Mineral resources of the Area and current status of marine mineral technology

Workshop for the promotion of sustainable development of Africa's deep seabed resources in support to Africa's Blue Economy

Abuja, Nigeria, 5th October 2022

Pedro Madureira

Legal & Technical Commission of the ISA

Task Group for the Extension of the Continental Shelf

Dep Geosciences of the University of Évora

Summary:

- Mineral resources of the Area;

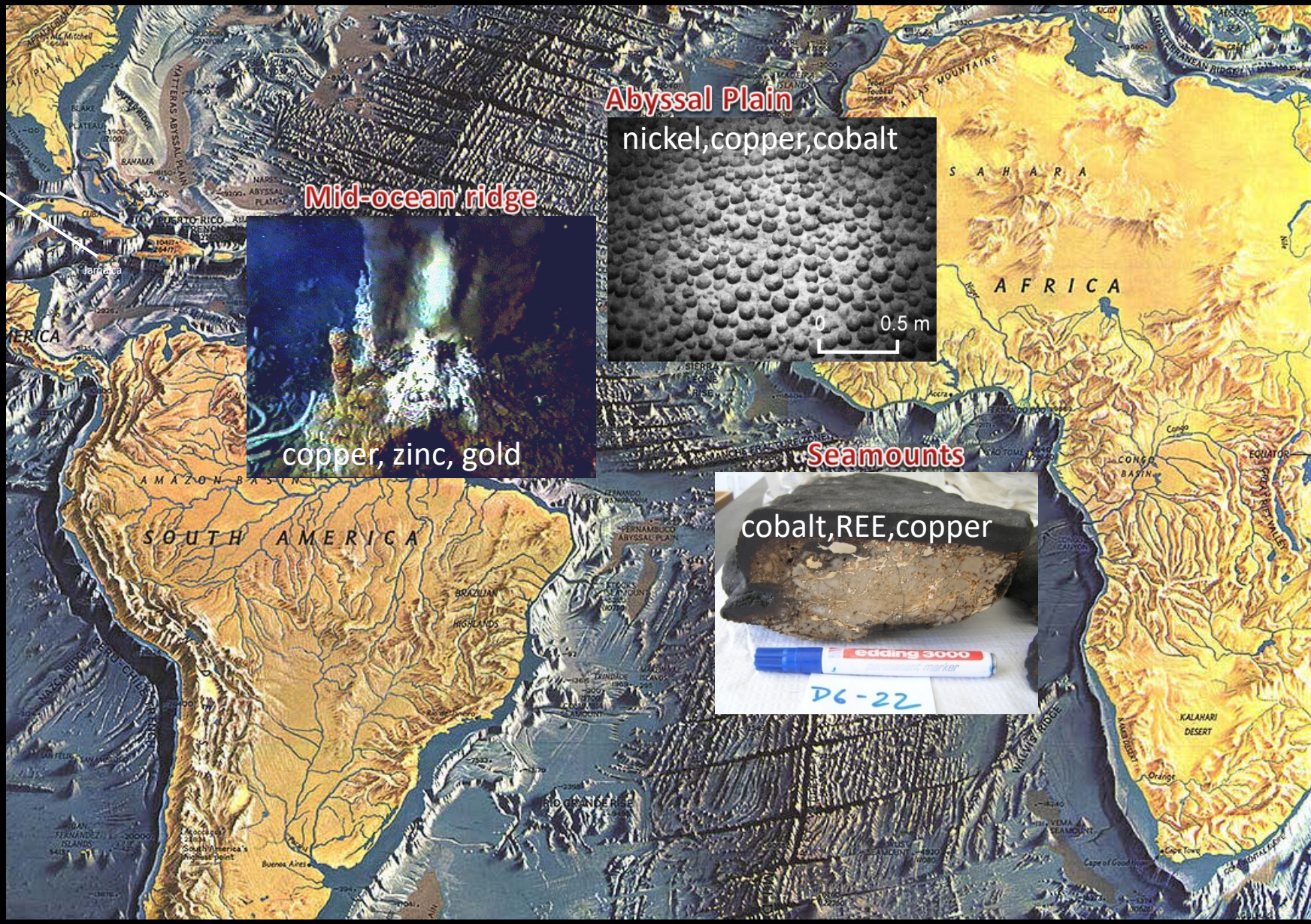
- Technology and the protection of the marine environment;

- Future Technologies?

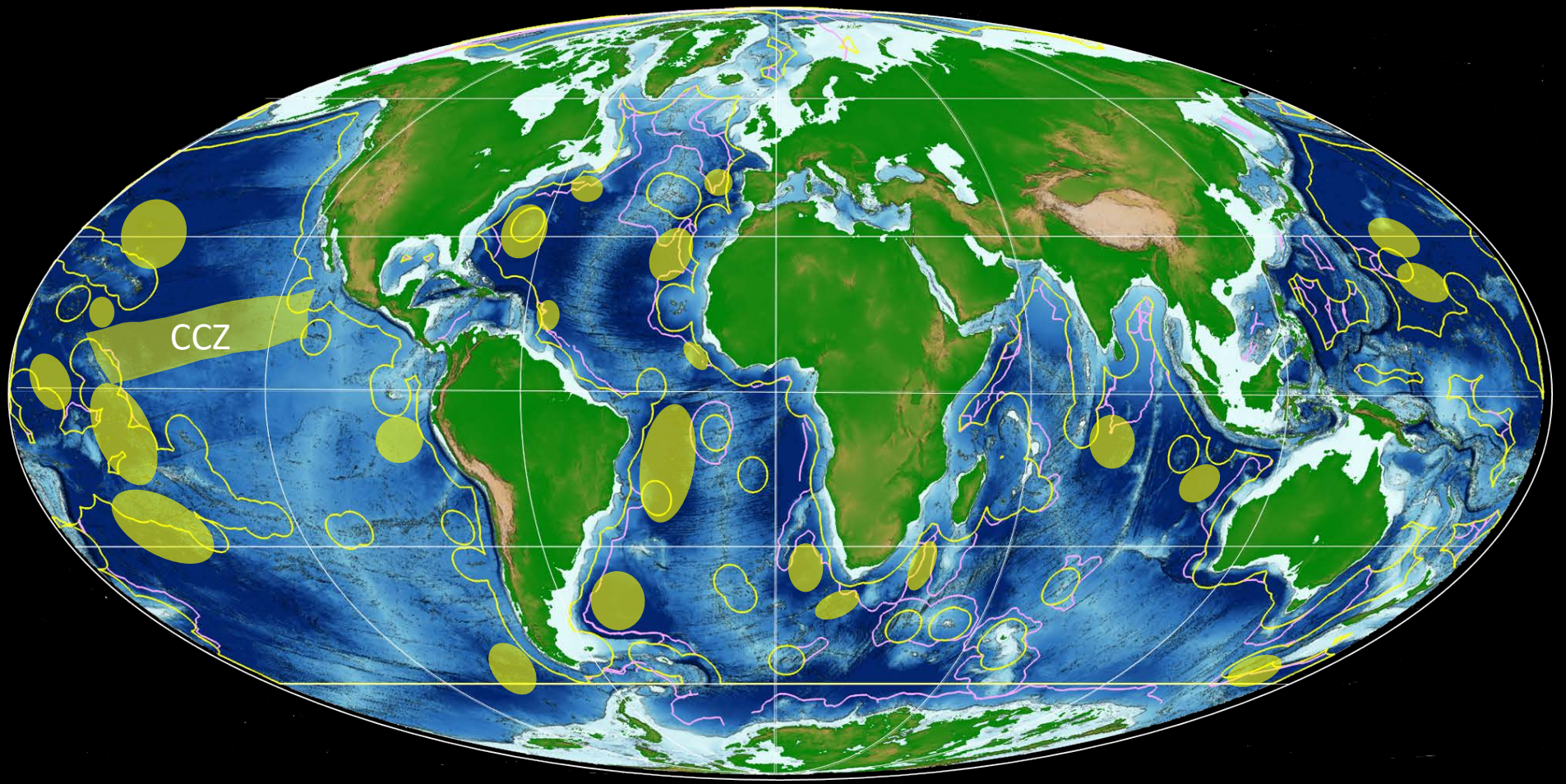
- Final remarks.

