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A CASE STUDY FOR DEEP SEA MINING:
WHAT IS AT STAKE FOR PORTUGAL?

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Abstract

Although the deep sea accounts for around 95% of the global biosphere, it is the least scientifically known habitat on the planet. Valuable minerals to the energy transition lie in it, while environmental impacts of extracting them still remain inconclusive. Portugal has demonstrated contrasting interests with regard to deep sea mining. This interdisciplinary case study breaks down the conundrum of deep sea mining to a lay audience on the topic, exposing students to the problem's complexity. It aims to support sustainable decision making on the subject and prepare future decision-makers to highly challenging political scenarios.

Keywords: Deep Sea Mining, Portugal, Public Policy, Development, Ecocide, Green Mining, Energy Transition, Portuguese Blue Economy.

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DEEP SEA MINING: WHAT IS AT STAKE FOR PORTUGAL?

It had been shortly a month after the United Nations Ocean Conference, which had taken place in Lisbon from June 27th to July 1st 2022, and Portugal, the host country, still hadn't taken an official stand on deep sea mining. The international community and the Portuguese citizens expected a formal announcement from the Portuguese Government with regard to an international moratorium on deep sea minerals exploitation in the areas beyond national jurisdiction, but most importantly, what was the country's plan for its own maritime territory. Even though the topic had already been discussed in international and domestic settings, civil society still wasn't sure whether Portugal supported or not exploitation contracts in its Exclusive Economic Zone (EEZ), the third largest of the European Union. As a country culturally and economically dependent on the ocean, it was no wonder that the Ministry of Economy and Maritime Affairs had been recently merged, and that its continental shelf was undergoing a process of expansion. Being only 1 out of 2 European countries in the High Level Panel for a Sustainable Ocean Economy, receiving pressure from environmental groups and having ongoing exploration expeditions evidencing the richness of minerals its deep sea possesses, a stand had to be made.

DEEP SEA MINING CONTEXTUALIZATION

Even though there hasn't been one single commercial contract in the world to mine the deep seabed, many countries and companies are in possession of exploration contracts, such as Germany, France, Belgium, the United Kingdom, China and Japan. But to begin with, what is this idea of deep sea mining?

It was in 1873 that for the first time minerals were found at the bottom of the sea, when the historic scientific expedition on board of the Challenger discovered, besides around 4000 new

ocean species, “several peculiar black oval bodies which were composed of almost pure manganese oxide”¹. (See Exhibit 1.) Science later on found that apart from those metal rich rocks, nowadays called polymetallic nodules and known to be located in abyssal plains and formed around sharks’ teeth and other hard particles, minerals could also be in the deep sea in the form of polymetallic sulphides (found around hydrothermal vents) and cobalt-rich (ferromanganese) crusts, which are found on seamounts and ridges (elevations on the bottom of the ocean). (See Exhibit 2.) Diamonds, phosphorites, ironsands and methane rich gas hydrates are also some of the other resources of commercial interest that can be found in the deep sea, as well as Rare Earth Elements. (See Exhibit 3.)

Even though 150 years ago the Challenger Expedition proved that the deep sea is rich in biodiversity, contrary to the thought that the bottom of the ocean was uninhabitable and consisted only of the sea floor, up until this day it remains as a “mystery” to science. Although it covers 71% of the planet (362 million km²), it is the least explored ecosystem on Earth, with the deep sea accounting for 90% of that area². We know more about the Moon and Mars than we do about the deep ocean, which is considered as everything below 200m from the water surface. However, as technology advances, reaching the depths has become more possible, and so has discovering new species and the prospect of mining the seabed. In other words, exploitation is becoming more feasible as exploration also advances, and in some countries seabed mining operations are already taking place within the territories under their jurisdictions, however still at relatively shallow depths.

Why mining the deep sea?

It is said by many that the key to our low-carbon future could lie on the billions of small rocks sitting at the bottom of the deep ocean, minerals tucked in seamounts or around hydrothermal vents. In the context of deep sea mining, a resource (not to be mistaken for a reserve, which is

a specific mineral deposit where extraction is possible) is a natural concentration of minerals that possess economic interest given the possible uses it can have, and those available at the deep sea might be helpful in tackling political conflicts and the climate crisis, which both have links to the energy transition.

Even though the Clarion-Clipperton Zone, in the central eastern Pacific, is coveted by many countries and companies due to its deep sea minerals exploitation potential, the European deep sea floor is often assumed to be economically relevant as well. It is no surprise for instance that in 2017 the Blue Growth strategy from the European Commission included deep sea mining as one of the sectors with a high potential for development³, and already back in 2012 they estimated that by 2020 5% of the world's minerals could be sourced from the ocean floor, having a €10 billion turnover of mining the deep seas by 2030⁴. With the outbreak of the Ukrainian war in 2022, the push for an energy transition due to political reasons grew even more, aiming to rely less on gas coming from Russia (in that specific case) while not being heavily dependent on coal and gas due to concerns about the climate crisis.

However, reducing the burning of fossil fuels and transitioning to clean energies such as building more wind farms, solar panels and electric vehicles depend on critical materials for their manufacture. Technological development and the consequent cost reduction led to an increase in adoption of those sources of energy, causing an imbalance between supply and demand and a shortage of the critical materials needed for their manufacture⁵, such as rare earth metals. These are necessary to several appliances, from biomedical devices to high tech applications, communication systems and green technologies.

The rise in demand and price of those critical resources, not only rare earth metals but also others like copper, cobalt (used for example in battery technology) and tellurium (valuable for the solar cell industry), plus their prospect of exhaustion in land mining, has then made deep

sea mining an economically attractive alternative. Additionally, companies such as DeepGreen have stated that seabed mining would be a more sustainable alternative for land mining, as it generates less waste and the polymetallic nodules, for instance, have higher concentrations of metals in comparison to land deposits.

