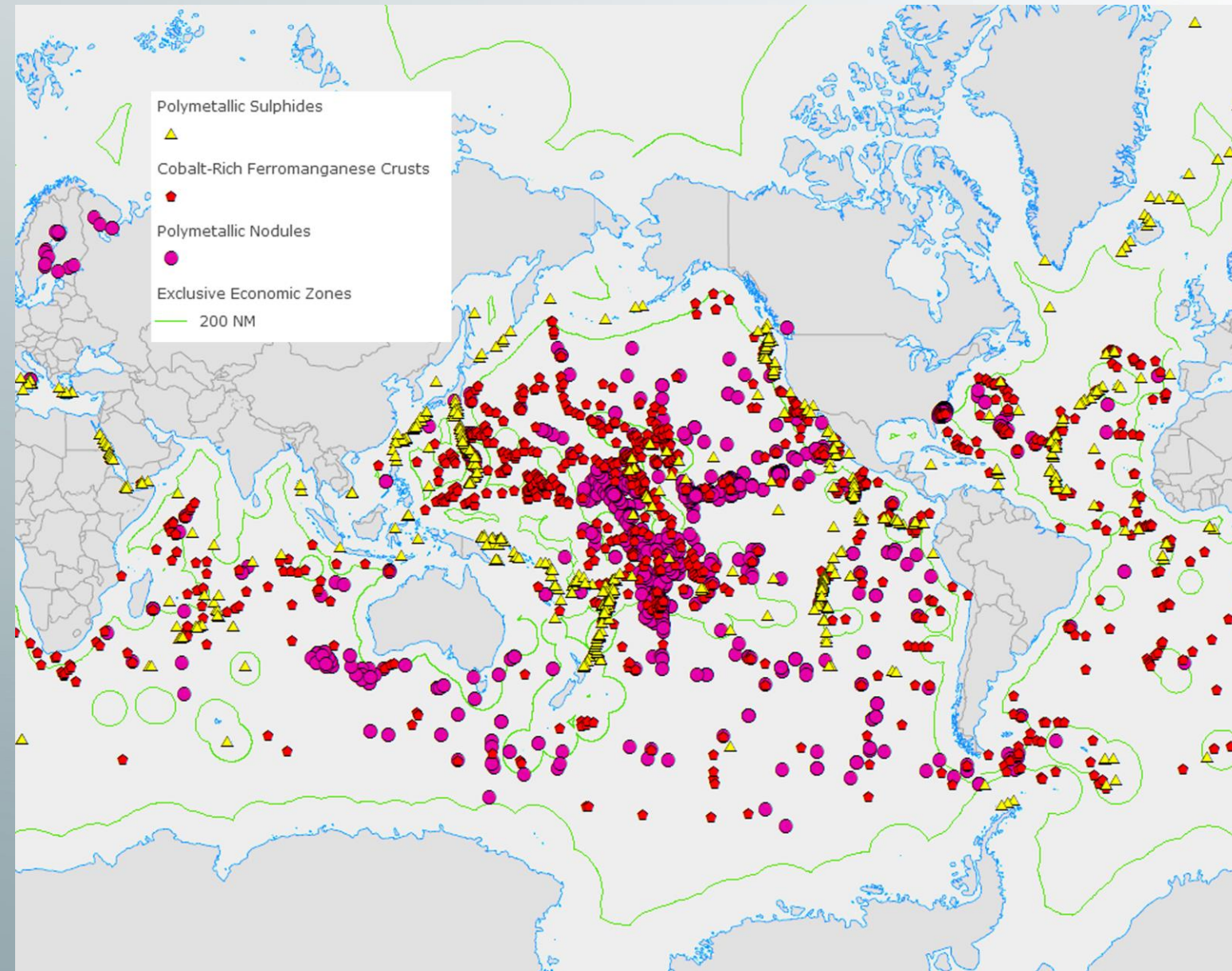
SUSTAINABLE IS THE ONLY OPTION



What? Marine Resources