Mineral resources of the Area


Jamaica
Atlantic Basin
SOUTH AMERICA
AMAZON BASIN
BRAZILIAN HIGHLANDS
AFRICA
SAHARA
ATLAS MOUNTAINS
CONGO BASIN
KALAHARI DESERT
EQUATOR
Dakar
Accra
Buenos Aires
Cape Town


Abyssal Plain
nickel,copper,cobalt
0 0.5 m
Mid-ocean ridge
copper, zinc, gold
Seamounts
cobalt,REE,copper
edding 3000
D6-22
AFRICA
SOUTH AMERICA
SAHARA
AMAZON BASIN
CONGO BASIN
KALAHARI DESERT
Jamaica
Buenos Aires

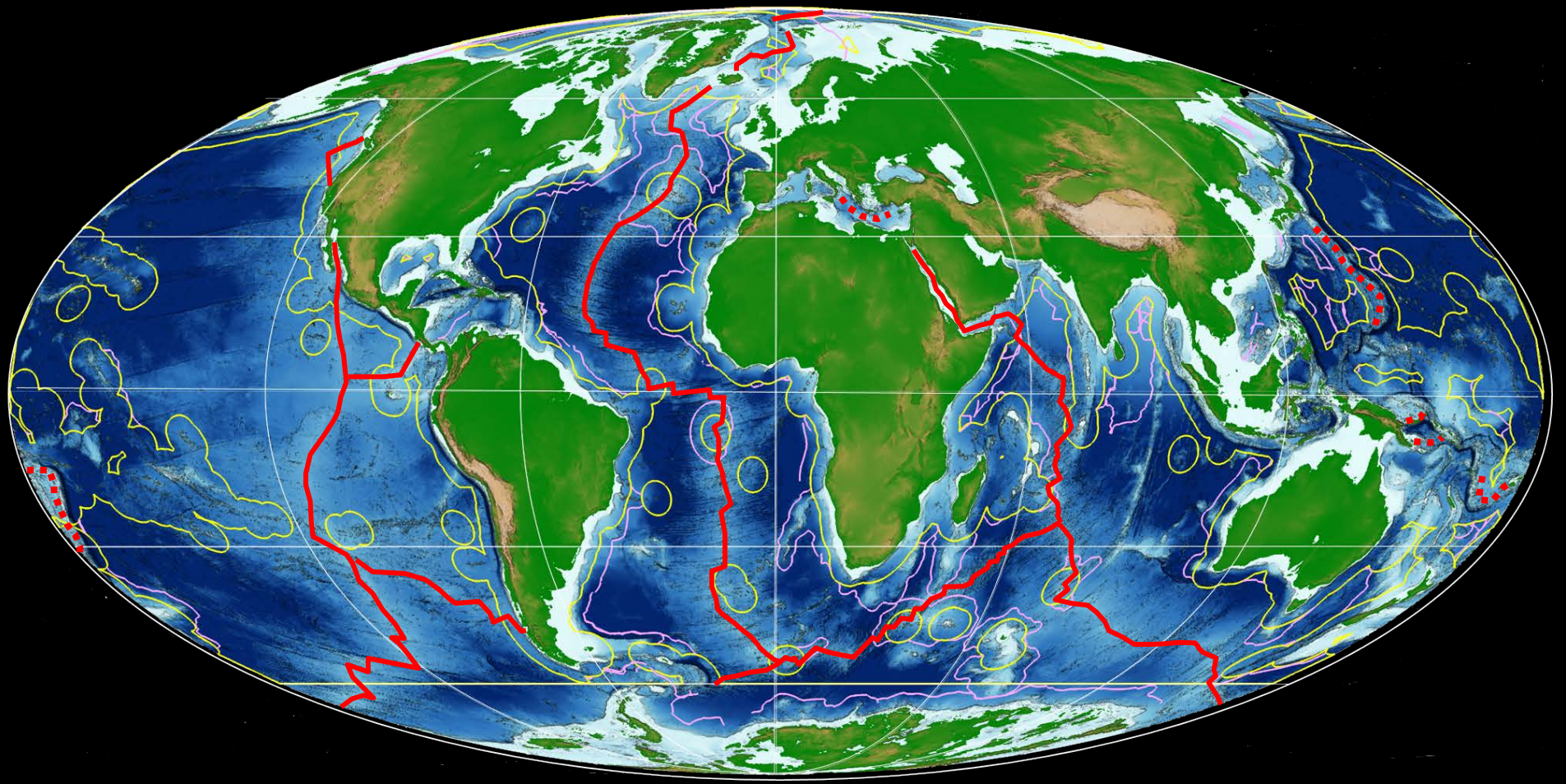
Favourable areas for polymetallic nodules



Adapted from H. Brekke, 2021

Sources:
doi:10.7289/V5C8276M, ETOPO1
http://www.un.org/depts/los/index.htm
Global Maritime Boundaries Database
T. Khun et al., 2017