Mineral exploitation of the deep seabed has also been justified as an economic development opportunity for coastal countries, which are also severely threatened by the climate crisis. Nauru, for example, sees deep sea mining as an opportunity to have revenue while not impacting their land, and is hoping to start exploitation operations in 2023. In their words, “As a Pacific Small Island Developing State, Nauru stands to lose the most from climate change. Achieving the emissions reductions necessary to avoid its worst impacts cannot happen without metals. The responsible development of this new industry offers a rare opportunity for our social and economic development, while also supplying the world with a lower-impact source of metals for the low-carbon technologies needed to combat climate change.”⁶

Why not mining the deep sea?

Short term financial revenues might be one outcome from exploiting the deep sea, but the revenues might not reach the whole international community and lie only in the pockets of a few, as a new facet of neocolonialism. Social concerns deriving from deep sea mining have been strongly raised by indigenous communities of coastal states, specially from the Pacific islands, alleging that exploiting the seabed would harm their cultural practices, affect their food sources and represent a definition of development that is not compatible with their own.

Due to the poor scientific understanding of the deep sea, environmental impacts are said to be either unknown or miscalculated⁷. However, it is a fact that it is home to very sensitive and special ecosystems, hosting reservoirs of endemism, and that loss of biodiversity and habitat degradation on that local scale would be inevitable. Around hydrothermal vents, for instance,

around 85% of the species are considered endemic⁸. Unsurprisingly, the Food and Agriculture Organisation of the United Nations (FAO) and the United Nations Environment Programme's Convention on Biological Diversity (CBD) have classified several vent communities as Vulnerable Marine Ecosystems (VMEs) and Ecologically or Biologically Significant Areas (EBSAs).

Therefore, if formally recognised internationally, the legal definition of "ecocide" could end up being applied to deep sea mining, as it being the "unlawful or wanton acts committed with knowledge that there is a substantial likelihood of severe and either widespread or long-term damage to the environment being caused by those acts"⁹ and leading to the mass destruction of ecosystems.

Besides, the deep sea is key to ecosystem services such as nutrient cycling and carbon sequestration, with a healthy ocean being more effective than forests, acting as the planet's largest carbon sink. However, not only does the climate crisis damage the ocean, but deep sea mining could even worsen the situation, as operations could increase the water temperature and accidents such as methane leakages (from the extraction of gas hydrates) could lead to positive carbon feedbacks, as it is a greenhouse gas 28 times more potent than CO₂.¹⁰

Furthermore, compared to land mining, the one taking place in the deep sea would disturb much larger areas. As an example, extracting manganese from land takes up 0,5km², whereas extracting it from the seabed requires around 80km².¹¹ As for similarities with onshore mining, some argue that deep sea mining reproduces the same destructive extractivist mindset as the first, instead of better using the resources we already have at hand. As recently stated by Emma Wilson from the Deep Sea Conservation Coalition during the International Seabed Authority's Assembly, "we will not be able to neatly contain the damage, or control it. Deep sea mining would perpetuate the same behaviours that drove us into the environmental crisis."¹²

Seabed mining has also been considered as a form of greenwashing, as under the pretext of “green mining” for the necessary green transition, the mining industry and governments might be unjustly and unsustainably justifying their need to look for more minerals in the deep sea. The assumption that more metals are needed for the green transition might be reflecting the “inequalities and ideology of growth which led to the ecological crises in the first place, such as the ambition of having one billion, mostly private, electric vehicles on the road by 2050”.¹³

In parallel, the European Environment Agency has called for an economy based on sufficiency rather than efficiency, with a Green Deal focusing on growth without economic growth, which means that there would be no room for extractive activities such as deep sea mining¹⁴. Additionally, huge industrial and tech companies such as Google, Samsung, BMW, AB Volvo, Volkswagen, Scania, Renault, Philips and Microsoft have supported the World Wildlife Fund’s (WWF) moratorium, committing not to finance deep sea mining activities and excluding minerals coming from this source to their supply chain.

Who regulates that?

Managing the complexity of the ocean is a task shared by many entities, which all aim at protecting the marine ecosystems while making sustainable use of its resources. When it comes to ocean governance related to deep sea mining, the three main stakeholders are the International Seabed Authority (ISA), private companies and sovereign States.

Under the auspices of the United Nations Convention on the Law of the Sea (UNCLOS), the International Seabed Authority was established in 1982 as an autonomous intergovernmental body comprising 167 member States and the European Union. Its main task is overseeing the seabed and the subsoil that is beyond national jurisdiction, the so-called “Area”, as defined by UNCLOS as a common heritage of mankind, and which makes up 50% of the total world’s

ocean area. Therefore, all the deep sea mining interests that are outside of the national territory of coastal states fall under the regulation of the ISA.

Even though the ISA entered into force in 1994, it still doesn't have a proper legal framework for deep sea mining exploitation in the Area, having granted contracts only for exploration both to private companies and member states. (See Exhibit 4.) In June 2021, however, hoping to start exploitation in international waters in the Pacific, the Nauruan government triggered the “2-year rule”, which obliged the ISA to complete all relevant regulations concerning deep sea mineral exploitation in the Area until June 2023. If it fails to do so, the Authority will have to provisionally accept Nauru's exploitation plan, which hopes to “ensure that polymetallic nodules are considered as part of the solution for the global transition from fossil fuels and towards renewable energy.”¹⁵

Outside of the international seabed Area, it is up to the nation states to decide how to explore and exploit deep sea minerals in their territory, which are considered national resource endowments just as resources on land are. While seabed mining is already taking place in national territories, it is mostly done at shallow depths. Some of the countries however are more advanced in planning to exploit the deep sea, with licences having been given to companies to explore (and potentially exploit) the Exclusive Economic Zones (EEZ) of countries such as Papua New Guinea, Sudan, Saudi Arabia, Cook Islands, Norway, i.a.

Nevertheless, out of concerns with the natural environment, countries such as France, Costa Rica, South Africa, and Ecuador have previously publicly called for a moratorium on deep sea mining exploitation, either in national or international waters, until scientific progress is made on environmental impact assessment. While some countries such as Chile have called for a 15-year moratorium justifying that we lack the scientific data to allow exploitation contracts to be

granted¹⁶, others such as Nauru are rushing to start exploiting the deep sea under the pretext of development. Other coastal states are sitting on the fence.

