Study to investigate the state of knowledge of Deep Sea Mining

NGO Workshop:
Seas at Risk &
Deep Sea Conservation Coalition

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Ecorys
Brussels, 5 November 2014

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The study

- Commissioned by DG MARE
- Executed in period December 2014-October 2014
- Final report shortly available (see https://webgate.ec.europa.eu/maritimeforum/en/frontpage/490

- Team consisting of:
  - Ecorys (NL/BE)
  - MRAG (UK)
  - GRID Arendal (NO)
  - GEOMAR (GE)
  - NOC Southampton / Seascape (UK)
  - TU Delft (NL)

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MRAG

UNEP GRID ARENDAL
Environmental Knowledge for Change

GEOMAR
Helmholtz-Zentrum für Ozeanforschung Kiel

seascape consultants ltd

TU Delft
Delft University of Technology

Drivers of Deep Sea Mining

	Global	Industry	Pacific Island countries
Primary drivers	Global economic growth: supply and demand, population and consumption, increased industrialization and urbanization	Innovative, frontier field in an industry used to high-risk investment	Alternate development option: alleviate poverty, meet rising aspirations, lack of comparative advantage in other areas
	State actors: securing access to essential resources, capable of vertical integration of resource extraction and processing with product manufacture	Increasing difficulty and complexity of terrestrial mining: increasing costs, decreasing grade, slowing discovery, environmental issues, social and cultural issues	Marine minerals are a new natural resource capable of commercial exploitation in a region with few economic industries/choices
Secondary drivers	Growing societal aspirations for environmental and social sustainability	Technological improvements and scalable applicability	National independence and autonomy
	New uses/markets, the green economy		
Restricting forces	Price volatility	Availability of finance, financial uncertainty	Increasing community concerns about governance of, impact and returns from extractive industries
	Concerns over threats to marine environment, lack of marine science to inform conservation planning	Regulatory uncertanty in EEZ and the Area Significant obligations to share knowledge proceeds	Lack of governance, capacity, and regulation

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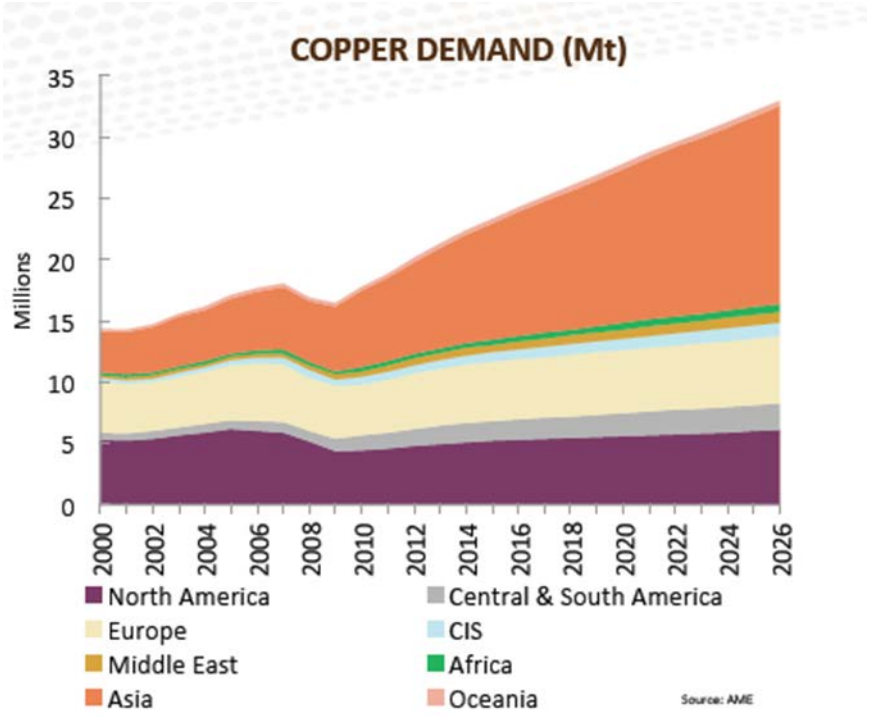
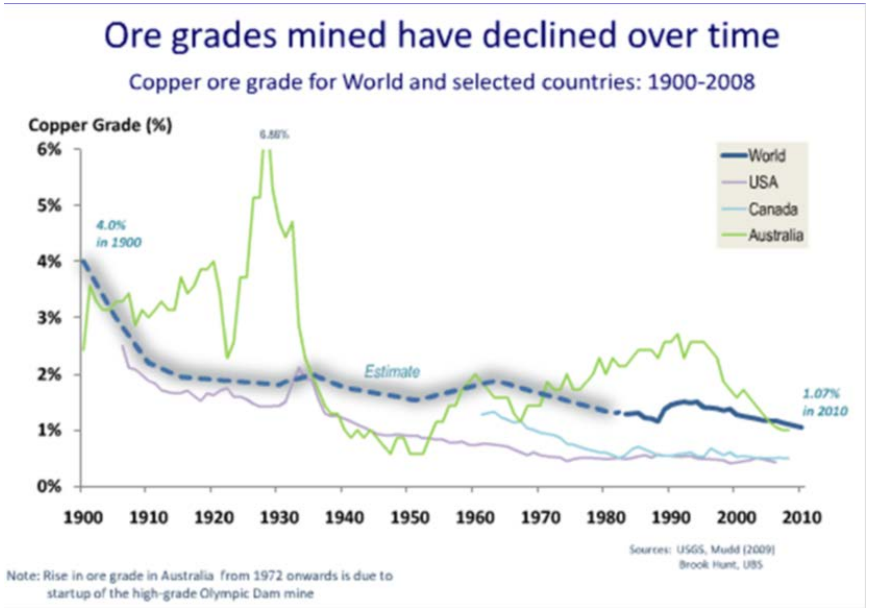
Drivers of Deep Sea Mining: the example of copper