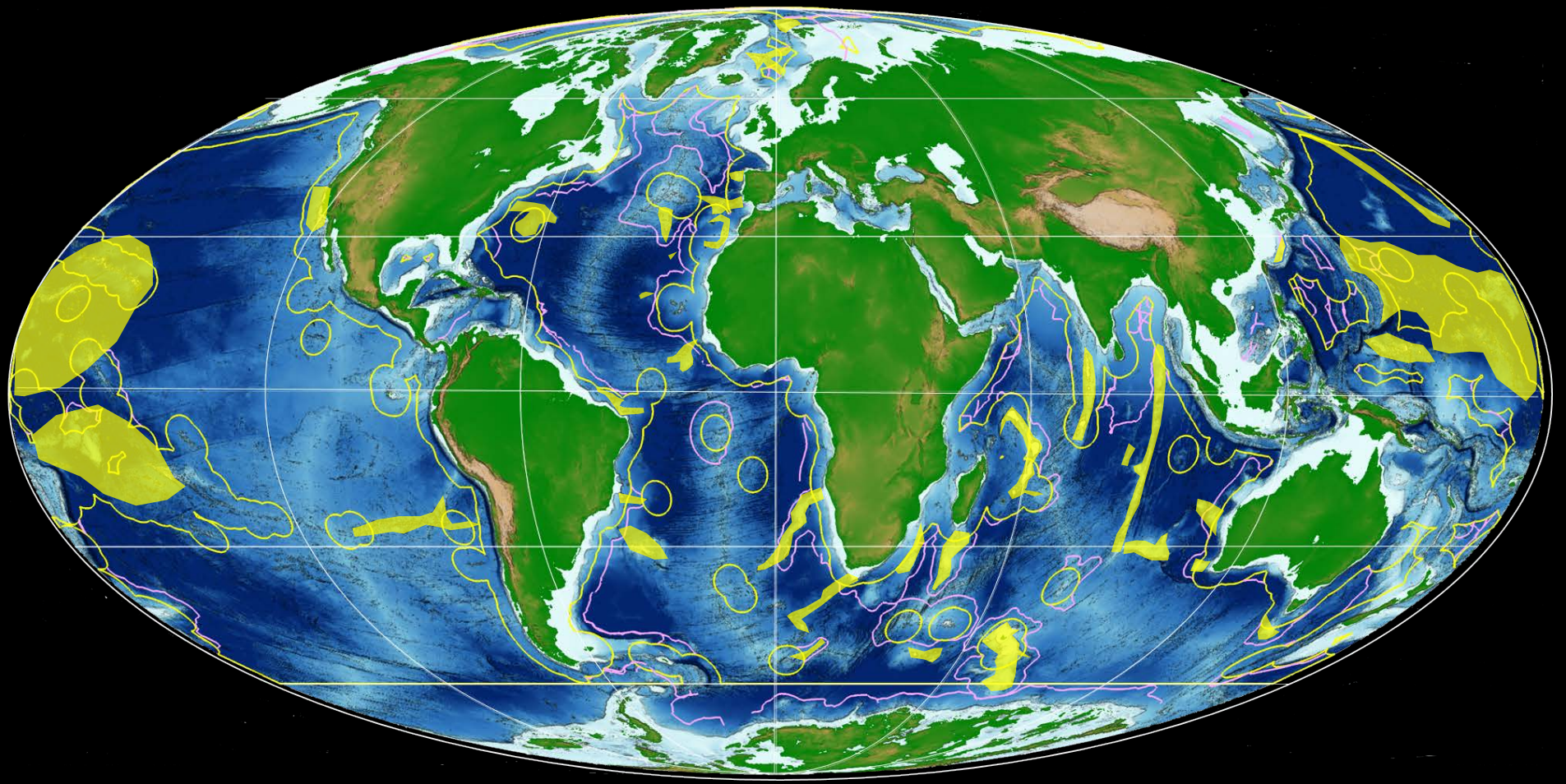
Favourable areas for polymetallic sulphides



Adapted from H. Brekke, 2021

Sources:
doi:10.7289/V5C8276M, ETOPO1
http://www.un.org/depts/los/index.htm
Global Maritime Boundaries Database

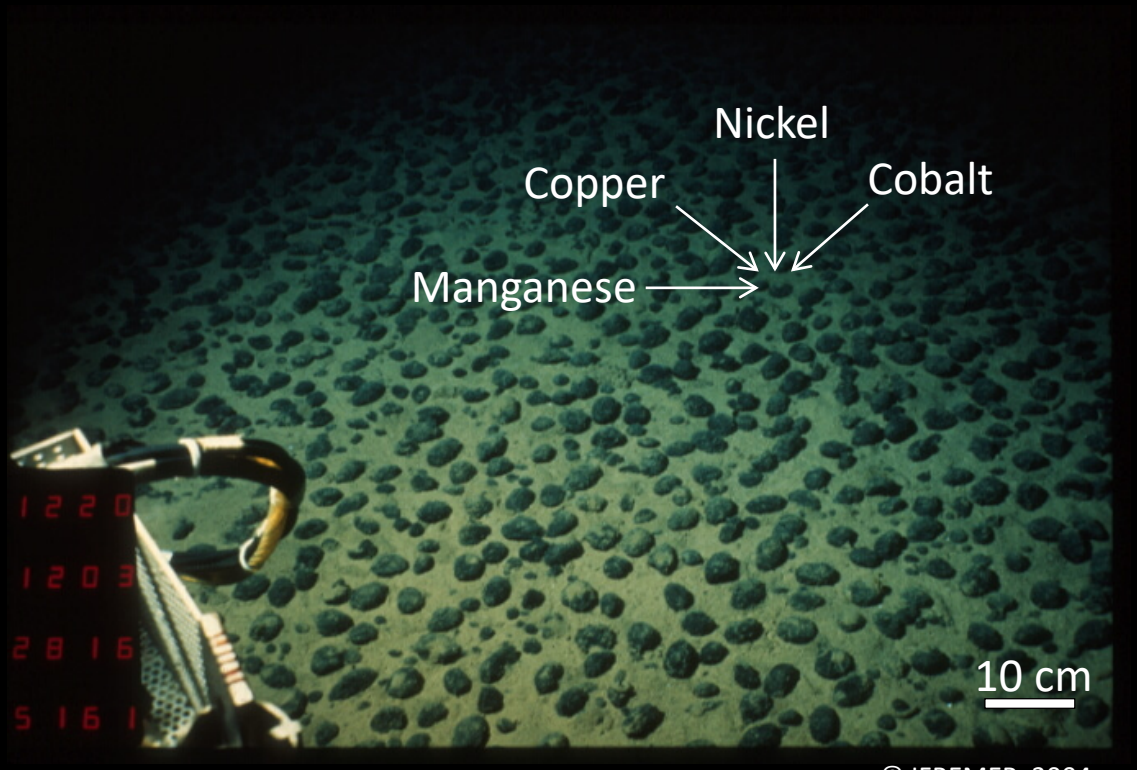
Favourable areas for cobalt-rich ferromanganese crusts