THE CASE OF PORTUGAL

The Portuguese maritime area under national jurisdiction, as defined by UNCLOS, includes its inland maritime waters (6,508km² from mainland Portugal, 6,082km² and 825km² from the Azores and Madeira archipelagos, respectively), its territorial sea (50,957km²), its exclusive economic zone (adjacent to the territorial sea, comprised of 287,521 km² from mainland Portugal, 930,687 Km² and 442,248 Km² from the Azores and Madeira archipelagos, respectively) and the continental shelf, which can be interpreted both geologically (the portion of the seabed and subsoil that starts at the coastline and extends to a mean depth between 200 and 300m in the transition of the continental slope, which is where the continent “drops” to the deep ocean floor) and legally according to UNCLOS (the seabed and subsoil which extend beyond the territorial sea). (See Exhibit 5.) Nevertheless, the Portuguese Task Group for the Extension of the Continental Shelf is carrying an ongoing process of increasing its sovereign waters beyond the 200 nautical miles’ baseline from UNCLOS, having submitted its first request to the United Nations’ Commission on the Limits of the Continental Shelf (CLCS) in 2009, which is still under consideration. Increasing the knowledge on the geological characteristics of the seabed is defined as one of the main goals of the Task Group¹⁷, which is hoping to open doors for the discovery of new mineral deposits.

Portugal has, therefore, the right to protect, explore and exploit its marine resources in the way it seems fit up until its continental shelf, where it holds exclusivity. Other countries can eventually exploit its continental shelf area, but only with the express consent of the Portuguese government. Beyond its continental shelf, however, it doesn’t hold any more sovereign rights over its seabed and water column, being the International Seabed Authority the one in charge.

As of now, Portugal doesn't have any ISA contracts for deep sea exploration, limiting itself to exploring the sea floor within national jurisdiction. However, according to the Interdisciplinary Centre of Marine and Environmental Research (CIIMAR), located in Porto, "in a European Union context, Portugal, and Azores in particular, is considered the most suitable region for deep-sea mining. On the Azores Plateau and along the Mid-Atlantic Ridge there are several hydrothermal fields and seamounts with recognized occurrences of mineral resources."¹⁸

Availability of deep sea mineral resources in Portugal

The exact extent of potential mineral resources in the Portuguese deep waters remains yet unknown, with studies and exploration expeditions confirming the presence of resources, but not the mineral reserves which would enable commercial mining. So far, the only sediment extraction happening in its continental shelf doesn't have to do with deep sea minerals, but with sand extraction in shallow waters.

Scientific studies have confirmed, however, a number of areas in the Portuguese Exclusive Economic Zone and its continental shelf (see Exhibit 6) that are rich with deep sea minerals valuable for high technology developments, specially polymetallic sulphides (rich in copper, zinc, silver and gold) and ferromanganese crusts (also called cobalt-rich crusts), with the potential of the latter in the Portuguese EEZ being compared to the most promising area for deep sea mining, the one of the Central Pacific Ocean¹⁹.

The polymetallic sulphides in Portuguese waters have been found inside the EEZ on the hydrothermal vents of Menez Gwen, Lucky Strike and Saldanha, and inside the continental shelf in the hydrothermal vents of Rainbow and Moytirra. Menez Gwen, Lucky Strike and Rainbow are considered to have the highest concentration of polymetallic sulphides. (See Exhibit 7.) The ferromanganese nodules have been found on the Madeira-Tore rise, to the north

of the Madeira islands and in the Azores area, both to the north and south. (See Exhibit 8.) The Portuguese deep waters are a new El Dorado.

Portuguese deep sea biodiversity threats

The non-living wealth that the Portuguese deep sea possesses in the form of minerals coexists with the living wealth that inhabits those same waters. Throughout the years, several exploration missions have tried to unravel the mysteries that lie in those pristine deep waters, encountering benthic creatures (those that live on the seafloor) such as the 2320 years old black coral (*Leiopathese spp.*) found in the Azorean territory, one of the longest living beings on the planet²⁰. (See Exhibit 9.)

It is no wonder that the government of the Azores and the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR), which is the current legislative instrument regulating international cooperation on environmental protection in the North-East Atlantic, have created marine protected areas²¹ which prohibit exploitation (but not exploration) around areas such as the Sedlo seamount and the hydrothermal fields Menez Gwen, Lucky Strike and Rainbow, the same ones rich in polymetallic sulphides.

Even though no commercial seabed mining has started and there is no proof of actual harm being done to the marine environment, terrestrial mining operations and scientific studies aid in predicting the outcomes of deep sea minerals exploitation. Public institutions, such as the Portuguese Institute of the Sea and Atmosphere (IPMA), have as part of their strategic plan to evaluate the impact of deep sea mining²², with the understanding that those minerals are in the vicinity of fragile ecosystems, and mineral exploitation could threaten deep ocean life services. As the ocean is already under stress due to anthropogenic action, such as the climate crisis and bottom fish trawling, exploiting the deep sea could be another stressor.

One of the predicted impacts caused by mining is the formation of toxic sediment plumes, which

can travel long distances with the ocean currents, increasing the turbidity in the water columns and affecting living organisms that are miles away from the mining site. The Azores Deep-Sea Ecology research group, from the University of the Azores, has predicted that sediment plumes might disperse for an area equivalent to 10 thousand football fields, thus affecting even commercial fishing²³.

Other impacts include direct mortality to immovable organisms (which would be crushed) and disruption caused by temperature increase, noise and light from the mining machines (which can affect communication and distress marine fauna and flora). (See Exhibit 10.) Furthermore, the physical and biological recovery of the exploitation sites might take decades to happen, as has been shown in an experiment undertaken in the Clarion-Clipperton Zone, where 26 years after the extraction of a polymetallic nodule the mining vehicles' tracks were still clearly visible, and the benthic biodiversity was considerably reduced compared to undisturbed areas nearby²⁴. Another study held 37 years after similarly found that the removal of nodules left the area devoid of fauna. (See Exhibit 11.)

Slow growth and recovery rate of species and endemism contribute to making the ecosystems associated with high concentration of deep sea minerals, such as hydrothermal vents and seamounts, as scientifically recognised vulnerable and rare biodiversity hotspots. If extracted, the nodules availability itself would take millions of years to be replenished, as the deposition rate of non-living creatures is even slower than that of living ones. Changes to the Portuguese deep sea might be irreversible in several generations' lifetime.