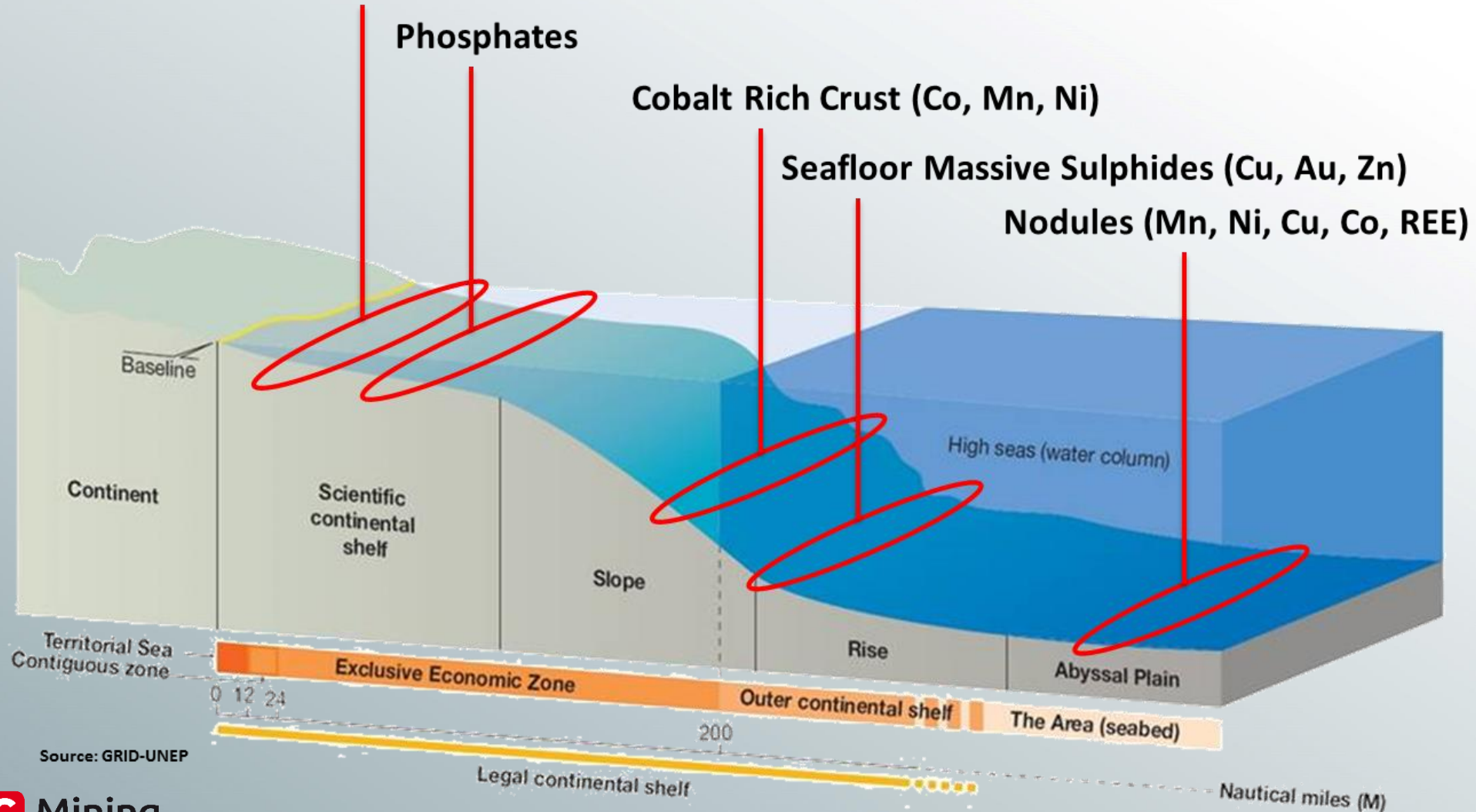


Where? Marine Resources



Where? Marine Resources and Jurisdiction