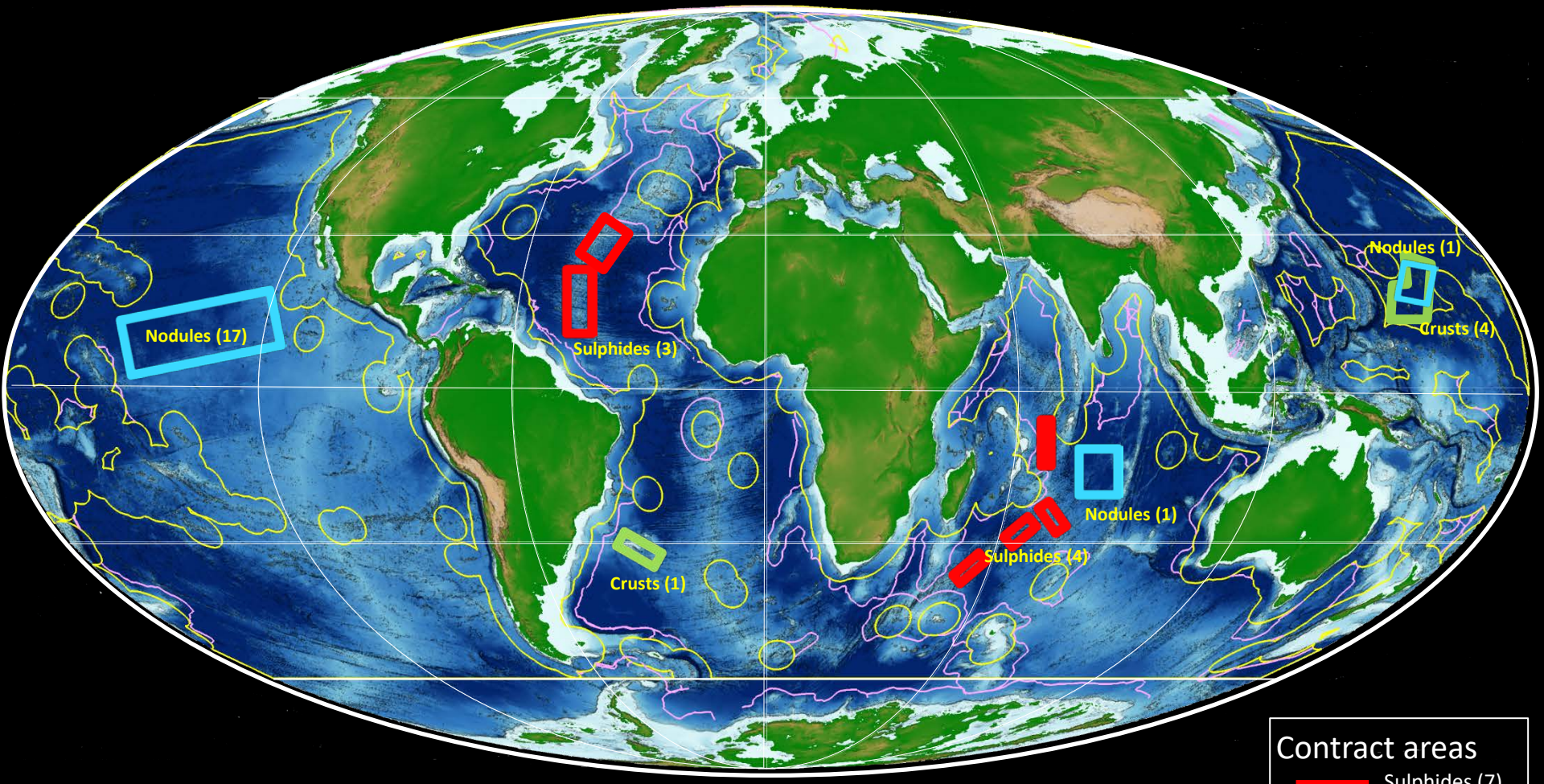
Adapted from H. Brekke, 2021

Sources:
doi:10.7289/V5C8276M, ETOPO1
http://www.un.org/depts/los/index.htm
Global Maritime Boundaries Database
P.E. Halbach et al., 2017

Polymetallic Nodules

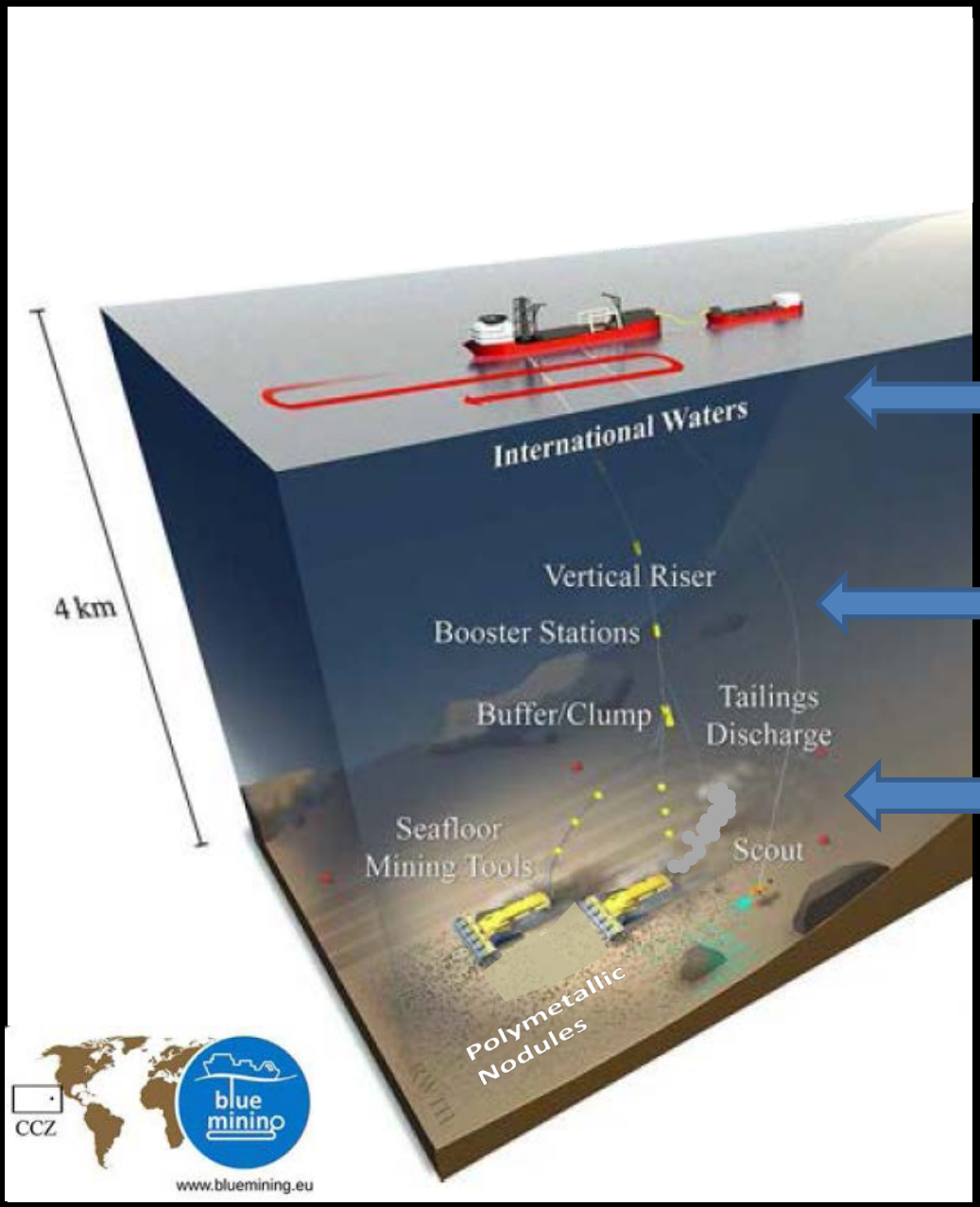


31 active exploration contracts with the ISA



Adapted from H. Brekke, 2021

Technology and the protection of the marine environment



How big ? How far ?

Surface impacts ?

Mid-water impacts ?

Benthic impacts ?