Recent political history of deep sea mining in Portugal (2012-2022)

Portugal has a long history with the ocean, stemming from being at the forefront of European overseas exploration in the 15th and 16th centuries. In contemporary times, its international importance includes having hosted the International Year of the Oceans during Expo98 and

chaired the presentation of the Independent World Commission on the Oceans' official report "The Ocean, Our Future" in that same year. More recently, it is worth highlighting that it was a founding member of the High Level Panel for a Sustainable Ocean Economy in 2018, and it hosted the United Nations Oceans Conference in Lisbon in 2022. According to the Portuguese Directorate-General for Marine Policy (DGPM), the Blue Economy accounts for 5,1% of the Portuguese GDP (see Exhibit 12), so it is no wonder that the richness available in its deep sea arouses interest.

Throughout the past decade, deep sea mining has been a topic of conflicting and diverging opinions in Portugal. Even though it was in 2008 that the company Nautilus Minerals (Canadian, gone bankrupt in 2019) submitted to the Azorean government an exploration request (which expired due to applicable legislation and existing regulation), in 2012 it generated an ongoing conflict between the autonomous government of the Azores and the central government.

2012

By filing five additional exploration licence requests near the newly protected area of the Azores Marine Park, Nautilus triggered a constitutional dispute. The Azorean autonomous government had decided that year to legislate the exploitation of its natural resources, but the Portuguese central government also restricted in 2012 the power of the autonomous regions (Azores and Madeira) to regulate resource exploitations in the Exclusive Economic Zones and to establish protected areas, which had just been done in the Azores with the creation of the Azores Marine Park (which included the protection of the minerals-rich Sedlo seamount and the hydrothermal fields Menez Gwen, Lucky Strike and Rainbow). The matter was taken to the Constitutional Court and would take a couple more years to be resolved.

At the time, the president of the regional government of the Azores, Carlos César, had stated that the Azoreans lived on top of seamounts where a great wealth lay, and which had to integrate their sustainability patrimony, while serving the development of the island. “We have to make use of the interest that several countries and companies of the whole world have in the prospection and exploitation of our deep sea mineral, energy and biological resources, and it is important that the profits of those exploitations aren’t swallowed by the country (central government) or lost abroad”, said the Azorean president²⁵.

On the continental side, the plan was that the central government would have the sole responsibility of managing the deep sea minerals, counting on the expansion of its Exclusive Economic Zone, which if approved would account for 4 million km². António Costa e Silva, president at the time of the executive commission of the Partex Oil and Gas group, has referred to the deep sea minerals as an “immense Maritime India”, alluding to the great Portuguese expeditions of the 15th century, and having the deep sea resources as the new colonies. He advocated for a national strategic plan of deep sea minerals exploitation, highlighting the potential that the archipelago-country had with the biggest polymetallic sulphides in the south of the Azores, the nickel and cobalt crusts and the copper, zinc, lead, gold and silver in the hydrothermal vents along the Mid Atlantic Ridge, which were the greatest trend for commerce and energy in the 21st century. As a matter of national sovereignty, he preached that Portugal had to map its deep sea minerals and form alliances with countries such as Brazil, the US, Germany and Norway in order to attract foreign investment.

Under the pretext of national development (creating wealth, direct and indirect employment, decreasing imports and increasing exports) and political resource crisis (after a shortage of rare earth minerals coming from China and Japan, and a fight for strategic raw materials), deep sea mining was regarded by António Costa e Silva as an opportunity that the country could not abdicate. If it failed to take it, it would be making a strategic mistake that could sacrifice entire

generations to come. According to him, however, the only reason why the country wasn't making good use of its resources was due to a lack of smartness in public policy, as there had to be "clear rules and policies for the exploitation of marine resources, integrating environmental protection in the model of development along the Portuguese coast, bringing the universities and research centres to the network of impact monitoring and ecosystems study"²⁶.

2013

The following year saw the establishment of the 'Managing Impacts of Deep-Sea Resource Exploitation' (MIDAS) 3-year project funded by the European Commission, which had as a main goal to evaluate the environmental impacts of deep sea mining exploitation, where two Portuguese institutions were taking part of the study (the University of the Algarve and the Institute of Marine Research from the University of the Azores). At European Union level, there was also the signing of the Galway Statement Atlantic Ocean Cooperation between the EU, United States and Canada, whose goal is to improve mapping of the seabed and the benthic habitats, while promoting efficient management of their resources.

2014

The Foundation of the Faculty of Sciences of the University of Lisbon joined the 4-year research program 'Blue Mining', another European Commission funded project which aimed at developing solutions to making deep sea mining viable, contributing to increasing the supply of mineral resources on the market.

2014 saw the Portuguese Constitutional Court declaring unconstitutional the Azorean government decision taken in 2012 of legislating the exploitation of the marine natural resources found in the autonomous region's territory. As a way to solve the conflict of interests between the governments and the mining company Nautilus, the central government approved a framework law (Law no. 17/2014 of April 10) which reduced the autonomous regions'

competences regarding marine spatial planning (comprising resource exploitation and the implementation of marine protected areas), leaving the central government as the main authority to those matters.

2015

The central government approved new laws concerning the exploration and exploitation of geological resources in its national territories, namely the Law no. 54/2015 of June 22, which was seen as very weak in what concerns environmental protection before, during and after extraction procedures; and Decree-Law no. 38/2015 of March 12, which increased the central government's authority as the sole decision maker for the continental shelf beyond 200 nautical miles. The Azorean government reacted to losing its constitutional right of adopting the environmental legislation that they seemed fit, but the Constitutional Court declared the laws to be constitutional. Hence, from 2015 onwards any decision made in areas beyond the 200 nautical miles of the continental shelf needs the central government's approval, and those areas which were protected before 2015 could also be disqualified. The existence of the Azores Marine Park, however, was confirmed by the central government, where only exploration was allowed in that area.