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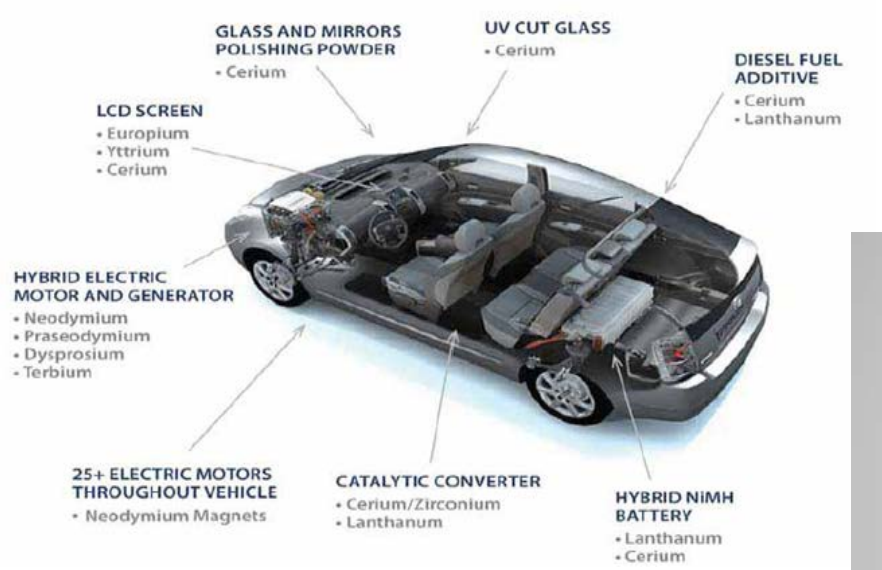
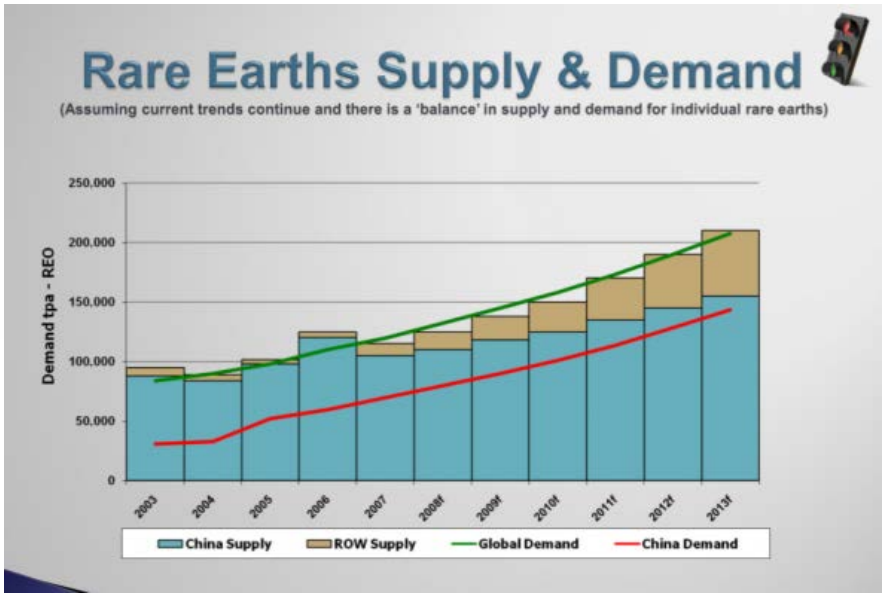
Drivers of Deep Sea Mining: the example of rare earth elements