2013

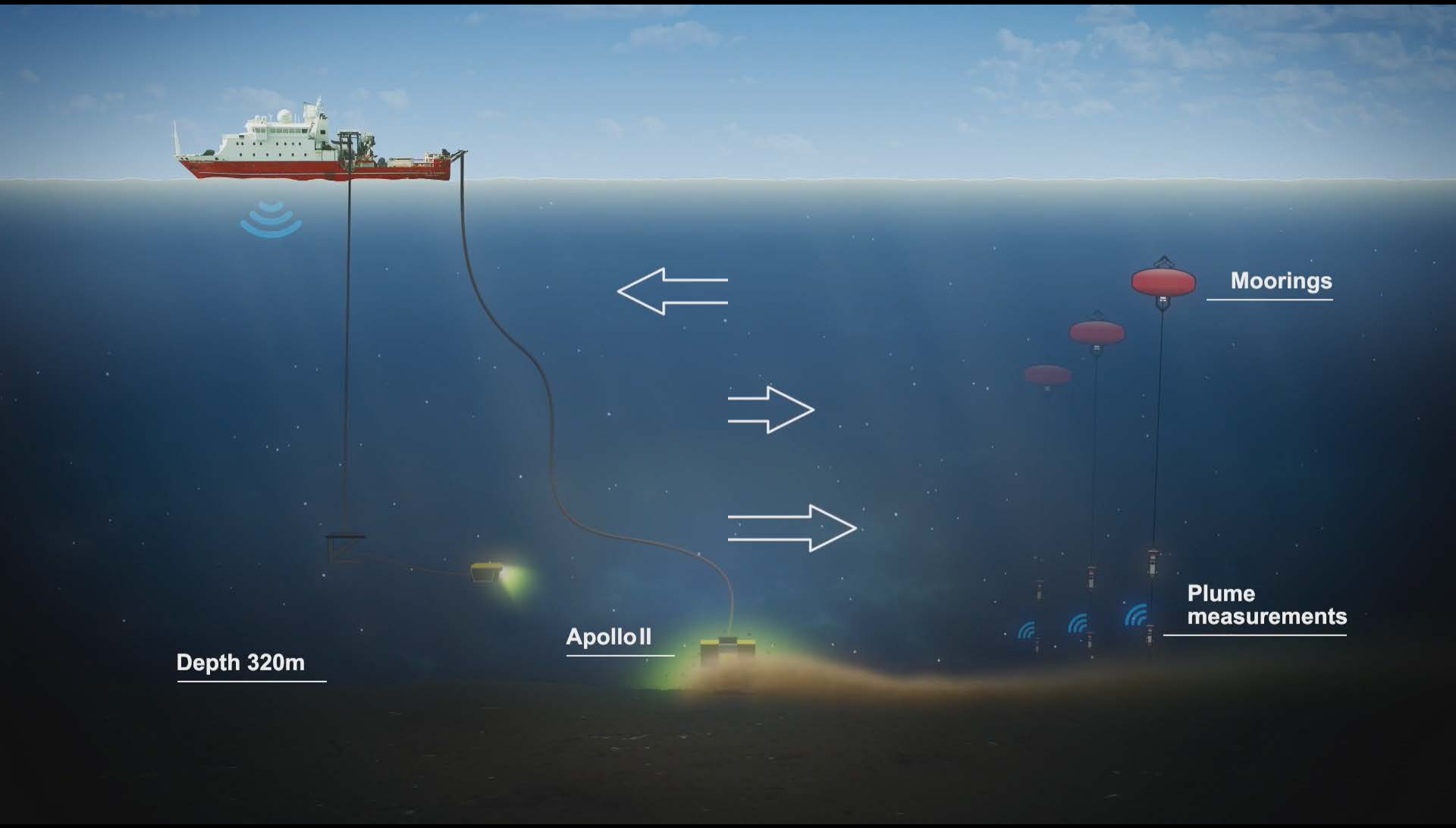
Tested at 1300 m

Resource Assessment & Mining Technology

: Safe and Eco-Friendly Mining

Korea Research Institute of Ships & Ocean Engineering KIOST


APOLLO II
IHC
2018
Tested at 350 m
Source: bluenodules



Source: bluenodules

International Seabed Authority ISBA/25/LTC/6/Rev.1

Legal and Technical Commission

Distr.: General
30 March 2020

Original: English

Twenty-fifth session
Legal and Technical Commission session, part I
Kingston, 4–15 March 2019
Agenda item 11
Review of the recommendations for the guidance of contractors for the assessment of possible environmental impacts arising from the exploration for marine minerals in the Area

Recommendations for the guidance of contractors for the assessment of the possible environmental impacts arising from exploration for marine minerals in the Area

Issued by the Legal and Technical Commission*

B. Activities requiring environmental impact assessment during exploration

(a) Use of sediment disturbance systems that create artificial disturbances and plumes on the sea floor;

(b) Testing of mining components;

(c) Test-mining;

(d) Testing of discharge systems and equipment;

(e) Drilling activities using on-board drilling rigs;

(f) Sampling with epibenthic sled, dredge or trawl, or similar technique, in nodule fields, that exceeds 10,000 m^2;

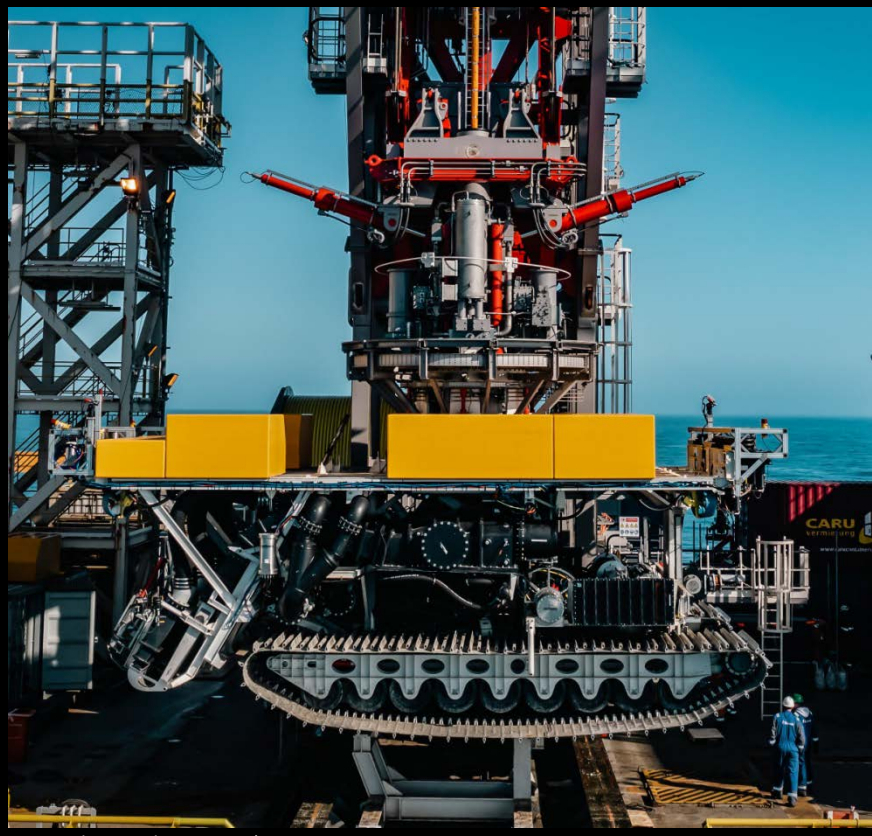
(g) Taking of large samples to test land base processes.