In 2015 the Azorean seafloor was selected as an ideal location for testing deep sea mining facilities in Europe, under the 5-year European Commission Project 'Blue Atlantis - Innovative Mining of Marine Mineral Resources – A European Pilot Mining Test in the Atlantic on Tools, Facilities, Operations and Concept'. Amongst 45 international partners, over 10 were Portuguese academic and governmental institutions.

2016

2016 saw yet another constitutional dispute between the Azorean government and the central one, when the regional authority attempted again to accuse the recent decree-laws as

unconstitutional and lost the appeal. Additionally, the central government contested at the Constitutional Court the regional decision (regional Decree-Law no 13/2016/A of July 19) of increasing the Azores Marine Park, as it was unilaterally adopted by the Azores without the permission of the central government, which now had authority over the area.

Meanwhile, the central government wanted to advance exploitation in the Azorean deep waters, with the Minister of Maritime Affairs at the time, Ana Paula Vitorino, hoping that in the coming year the company Nautilus, which was on the verge of beginning commercial exploitation in Papua New Guinea, would start its exploration works in Portugal. According to her, “the development of the mining activity in the Atlantic is less risky in geopolitical terms, it’s more economically advantageous and has less impact on the marine resources”. Following the Minister, Nautilus compared deep sea mining to land mining, stating that “there is a minimum of obstacles and residues, there are no chemical nor explosive products, there is no direct impact over communities nor significant infrastructures needed on land (like tailings dams)”. Furthermore, the company added that “deep sea mining might bring many economic advantages to countries that might be small in continental dimensions, but that are huge in their Exclusive Economic Zones”.²⁷

2017

The former Azorean president, Carlos César, at the time a congressman of the Assembly of the Republic, highlighted deep sea mining as one of the most promising activities to support the extension of the Portuguese continental shelf. The Azorean mineral potential was again pinpointed at the conference ‘A New Era of Blue Enlightenment’, which took place in Lisbon and where the Belém Statement was signed between the EU, Brazil and South Africa, strengthening the research and innovation commitment in the Atlantic.

Meanwhile, the Prime Minister António Costa committed to protect 30% of the maritime area under national jurisdiction until 2030.

2018

In 2018 another relevant conference was held in Portugal concerning deep sea mining, in Porto, as part of the project ‘CORAL – Sustainable Ocean Exploitation: Tools and Sensors’, where it was highlighted the need for clear and robust legal frameworks regulating deep sea mining activities. For regulation, mining contracts and operations to happen, it was concluded that the following overarching principles had to be followed: the precautionary approach, the ecosystem-based approach, the best available scientific evidence and the best management practices.

The academics at the conference also concluded that advancements needed to be made in environmental impact assessment, how to manage transboundary impacts, and tackling legal gaps. It was also reminded that Portugal had to comply with international obligations, such as the Espoo Convention (UNECE), the Kiev Protocol (UNECE), the Marine Strategy Framework Directive and the Natura 2000 Network, all concerning environmental impact assessment and conservation on protected areas.

2019

The International Seabed Authority organised a workshop on Regional Environmental Management Plan (REMP) in collaboration with the Portuguese Government and the European Commission at the University of Évora, aiming at addressing regional scale impacts that exploitation activities could cause. Michel Lodge, ISA’s Secretary-General, expressed his view that deep sea minerals are a benefit of all mankind, and Ricardo Serrão Santos, at the time the Minister of Maritime Affairs, stressed the remarkable ecological and geological diversity that

the Atlantic possesses, highlighting the relevance of studying and protecting it as a common shared resource.

At the Portuguese Assembly, heated debates concerning deep sea mining took place again when the deputy António Lima proposed changes to the Basic Law of the Planning and Management Policy of the National Maritime Space (Law no. 17/2014 of April 10), by arguing that it was a harmful legislation to the country and even more for the Azores, by diminishing the regional authority's management power over the shared Portuguese sea, and by serving only large economic interests rather than the environment and regional development. According to him, the current mining regulation stated that in case of dispute between economic activities the most profitable one would prevail, which meant that deep sea mining would be given preference as in the short term it would be more profitable than conservation efforts and the existing ocean-dependent commercial activities, such as fishing. For that reason, he believed that both the former Minister of Maritime Affairs, Ana Paula Vitorino, and the Portuguese Government were going against the wish of having a sea for the future that could be a source of wealth for many years to come.

The deputy António Lima didn't represent the entire view of the Azores, as the Azorean deputy Artur Lima strongly opposed his proposals, accusing him of serious falsehoods. Azorean Legislative Assembly member João Corvelo, however, followed António's concerns by arguing that the precautionary principle had to be adopted for deep sea mining in the region, as there were no solid environmental impact assessments made up to date.²⁸

2020

A public consultation was held concerning the regulation of the geological resources law, Law no. 54/2015 of June 22, which stated that the power to issue private licences to make use of

maritime resources would be given to the Directorate-General for Natural Resources, Safety and Maritime Services.

At the High Level Panel for a Sustainable Ocean Economy the Prime Minister António Costa once again made a commitment, this time of sustainably managing 100% of national waters until 2025. In parallel, Ricardo Serrão, the new Minister of Maritime Affairs, declared himself to be in favour of a 10 to 20 years moratorium on deep sea mining, depending on when the knowledge and technology would ensure reducing environmental harms caused by exploitation. According to him, deep sea mining was not an urgent matter, as he believed there were sufficient mineral deposits on land.

In that same year, professor and previous president of the executive commission of the Partex Oil and Gas group, António Costa e Silva published the Portuguese 2020-2030 Recovery Plan, where deep sea mining was featured as an opportunity to make the Portuguese seas as the new anchor of the national economy, and the expansion of the continental shelf would certainly help doing so. As much as environmental risk analysis were mentioned to be required, both mineral resources onshore and offshore were described as strategic resources for the energy transition and for the industry of computers, technological machineries and high precision electronics, with cobalt, nickel, manganese and polymetallic sulphides being given emphasis on the deep sea. Hoping to exploit while taking care of marine ecosystems, national and international partnerships were needed, as well as attracting foreign investment.²⁹

2021

At the International Union for Conservation of Nature (IUCN) General Assembly, the Portuguese governmental Institute for Nature Conservation and Forests (ICNF) voted as favourable to the motion “Protection of deep-ocean ecosystems and biodiversity through a moratorium on seabed mining”³⁰. The Minister of Maritime Affairs Ricardo Serrão positioned

himself again as favourable to a moratorium, stating that concerns are applied both to the international seabed and to the deep sea under national jurisdiction. He added that improving knowledge about deep sea minerals is of strategic interest for Portugal, but clarified that for him a moratorium only made sense to the seafloor under the International Seabed Authority's jurisdiction.