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Interest is increasing

- Number of (ISA) licenses in international water increased from 19 to 26 in 2014. These are all exploration licenses.

- In addition > 26 licenses in waters under national jurisdiction. Of these two are exploitation licenses:
  - Solwara I in Papua New Guinea; expected to start in 2016 – Nautilus Minerals Inc.
  - Atlantis II Deep in the Red Sea (Sudan/Saudi Arabia) – JV Diamonds Fields International/Manafa International; on hold as result of conflict between the two

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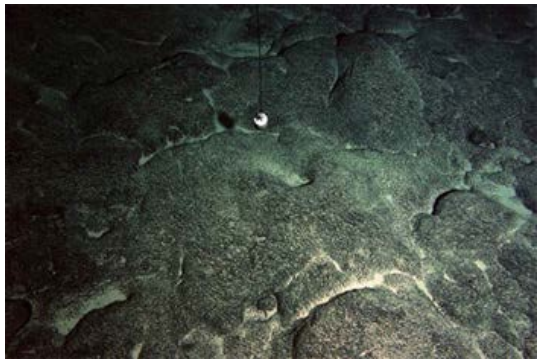
The seabed potential

- Polymetallic sulphides (seafloor massive sulphides)
- Polymetallic (manganese) nodules
- Polymetallic (cobalt rich) crusts

- Different potential and different impacts



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The seabed potential

	Sulphides	Manganese nodules	Cobalt-rich crusts
Geological setting	mid-ocean ridges and young island arc volcanoes	sedimented abyssal plains	flanks of old volcanoes
Characteristics	ten to several hundred meter wide mounds	baseball-sized nodules on soft sediment	several cm thick crusts paving hard substrate
Water depth of greatest economic potential	1,000 – 5,000 m	3,000 – 6,000 m	1,000 – 2,500 m
Main metals of interest	Copper Zinc, Gold, Silver	Manganese, Copper, Nickel, Cobalt	Manganese, Copper, Nickel, Cobalt
Other metals considered	Cadmium, Gallium, Germanium, Indium, Antimony	Molybdenum, Lithium, Zirconium	Rare Earth Elements, Tellurium, Platinum
Grade distribution	heterogeneous on local scale	homogeneous within large regions	homogeneous within large regions
Knowledge base for resource estimate	poor	good	moderate
Resource potential of the commodity	medium	high	high
Global impact of mining on metal markets	low	high	high
Size of the mining area	small	large	large