Source: National Institute of Ocean Technology (NIOT), India (@newindianexpress.com)

Environmental Impact Statement (EIS)

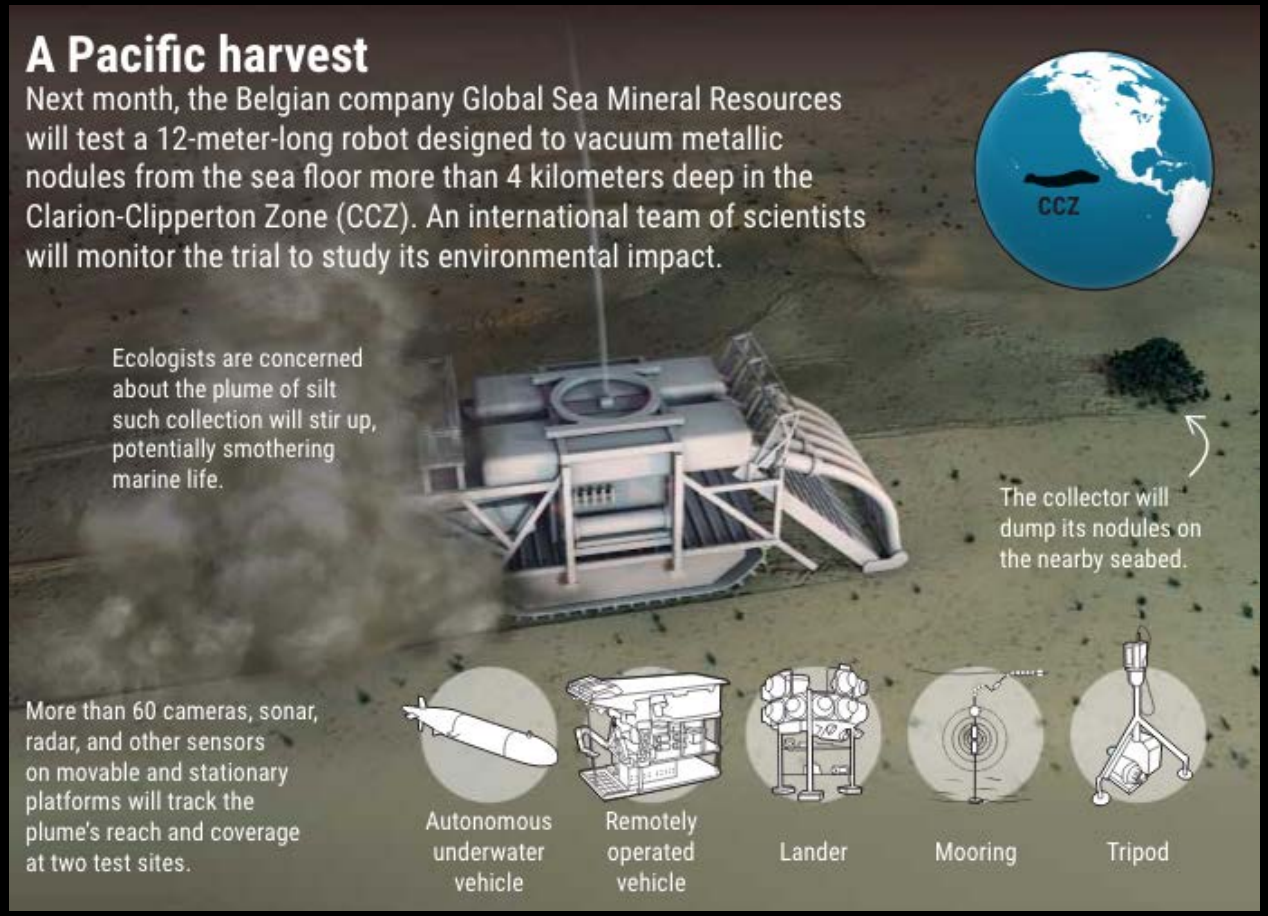
- GSR (sponsored by Belgium);
- BGR (sponsored by Germany);
- Government of India;
- NORI (sponsored by Nauru).

Source: DEME)



Source: The Metals Company)

GSR and BGR EIS



Source: V. ALTOUNIAN/*SCIENCE*

Source: BGR

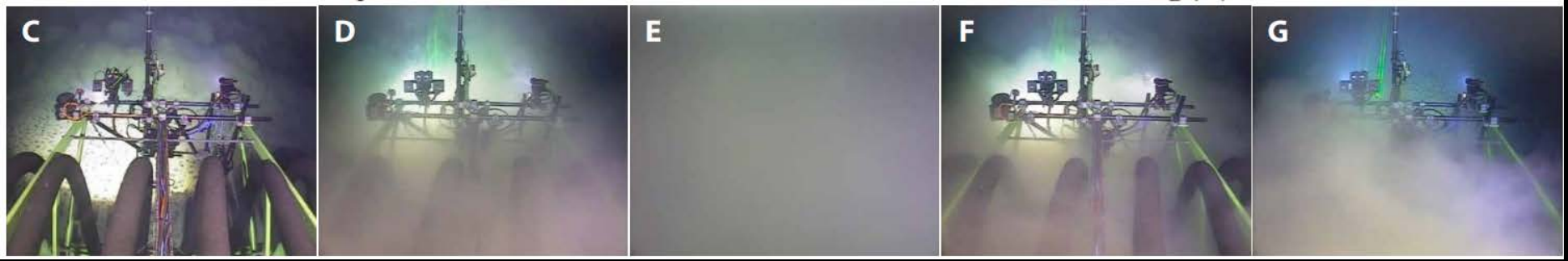
SCIENCE ADVANCES | RESEARCH ARTICLE

OCEANOGRAPHY

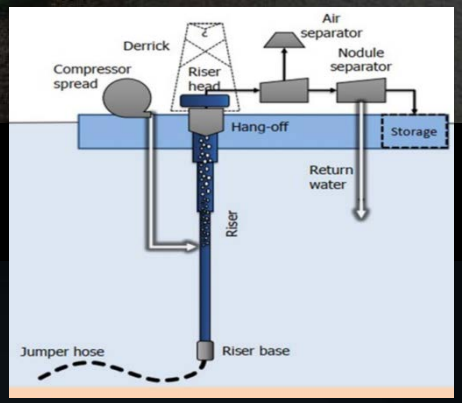
An in situ study of abyssal turbidity-current sediment plumes generated by a deep seabed polymetallic nodule mining preprototype collector vehicle

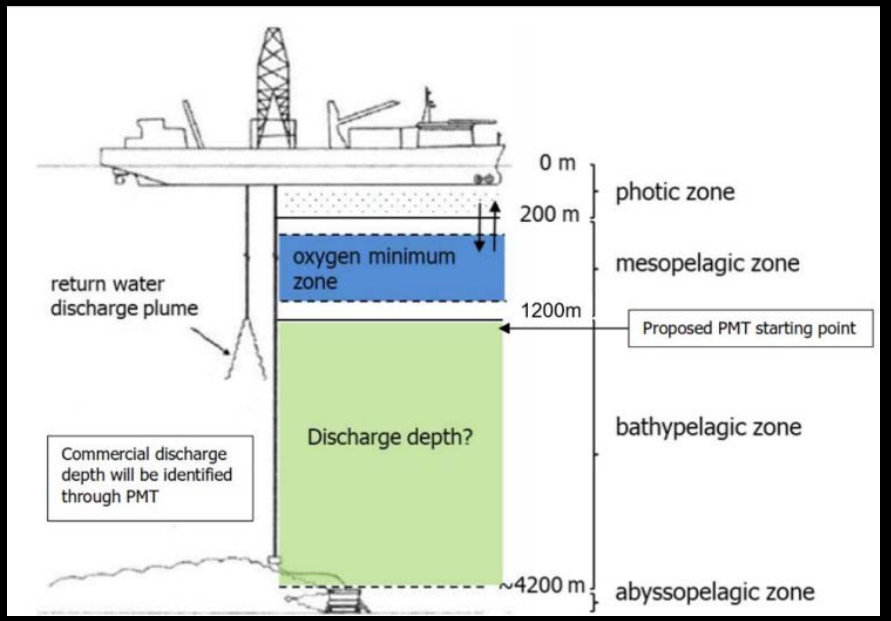
Carlos Muñoz-Royo[1]*, Raphael Ouillon[1], Souha El Mousadik[1], Matthew H. Alford[2], Thomas Peacock[1]*