In that same year, the government approved the National Strategy for the Sea 2021-2030, in which deep sea mining was seen as necessary to align with the European Commission's Green Deal, where decarbonisation and the energy transition are described as dependent on sustainable natural resources. The National Strategy acknowledged society's concerns regarding deep sea mining but concluded that it could play a key role in developing the Blue Economy, use of renewable energy and energy autonomy. Given the low degree of deep sea geological knowledge, investment in science was needed, as well as in creating pilot zones to manage the sustainable use of maritime mineral resources.

The Recovery and Resilience Plan (RRP), also approved in 2021, made a reference to deep sea minerals as well, mentioning the development of an Azorean Sea cluster where research on mineral resources could be part of an experimental research and development centre. And by the end of the year, the Portuguese Assembly voted favourably for the Climate Law (Law n.º 98/2021 of December 31), where doors were opened to environmental regulation of mining in maritime zones.

2022

In the months preceding the United Nations Ocean Conference held in Lisbon, rumours circulated that the Ministry of Maritime Affairs would be extinct. However, it ended up being merged with the Ministry of Economy, having as newly appointed Minister of Economy and Maritime Affairs António Costa e Silva, professor and previous president of the executive

commission of the Partex Oil and Gas group, who had throughout the past decade shown support for the advancement of deep sea mining.

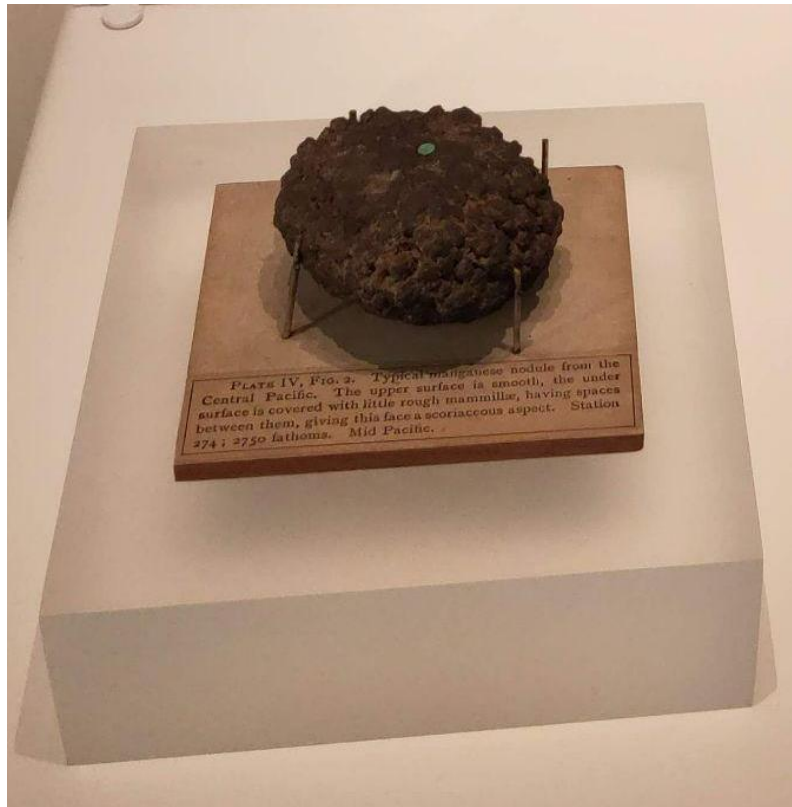
Even though during the United Nations Ocean Conference the Portuguese government did not position itself about the launch of the Global Alliance of Countries Calling for a Deep-Sea Mining Moratorium and the Global Parliamentarians Declaration Calling for a Moratorium, almost a week after the conference while visiting the Azores the Minister António Costa e Silva stated that “Deep sea mining is not a question we can ask today because it is completely out of question in the coming decades”³¹.

Challenges

The position of the Portuguese Government has changed and it is even contradictory throughout the years, with an evident power conflict between the duty to protect the natural environment and the right to exploit deep sea minerals. Public policy wise, official State documents and legislation don't match the views of public leaders, leading to inconclusive considerations towards deep sea mining in Portuguese waters. However, there is pressure from civil society, Academia and the private sector to understand what is in store for the near future of the Portuguese deep sea.