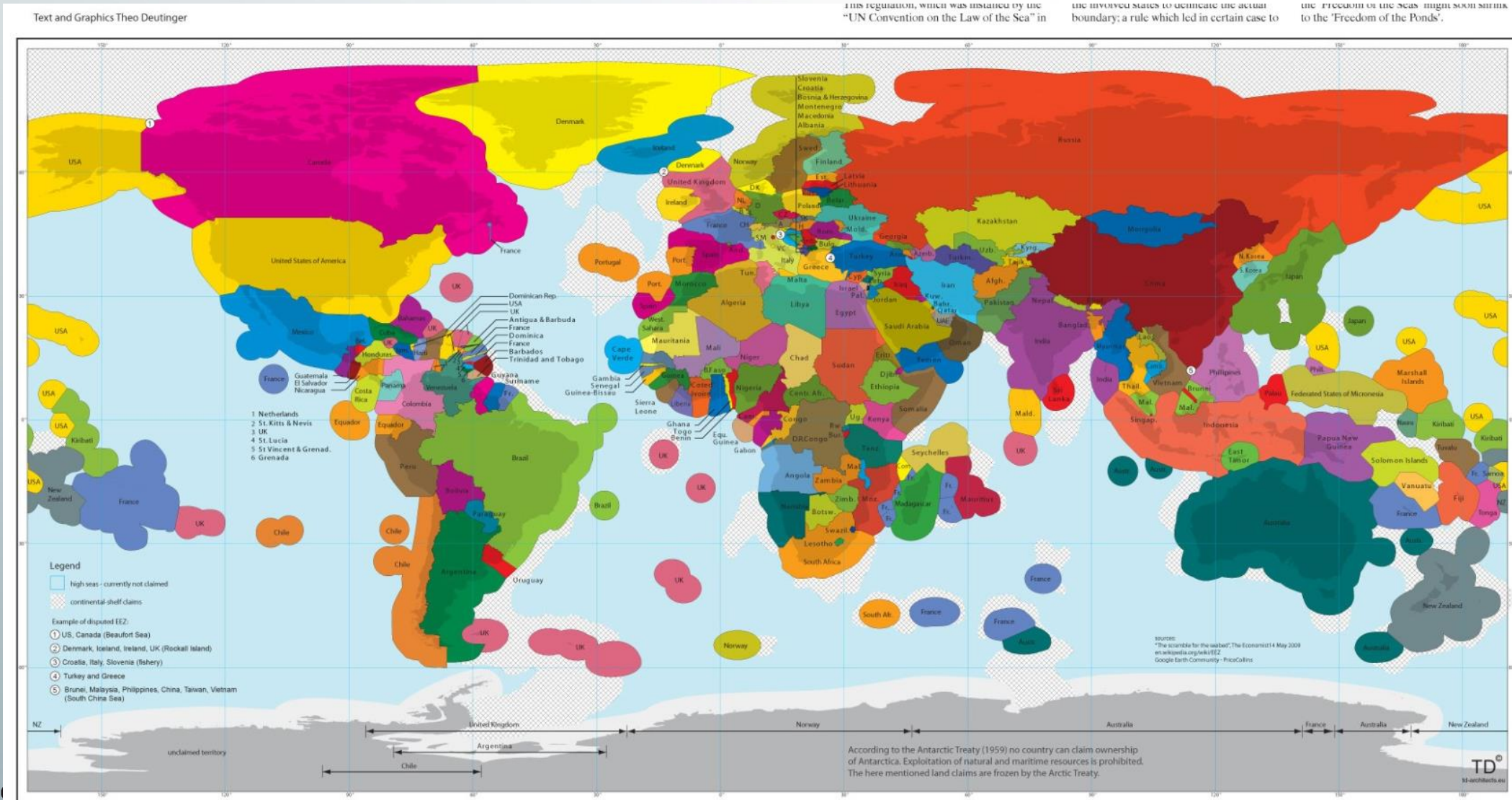
Offshore placers: Diamonds, gold, tin, heavy minerals (Ti-Zr)