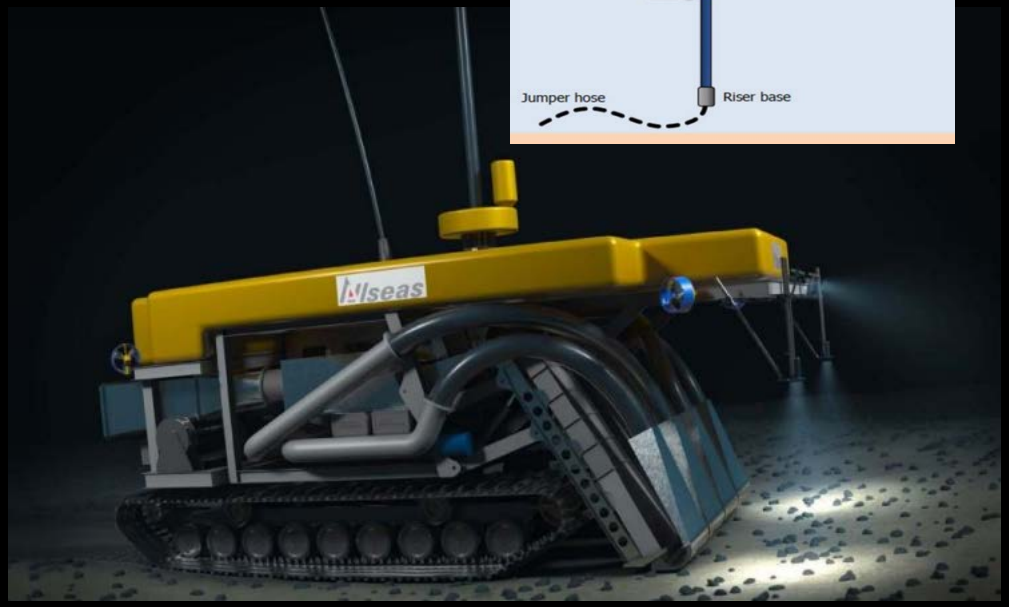
An in situ study to investigate the dynamics of sediment plumes near the release from a deep seabed polymetallic nodule mining preprototype collector vehicle was conducted in the Clarion Clipperton Zone in the Pacific Ocean 4500-m deep. The experiments reveal that the excess density of the released sediment-laden water leads to a low-lying, laterally spreading turbidity current. At the time of measurement, 2 to 8% of the sediment mass were detected 2 m or higher above the seabed and were not observed to settle over several hours, with the remaining 92 to 98% below 2 m and some fraction of that locally deposited. Our results suggest that turbidity current dynamics sets the fraction of sediment remaining suspended and the scale of the subsequent ambient sediment plume. The implications of this process, which is characteristically overlooked in previous modeling efforts, are substantial for plume modeling that will lie at the heart of environmental impact statements for regulatory consideration.



NORI EIS







Source: NORI Environmental Impact Statement

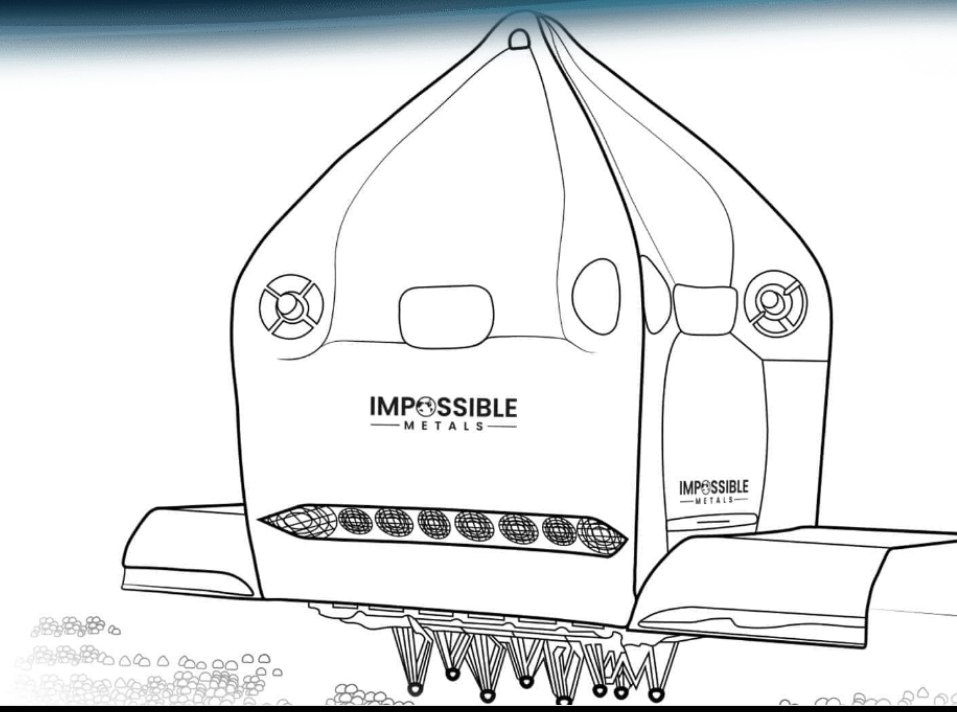
Future technologies ?