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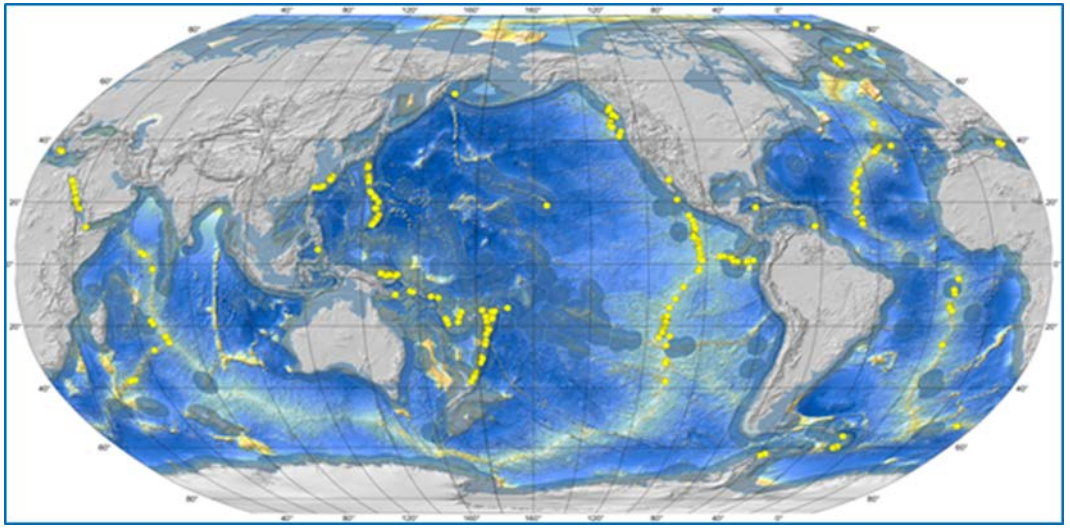
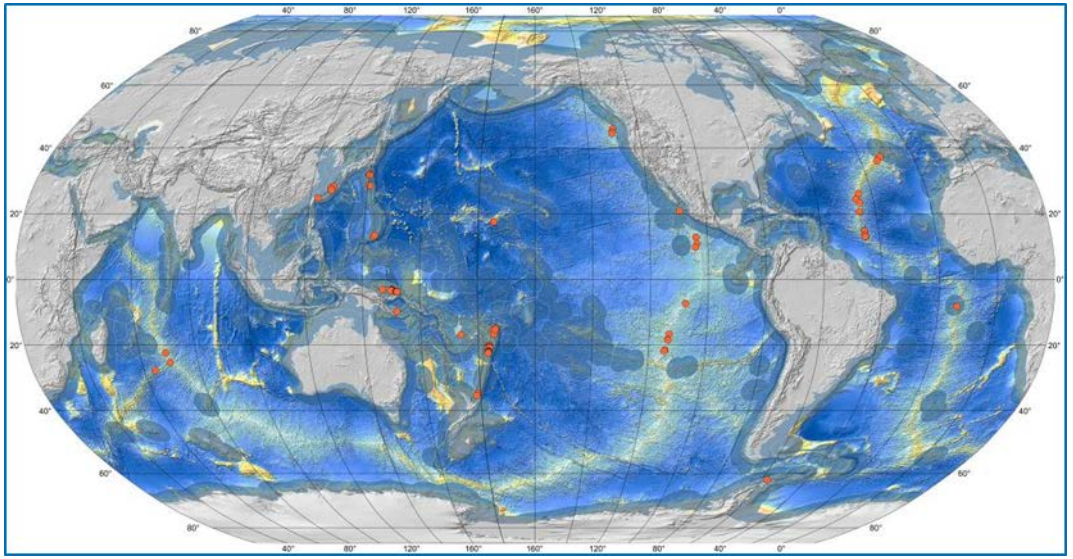
The seabed potential: sulphides



thresholds of 5 wt. % Cu, 15 wt. % Zn and 5 grams/tonne gold (Au)