Where? Marine Resources and Jurisdiction

EEZ:
Exclusive Economic Zone

High Seas:
The Area

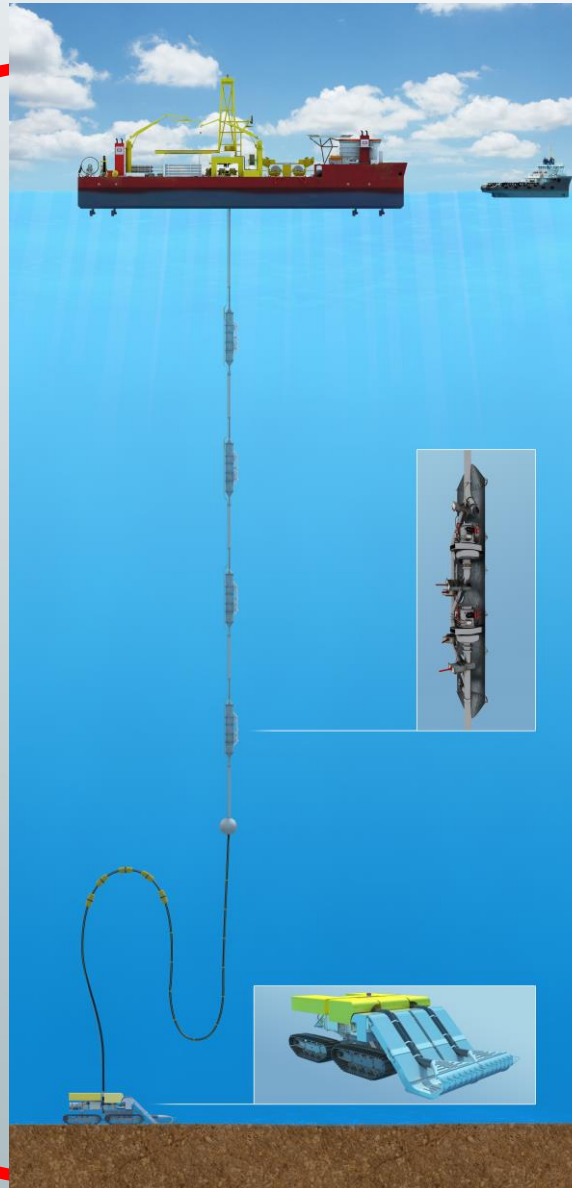


How? Underwater Mining > Integrated Challenge

- RULES AND REGULATIONS: fair and just balance for all stakeholders

- SOCIAL CONTEXT: Benefit of Humankind, Responsible use of Oceans and Resources

- ENVIRONMENT: Benthic Impact, Plumes, Noise, Recovery



- MINING VESSEL: platform for LARS, operations, processing and logistics

- ONSHORE: logistics, processing/refining



- VERTICAL TRANSPORT SYSTEM: Dynamics, Safe operations, Slurry flow and control

- EXTRACTION SYSTEM: High efficient with minimized impact and plumes

- PROVEN RESERVES: Geology, Seafloor conditions, Environmental baseline, Mining/Production requirements

How? Mining System -> Technology

Similar:

- Pipe/riser: Vertical Transport System
- Launch and Recovery systems
- Accurate Station keeping Capabilities
- Deep water Capability



Different:

- Business model: Operational Day Rate v. Ore
- Seafloor Mining Tools -> 200T+ Crawlers
- Excavation technology
- Vertical Transport of High Density Slurry
- Large volumes of Slurry and Ore: processing, storage and offloading

How? Extraction Crawlers→ Excavation Volume



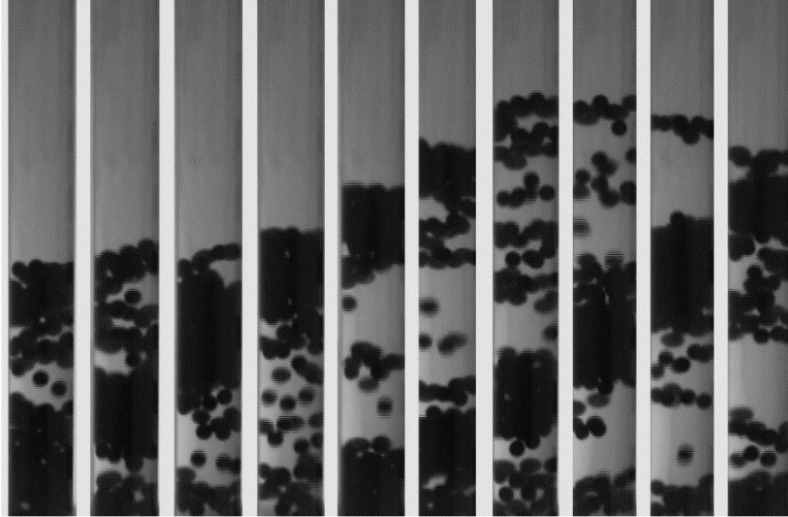
How?

