Deep-Sea Mining impact on biodiversity

Mejjad Nezha[1], Rovere Marzia[2]

[1]*Faculty of Sciences Ben M'sik, University Hassan II- Casablanca Morocco* & [2]*The Marine Sciences Research Institute (ISMAR) of the Italian National Research Council (CNR), Bologna, Italy*

The growth need for raw materials for technology had raised the minerals price especially with the mineral resources depletion on land which rises up the interest on exploring and exploiting deep-sea minerals. However extracting these resources could have a major impact on the deep-sea biodiversity and habitats, since the effects of mining operation on these ecosystems are unknown. In the present study, we review and assess the potential risk of mining activities on habitat and biodiversity of deep-sea ecosystems.

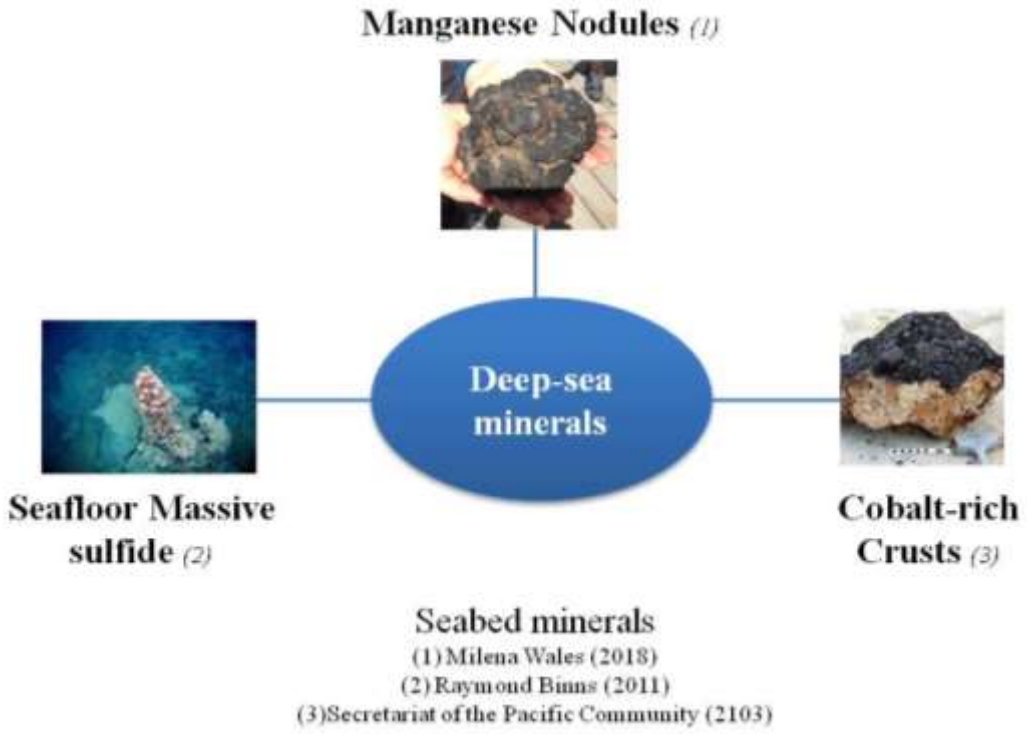
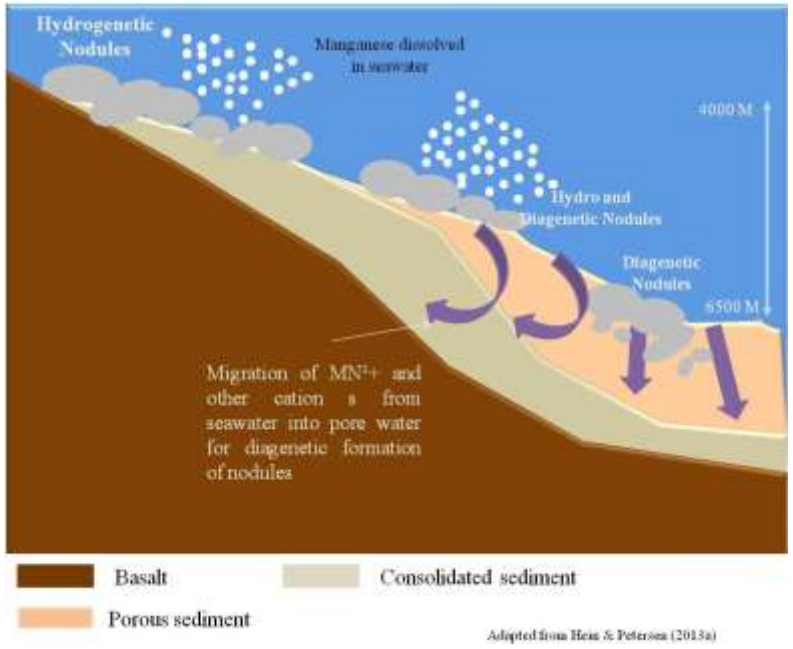


Figure 1: Three main seabed minerals.