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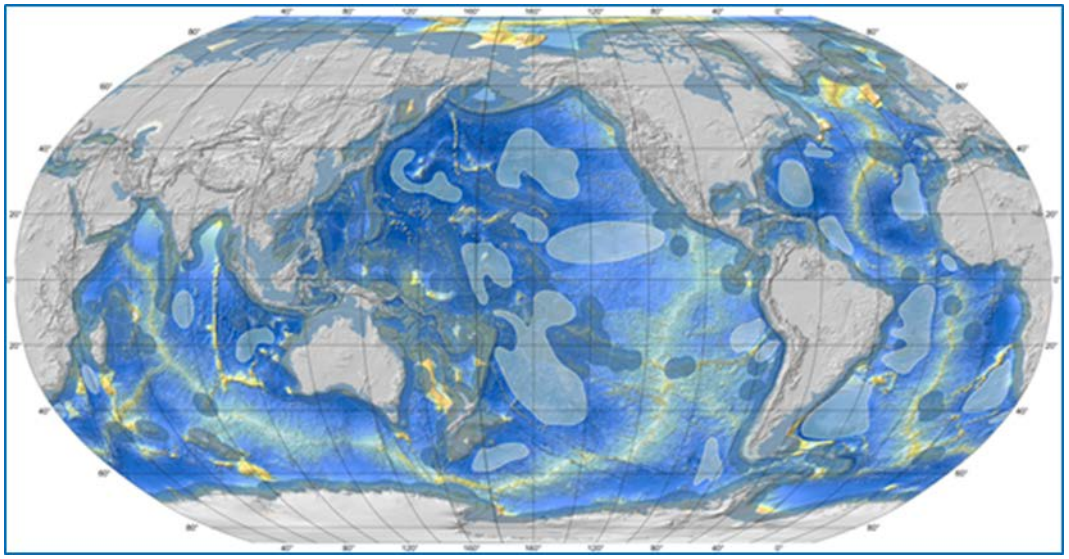
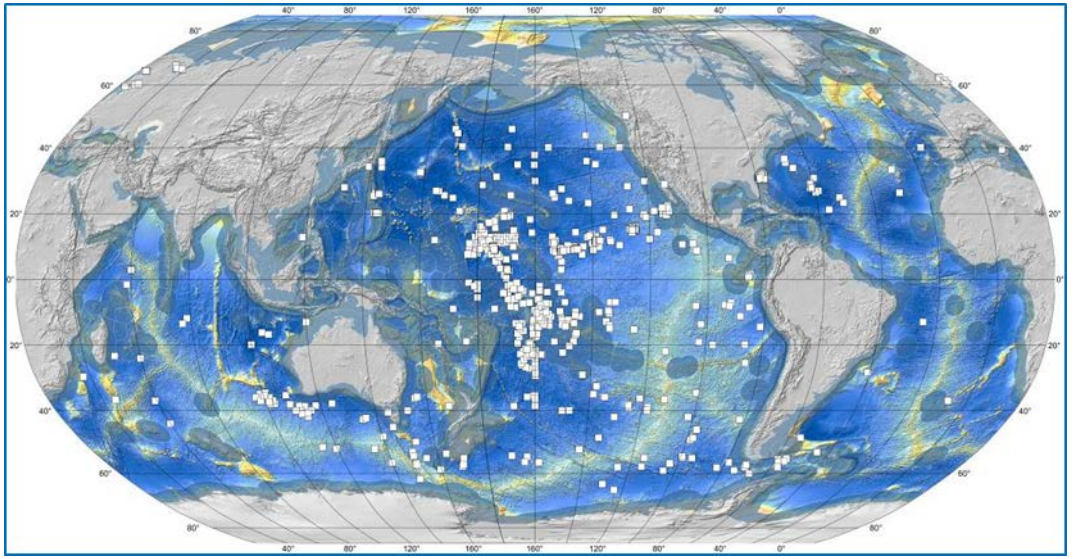
The seabed potential: nodules