Extraction Crawlers → Size, Power, Capabilities matter



How?

Vertical Transport System -> Flow Assurance



Density waves during fluidization
Van Wijk et al.
(2015)



The IHC Deep Sea Special Pump with Open Permanent Magnet Motor has been developed and designed to 5km water depth and is:

- Seawater filled
- Seawater lubricated
- Seawater cooled

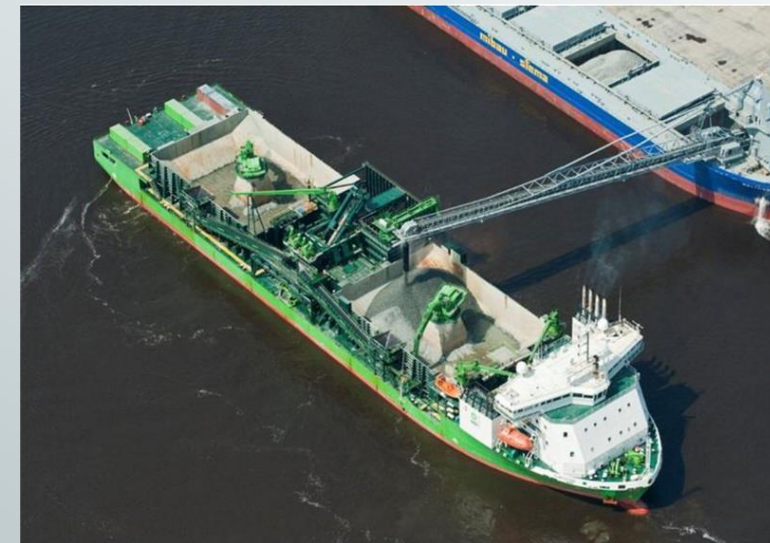
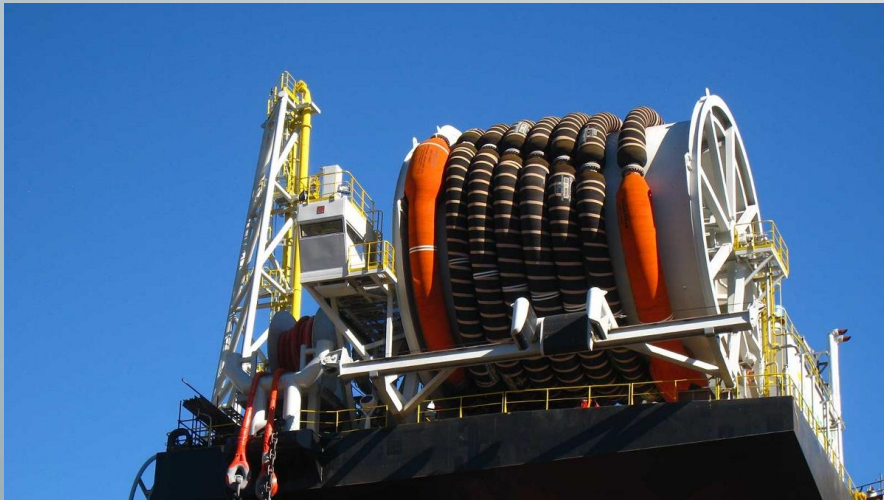
Since it is an open design there is no need for pressure compensation, cooling and **COMPLETELY OIL FREE**

How?