Deep-Sea Mining impact on biodiversity

Description of Poly metallic nodules

Polymetallic nodules are mineral concretion and they also called ferromanganese nodules because they are formed by concentric layers of manganese and iron but they also contain other metals of commercial interest around a tiny core such as nickel, copper, cobalt and traces of molybdenum, lithium and rare earth elements (Hein et al., 2013; Haldar, 2018).



Polymetallic nodules occur in the abyssal ecosystems characterized by very poor food, cummunity structure, with biomass, growth rates, production and recolonization rates which all under the control of very low flux of particulate organic material sinking from the distant euphotic zone (Smith et al., 2008)

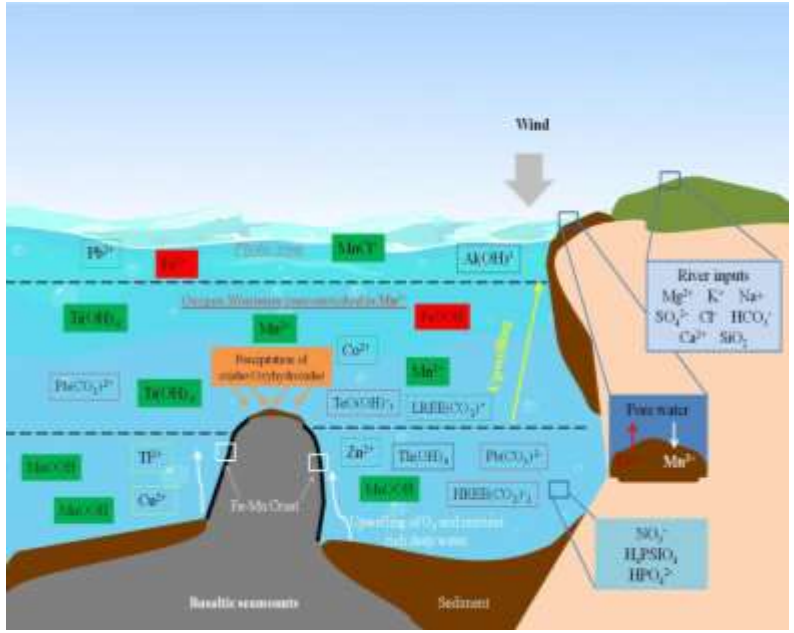
Possible impact on Biodiversity

Extracting nodules will lead to the removal of specialized fauna living in the nodules such as foraminifera and sponges (Veillette et al., 2007 and Clarck et al., 2013), as well as organisms that live in the soft sediment patches between and under the nodules. Collecting nodules will cause also sediment plumes which can lead to bury or smother organisms and habitats and consequently prevent larval settlement and colonisation, as the sedimentation rate is too low (Smith et al., 2003)

Deep-Sea Mining impact on biodiversity

Description of Cobalt rich-crusts :

Cobalt rich-crusts are also called "cobalt-rich ferromanganese crusts", and they are found in the entire ocean and in many cases, the deposits occur within the Exclusive Economic Zone (EEZ) of the countries (**Fig.5**). They are occurring in the rock areas free of sediment in geologically stable seamount, Plateaus, and ridges at depths between 400 and 7000 metres (Hein et Petersen, 2013).



Formation of Cobalt rich-Crust in seamounts

Possible impact on Biodiversity and habitat:

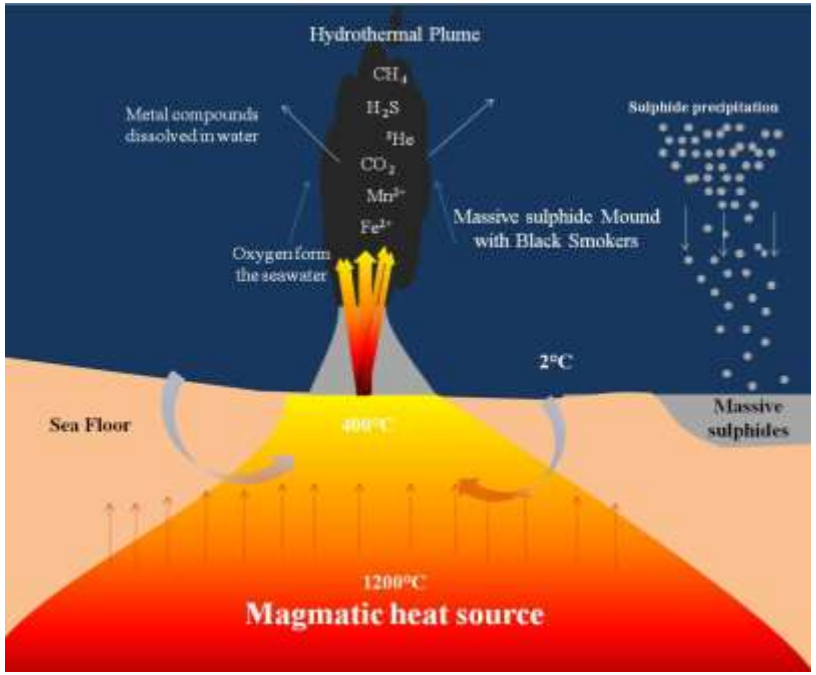
Sessile corals and sponges are the dominant benthic fauna on seamounts (Rogers et al., 2007). The fragility and complexity of these taxa make them highly vulnerable to mining operations effects.