IMPOSSIBLE METALS

TECHNOLOGY SUSTAINABILITY NEWS CONTACT

ROBOTIC COLLECTION SYSTEM

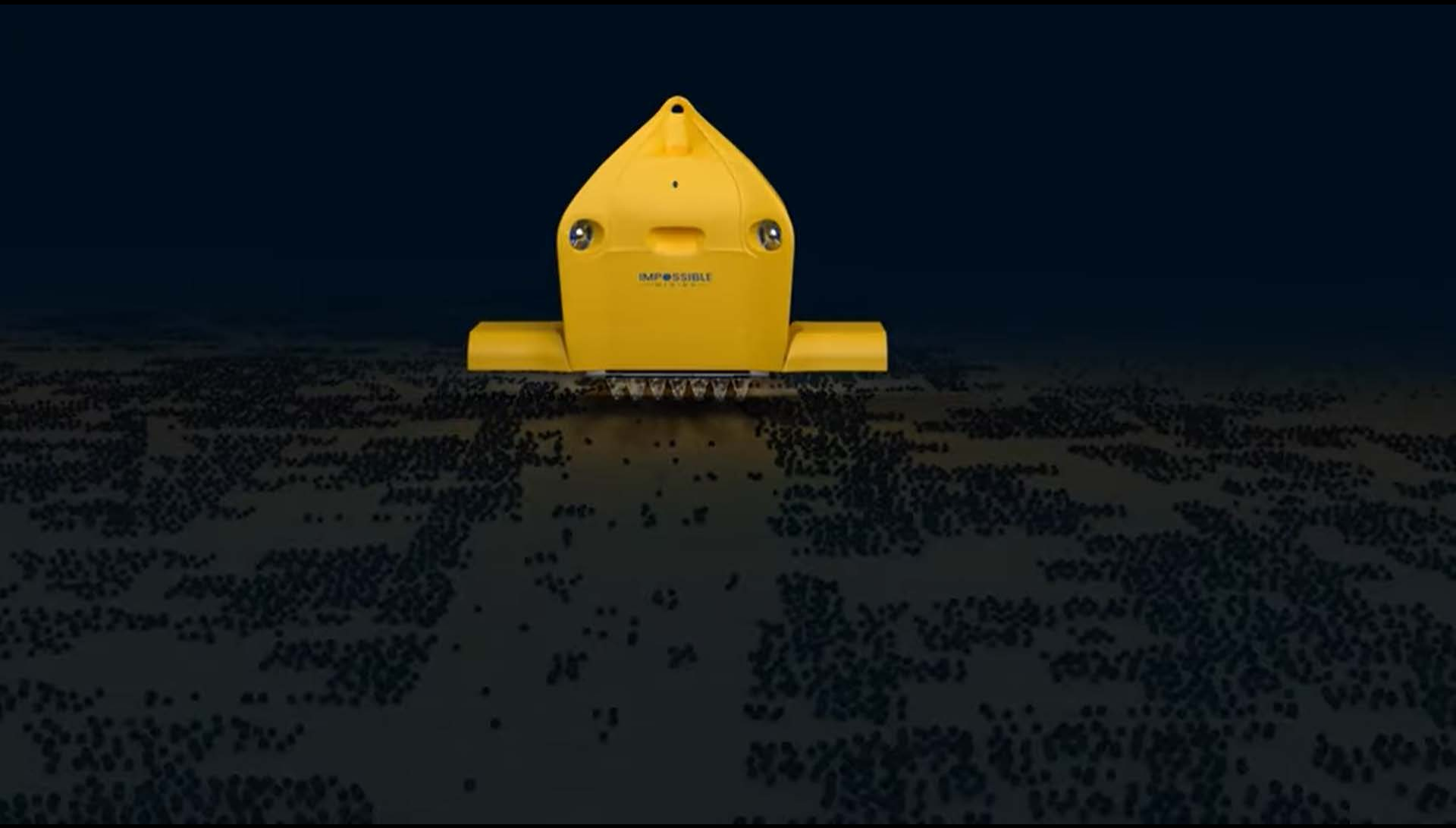
Impossible Metals commenced work on its engineering architecture in 2020, with first patents filed in 2021. In 2021 we also closed our first funding round, enabling us to begin working on Proof of Concept for both nodule harvesting and bio-extraction technologies. We anticipate delivering Proof of Concept in late 2022.



Source: Impossible Mining

Source: Impossible Mining

No plume, minimum impact



Source: Impossible Mining

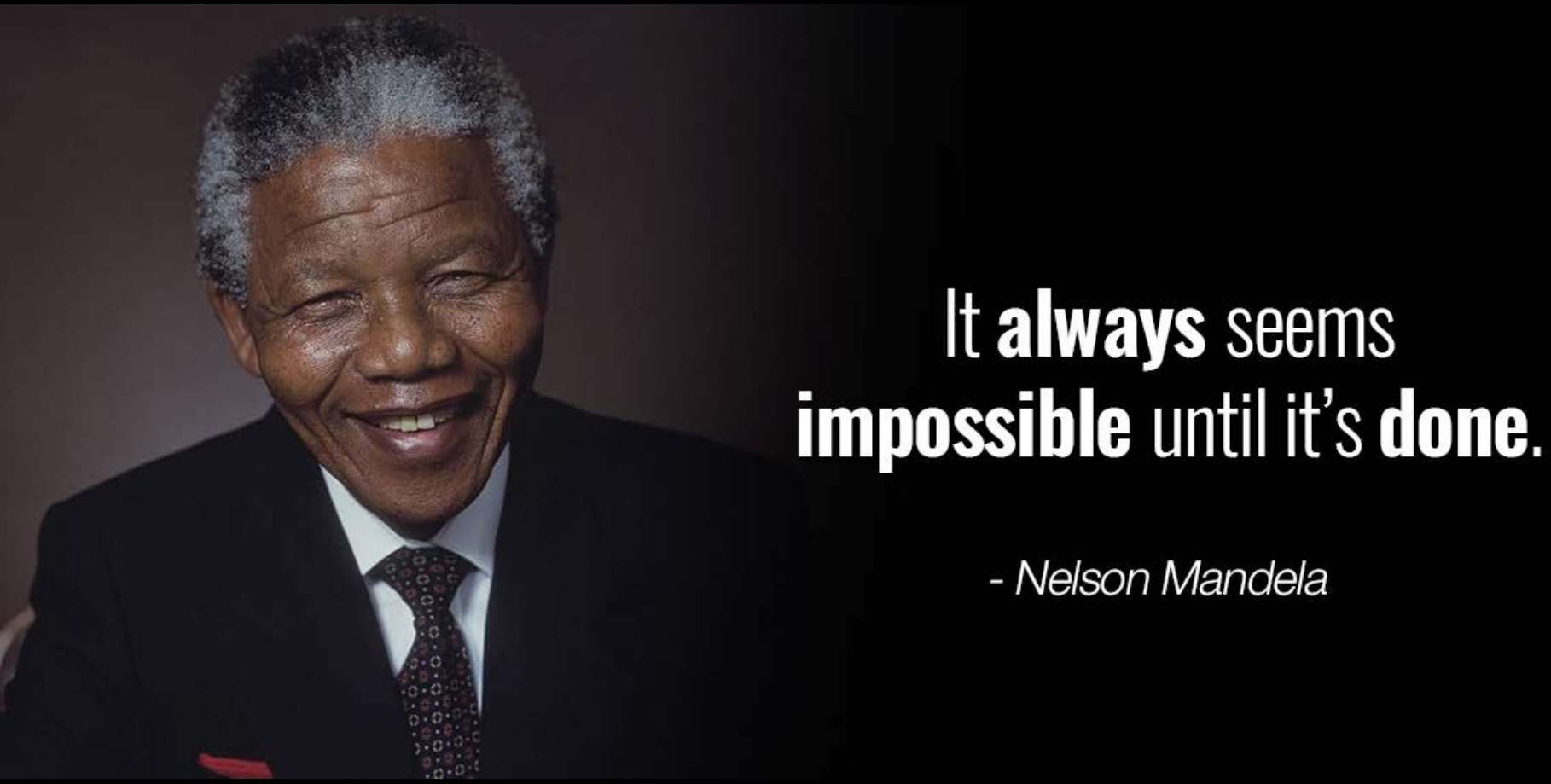
Final remarks

- Some African coastal States will have access to marine mineral resources from the deep sea as expected from the extension of their continental shelf beyond 200 nautical miles;

- However, the 'parallel system' as included in UNCLOS may also provide an opportunity for the participation of developing States in the activities in the Area;

- Deep sea exploration and exploitation is not only about access to minerals and metals. It is also about the opportunity to develop technology and expertise for deep sea and Ocean sciences;

- Deep sea mining without the generation of impacts from sediment plumes seems to be impossible. However, ...


It always seems
impossible until it's done.
- Nelson Mandela