Launch and Recovery

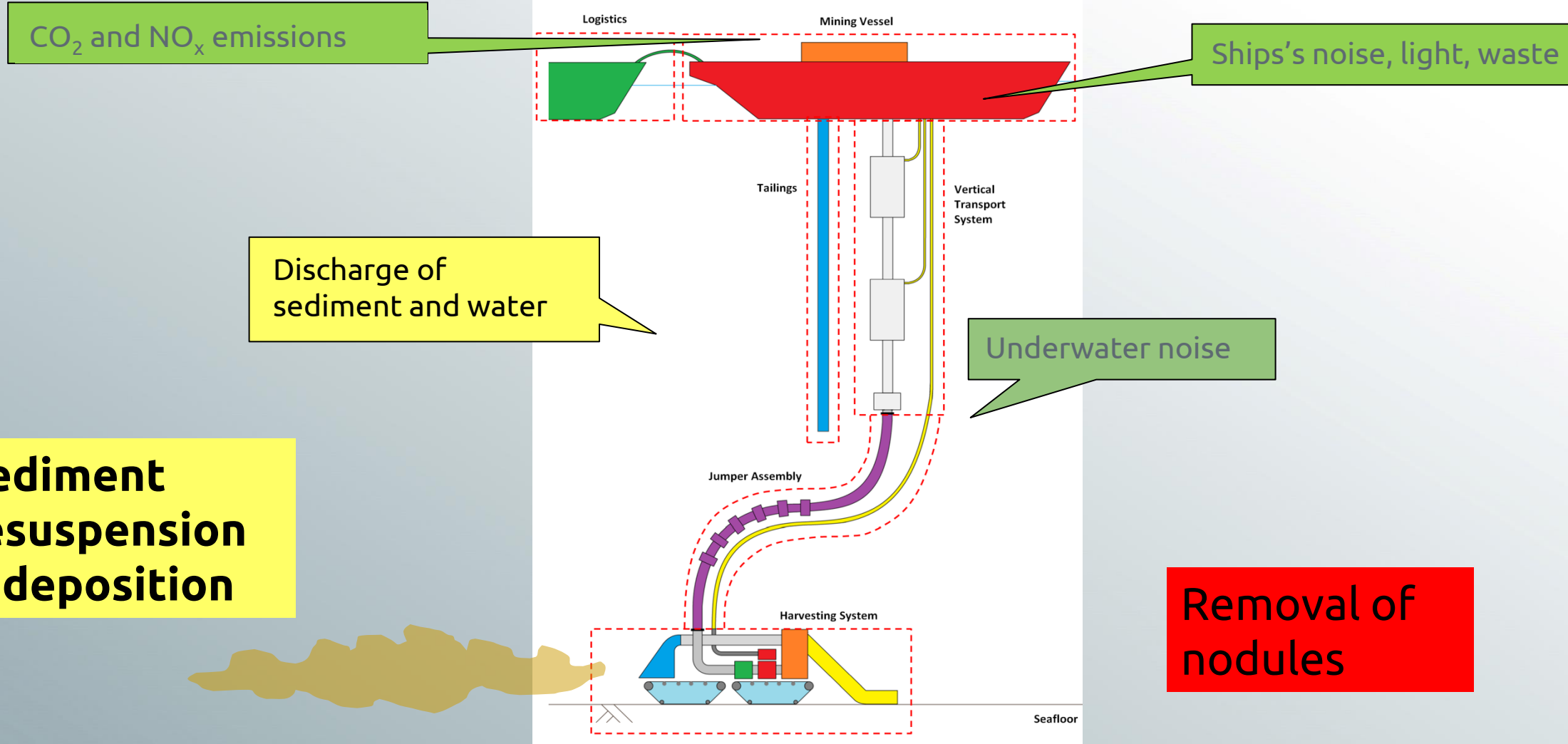


How? Logistics -> Ship-Ship Transfer



How?