thresholds of combined Cu+Ni+Co grade of > 2.5 wt. %



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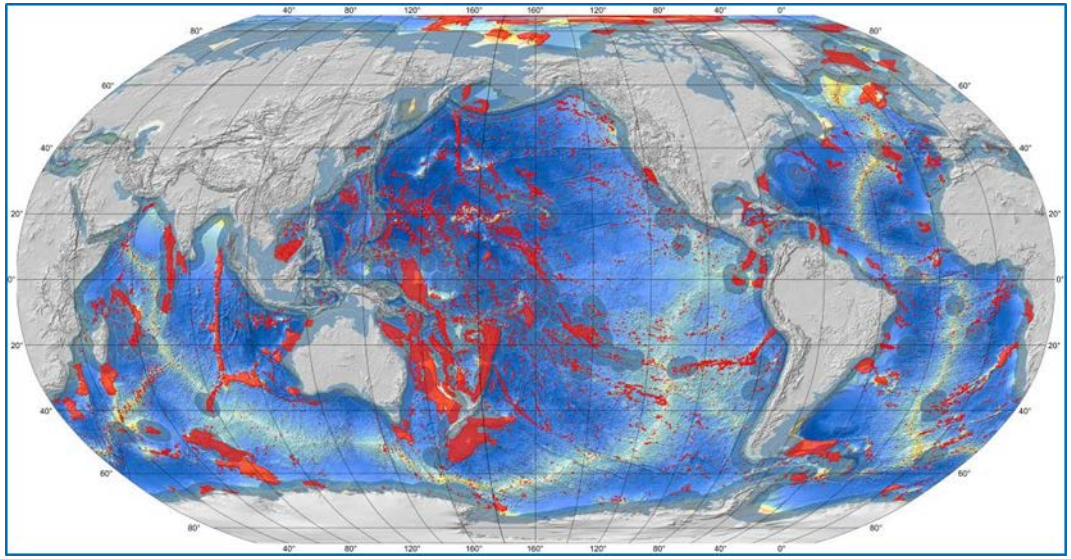
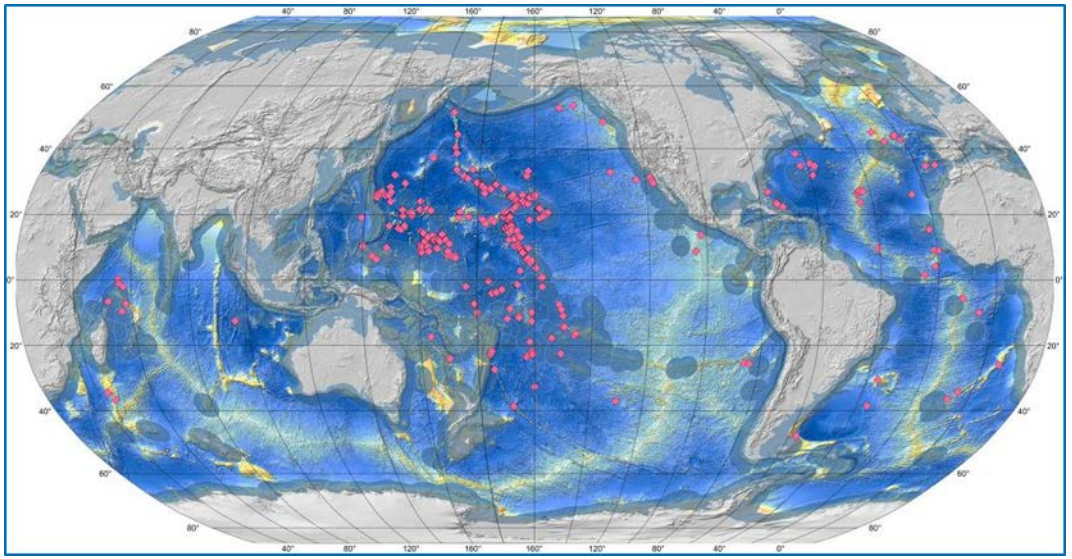
The seabed potential: crusts