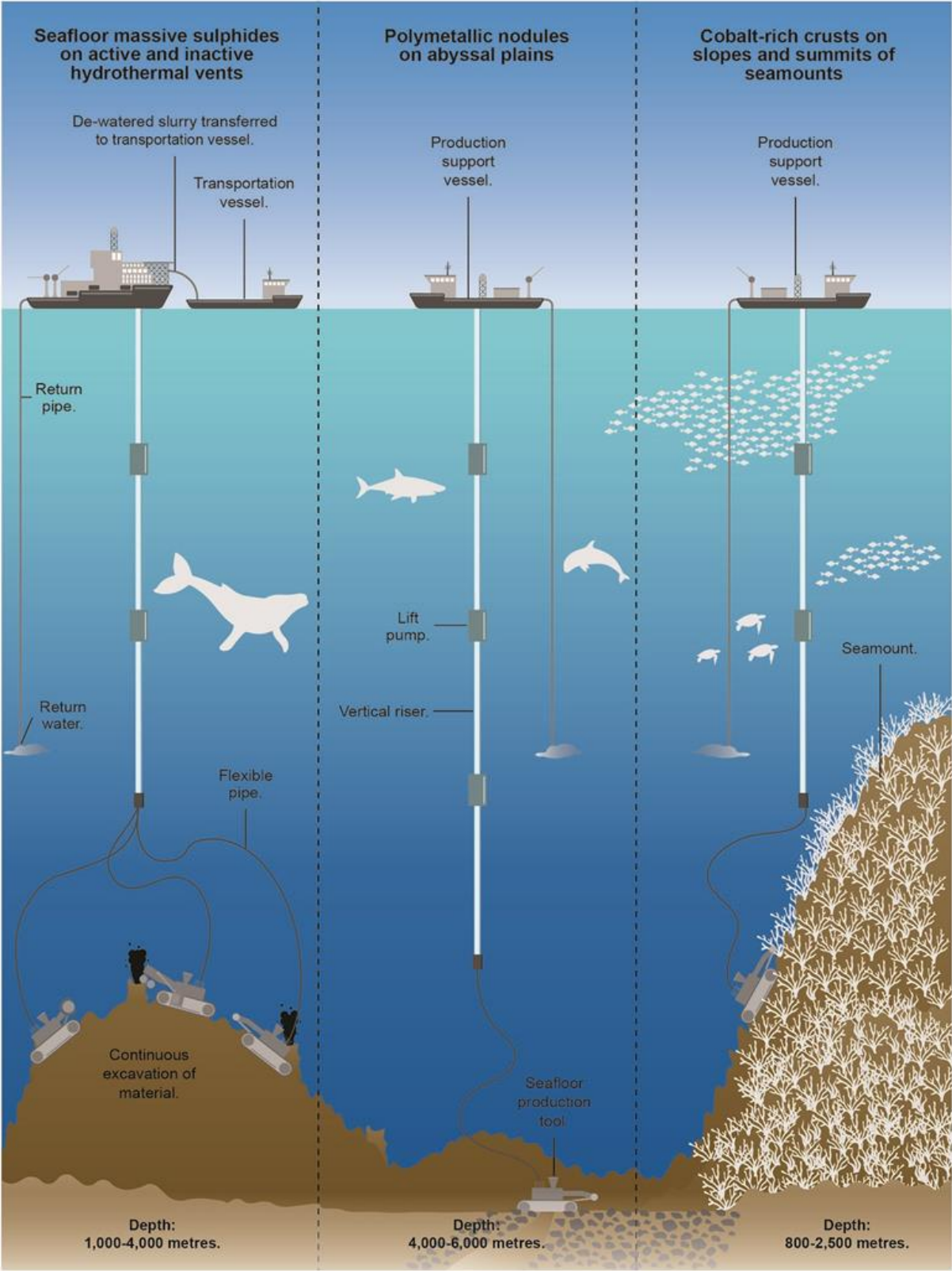
At the closing session of the United Nations Ocean Conference Youth and Innovation Forum, taking place at Nova School of Business and Economics at Carcavelos beach, the Portuguese President Marcelo Rebelo de Sousa told the young participants not to trust decision-makers³². A most unusual remark made directly by one of the country's highest ranked decision-makers, and given that trust in rulers is a nation's backbone to political stability. With regard to deep sea mining in Portugal then, who should be trusted and what should be done?

Exhibit 1 Polymetallic nodule collected by the Challenger Expedition (1874)



Source: picture taken by the author at the Natural History Museum in London, July 2022

Exhibit 2 The 3 main types of deep sea minerals deposits and their location



Source: Miller KA, Thompson KF, Johnston P and Santillo D. (2018) An Overview of Seabed Mining Including the Current State of Development, Environmental Impacts, and Knowledge Gaps. *Front. Mar. Sci.* 4:418. doi: 10.3389/fmars.2017.00418

Exhibit 3 Summary of the uses of major resources found on the seabed

Resource	Symbol	Uses	References
Copper	Cu	<p>Electricity production/distribution – building wires and telecommunication cables/circuit boards.</p> <p>Transport sector—vehicle brakes, radiators and wiring, copper-nickel alloys are non-corrosive and provide material for the hulls of ships. <i>Ecorys (2012)</i> classes mid-ocean ridge copper deposits as areas of “high” economic interest.</p>	<p>British Geological Survey, 2007</p> <p>Goonan, 2009</p> <p>Ecorys, 2012</p> <p>United States Geological Survey, 2012b</p>
Silver	Ag	<p>Mobile phones, PCs, laptops and batteries currently use the largest volumes of silver, many of the newer uses of silver focus on its antibacterial properties. Silver used domestically in mirrors, jewellery and cutlery. <i>Ecorys (2012)</i> classes mid—ocean ridge silver deposits as areas of “high” economic interest.</p>	<p>Ecorys, 2012</p>
Gold	Au	<p>Predominantly jewellery, although has also been used in electrical products. However, the total amount of material used for electricity is decreasing as base metal-gold alloys are increasingly providing a cheaper alternative to pure gold in electrical products. <i>Ecorys (2012)</i> classes mid—ocean ridge gold deposits as areas of “high” economic interest.</p>	<p>Ecorys, 2012</p> <p>British Geological Survey, 2007</p> <p>United States Geological Survey, 2012a</p>
Zinc	Zn	<p>Galvanizing steel or iron to prevent rusting, also commonly used as an alloy in the production of brass and bronze. Zinc is also used in the production of paint, as well as pharmaceutical products as a dietary supplement. <i>Ecorys (2012)</i> classes mid—ocean ridge zinc deposits as areas of “high” economic interest.</p>	<p>British Geological Survey, 2004</p> <p>Ecorys, 2012</p>
Manganese	Mn	<p>Mainly used in construction industry due to its sulfur fixing, deoxidizing, and alloying properties. It is preferred over other more expensive alternatives. <i>Ecorys (2012)</i> classes manganese crusts and nodules at intraplate seamounts as areas of “low” economic interest.</p>	<p>Ecorys, 2012</p> <p>Geoscience Australia, 2012</p> <p>Blöthe et al., 2015</p>
Cobalt	Co	<p>Primarily used in production of super alloys with exceptional resistance to high temperatures, for example those used to make aircraft gas turbo engines. Also used in rechargeable batteries—notably lithium-ion batteries used in hybrid electric vehicles. These batteries contain high proportions of cobalt as 60% of the cathode in lithium-ion batteries is composed of lithium-cobalt oxide.</p> <p><i>Ecorys (2012)</i> classes deep sea and intra plate seamount deposits of cobalt as areas of “moderate” and “low” economic interest, respectively. Cobalt is also found in manganese nodules.</p>	<p>British Geological Survey, 2009</p> <p>Ecorys, 2012</p> <p>United States Geological Survey., 2012c</p>
Rare Earth Elements	REEs	<p>Set of 17 elements including the 15 in the lanthanide series, plus scandium and yttrium. Used in the widest group of consumer products of any group of elements and have electronic, optical, magnetic and catalytic applications. Trends suggest that</p> <p>“green”—carbon reducing—technologies such as hybrid and fully electric cars, catalytic convertors, wind turbines and energy efficient lighting are key growth areas for REEs in the future. Demand for rare earth elements is increasing by 5–10% annually. <i>Ecorys (2012)</i> classes intraplate seamount deposits of REEs and yttrium as areas of “low” and “moderate” interest, respectively.</p>	<p>British Geological Survey, 2011</p> <p>Ernst Young., 2011</p> <p>Ecorys, 2012MIDAS, 2016</p>