Environment -> No Harm



CO₂ and NO_x emissions

Ships's noise, light, waste

Discharge of sediment and water

Underwater noise

Sediment resuspension & deposition

Removal of nodules

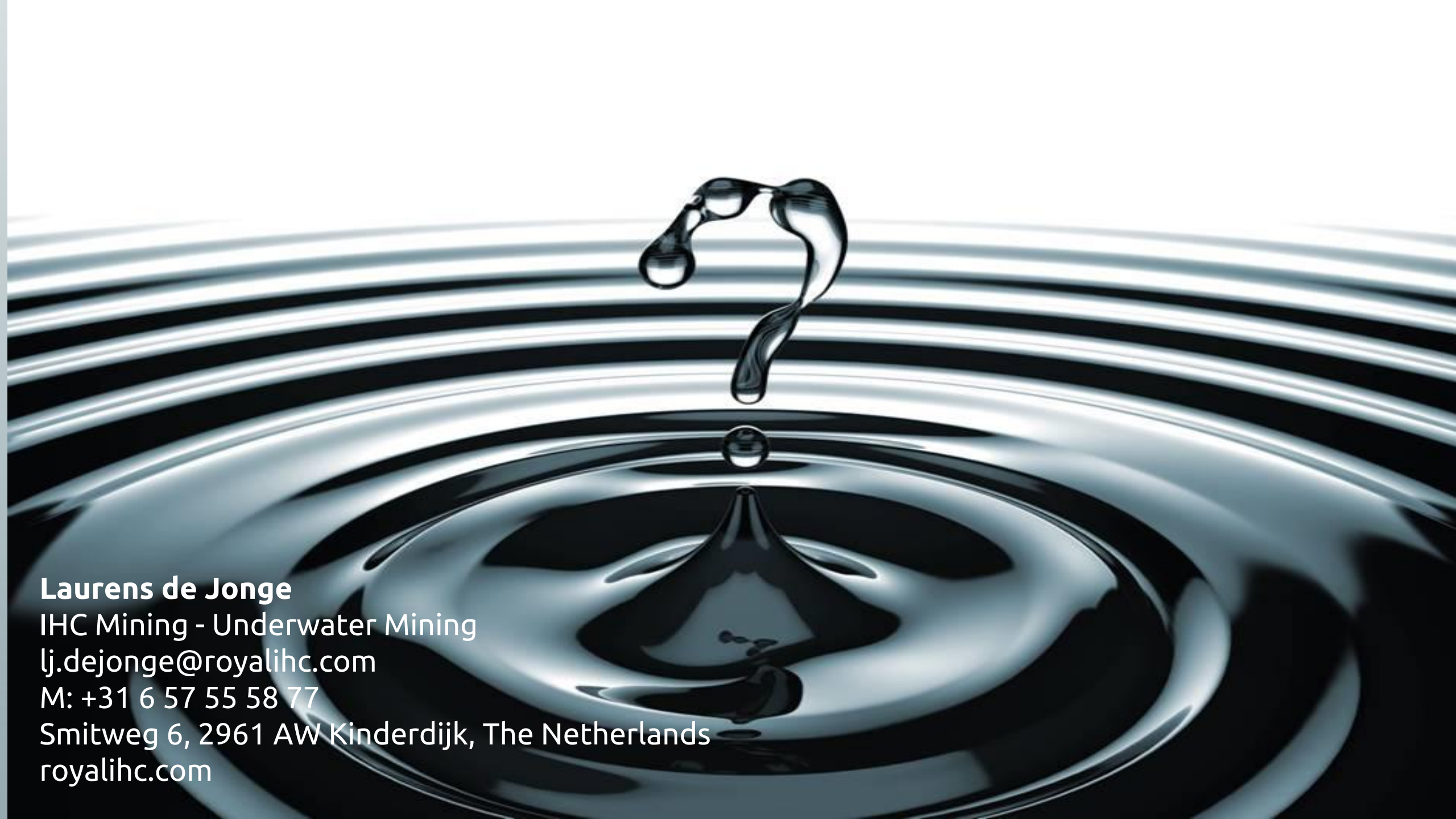
Disturbance of surface sediment

Conclusion

Underwater Mining:

A **Multi Discipline Challenge** requiring **Balanced Integrated Solutions** provided by **Cooperation** between all Stakeholders and Offshore and Onshore Disciplines





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Mining Creating the mining future

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