threshold Co concentrations above 0.5 wt. %



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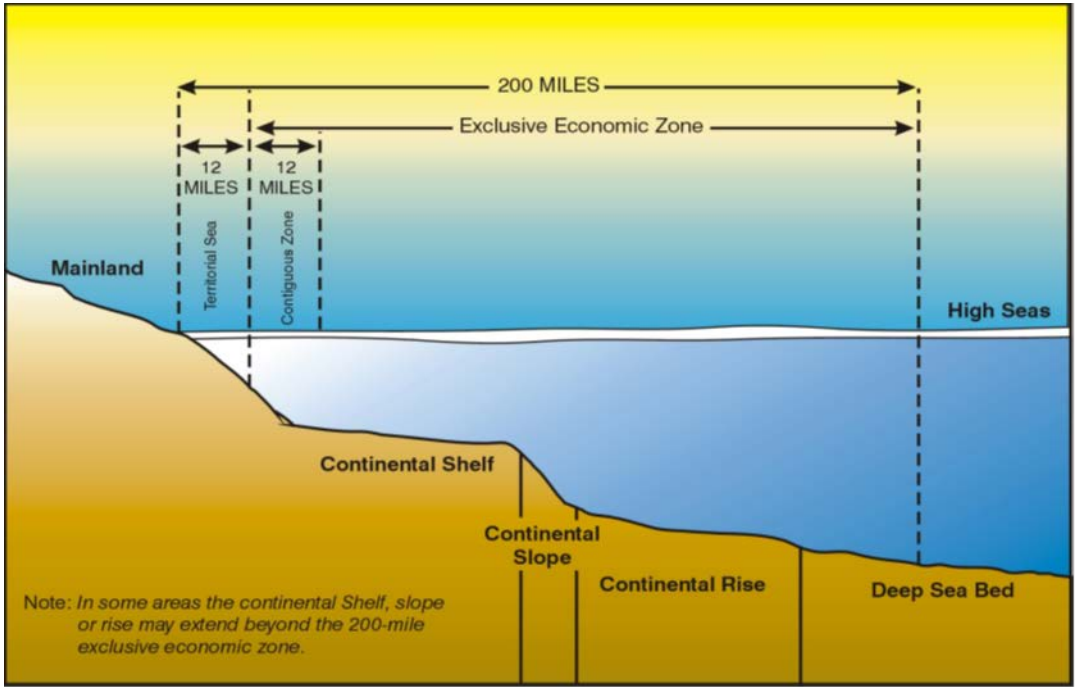
The legal environment

- Areas within the jurisdiction of coastal states
  - In many cases based on terrestrial mining legislation
- Area beyond national jurisdiction (the “Area”)
  - ISA – International Seabed Authority