These benthic fauna (corals and sponges) provide important food, habitat and refuge for a vast number for associated fish and invertebrates species (Freiwald et al., 2004).

Deep-Sea Mining impact on biodiversity

Description of Seafloor massive sulphides (SMS) :

Seafloor massive sulphides (SMS) are called also polymetallic sulphides (PMS), they were first identified in 1948 during the Swedish Albatross oceanographic expedition in the Red Sea (ISA). SMS are deposits that occur in active hydrothermal vent sites and can enclose metals of economic interest such as zinc, copper, gold, and silver (SPC, 2013)



Formation of Seafloor Massive sulfide

Possible impact on Biodiversity and habitat:

Extracting SMS minerals may cause a serious harm to habitat and aquatic life as the mining operations will affect directly habitat and fauna through removing the substratum which can lead to dimunishing diversity at all levels: genetic, species, functional,
and habitat (Van Dover et al., 2014).
Generated plumes from mining activities will be enriche in toxic metals that can become bioavailble and have harmful impact on biota (pelagic and Benthic).

Conclusions

The present work sought to understand the possible impact of deep-sea mining on marine environment, biodiversity and habitat. The lack in knowledge regarding deep-seas ecosystems functions, habitats, biodiversity is the challenging issue that face the development of this sector.

Moreover, the deep-sea provide highly valuable services for human well-being and understanding the importance of every component of deep-sea ecosystems can help to overcome the existing gaps in knowledge regarding these ecosystems and allowing better governance.

Acknowledgment

*The present work is performed under the framework of **Deep Blue project.***
The project is funded by the European Maritime and Fishery Fund (EMFF) and the European Agency for Small and Medium-sized enterprises (EASME) within the framework of the Sustainable Blue Economy Call 2017 which aims to accelerate the development of the blue economy in the Mediterranean through closer cooperation between public and private maritime stakeholders supporting skills, innovation, entrepreneurship as well as job diversification and local communities' empowerment.

References

- A. Freiwald, J.H. Fossa, A.J. Grehan, J.A. Koslow, J.M. Roberts, Cold-water coral reefs: out of sight - no longer out of mind UNEP World Conservation Monitoring Centre, UNEP-WCMC, Cambridge, UK, 2004, p. 84.
- C.L. Van Dover, Impacts of anthropogenic disturbances at deep-sea hydrothermal vent ecosystems: a review, Mar. Environ. Res. 102 (2014) 59–72.
- C.R. Smith, A.W.J. Demopoulos, Ecology of the deep Pacific Ocean floor, in: P.A. Tyler (Ed.), Ecosystems of the World, Ecosystems of the Deep Ocean 28, Elsevier, Amsterdam, 2003, pp. 179–218.
- J. Veillette, J. Sarrazin, A.J. Gooday, J. Galeron, J.-C. Caprais, A. Vangriesheim, J. Etoubleau, J.R. Christiand, S.K. Juniper, Ferromanganese nodule faunain the Tropical North Pacific Ocean: species richness, faunal cover and spatial distribution, Deep-Sea Res. I 54 (2007) 1912–1935.
- M. Clark, S. Smith, Environmental management considerations (Chapter 3), in: E. Baker, Y. Bedouin (Eds.), 1B. Deep Sea Minerals: Manganese nodules-a physical, biological A.D. Rogers, A. Baco, H. Griffiths, T. Hart, J.M. Hall-Spencer, Corals on Seamounts, in: T.J. Pitcher, T. Morato, P.J.B.
- Hart, M.R. Clark, N. Haggan, R.S. Santos (Eds.), Seamounts: Ecology, Fisheries and Conservation, Blackwell Publishing Ltd, 2007, pp. 141–169.