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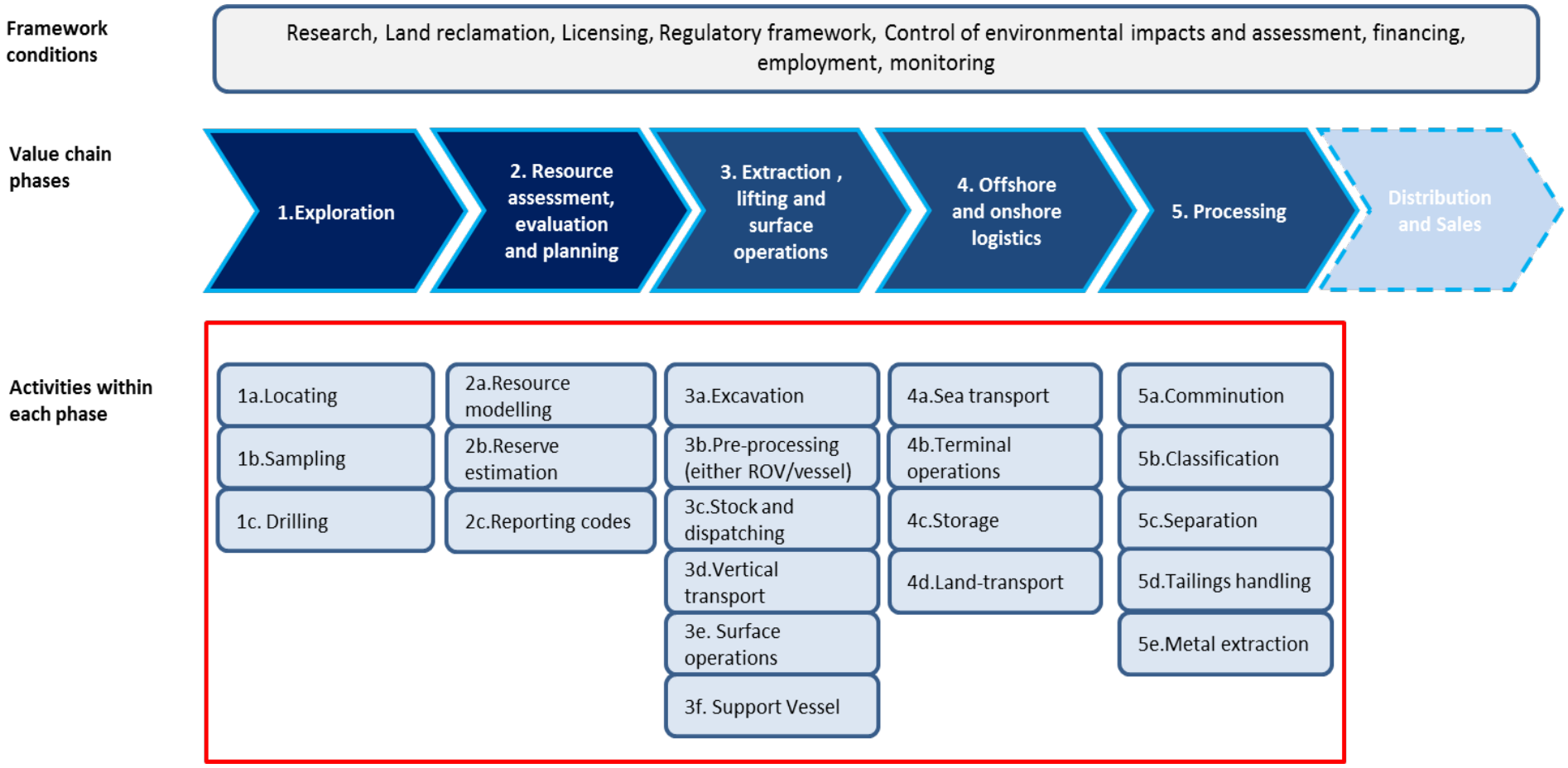
State of play of technology



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Mapping the state of play for DSM technology: Technology Readiness Levels (TRL)

Table 3.1 Technology readiness levels

TRL	Definition
TRL 1	Basic principles observed
TRL 2	Technology concept formulated
TRL 3	Experimental proof of concept
TRL 4	Technology validated in lab
TRL 5	Technology validated in relevant environment[5]
TRL 6	Technology demonstrated in relevant environment
TRL 7	System prototype demonstration in operational environment
TRL 8	System complete and qualified
TRL 9	Actual system proven in operational environment

Source: European Commission (2013) Horizon 2020 Work programme

- TRL levels lower (1-4) for technologies required on sea bed and riser systems
- EU players important in technology development

Environmental impacts

- Many unknowns, due to:
  - Unknowns on habitats, biodiversity and ecosystems and resilience
  - Unknowns on actual impacts due to lack of experience.

- Main impacts expected as a result of:
  - Loss of substrate (sea bottom habitat)
  - Operational plume (and re-sedimentation)
  - Discharge plume (also depending on depth of discharge)

- Pace of recovery is expected to be highest for sulphides mining and slowest for nodules.

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Some conclusions

- Exploration will continue
- Exploitation potential:
  - Sulphides mining looks commercially attractive, but resource potential is still unclear;
  - Nodules & crust mining has large resource potential but requires further development to make it commercially viable; number of parallel projects expected to be limited due to price impacts at world market;
  - Longer term option of access to critical raw materials
- There is a need for:
  - A deepened understanding of the deep-sea environment;
  - Improved deep-sea technology development can assist;
  - Further development of the regulatory framework.

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THANK YOU!

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