Tin	Sn	Used in the high-tech industry for manufacture of items such as smartphones and laptops in which the metal is used in solder. Also found in tinplate and in compounds that are used to make plastics, ceramics and fire retardants.	Geoscience Australia, 2016
Gas Hydrates		Gas hydrate is a solid ice-like form of water that contains mainly methane gas molecules in its molecular cavities. Methane from gas hydrates may constitute a future source of natural gas. Note that the high methane content of these hydrates and their potential adoption as a fuel resource could make them key sources of Carbon emission. According to the United States Geological Survey, the world's gas hydrates may contain more organic carbon than the world's coal, oil, and other forms of natural gas combined. Estimates of the naturally occurring gas hydrate resource vary from 10,000 trillion cubic feet to more than 100,000 trillion cubic feet of natural gas.	Sloan, 2003 Kretschmer et al., 2015

Some specific information on economic interest in these resources in European waters has been provided where available.

Source: Miller KA, Thompson KF, Johnston P and Santillo D. (2018) An Overview of Seabed Mining Including the Current State of Development, Environmental Impacts, and Knowledge Gaps. *Front. Mar. Sci.* 4:418. doi: 10.3389/fmars.2017.00418

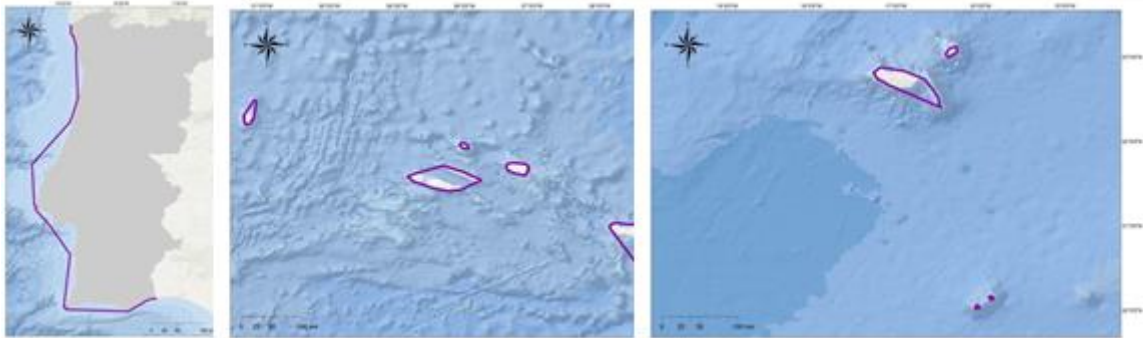
Exhibit 4 Deep sea mining exploration in the Area (beyond national jurisdiction)



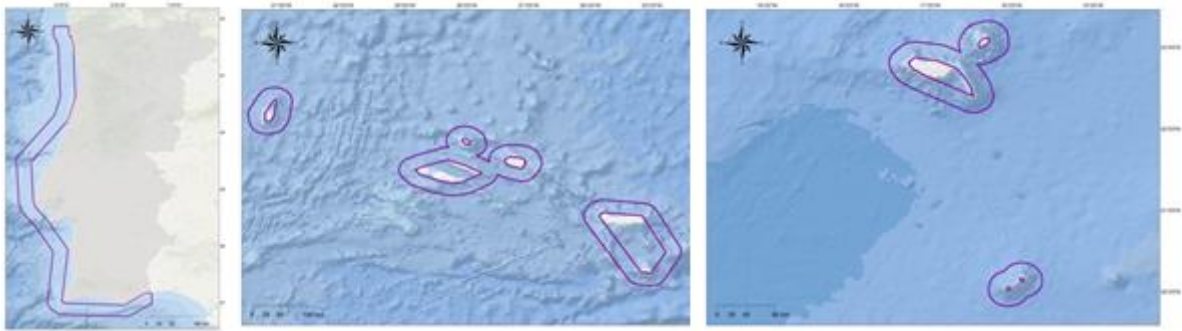
Source: International Seabed Authority, <https://www.isa.org.jm/minerals/exploration-areas>, Accessed August 2022

Exhibit 5 Maritime Zones under Portuguese Jurisdiction

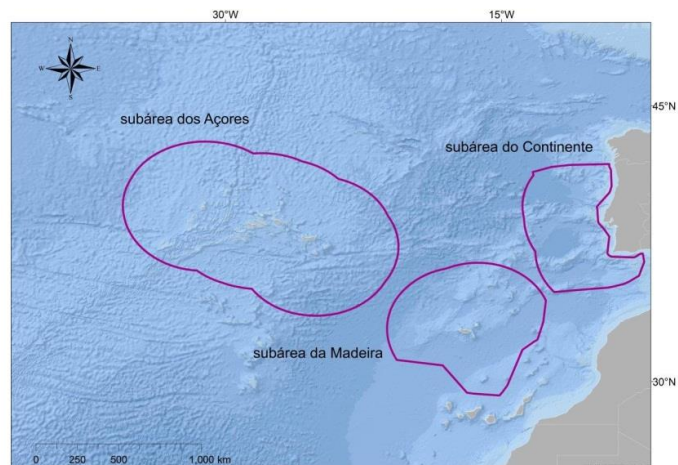
Inland Maritime Waters



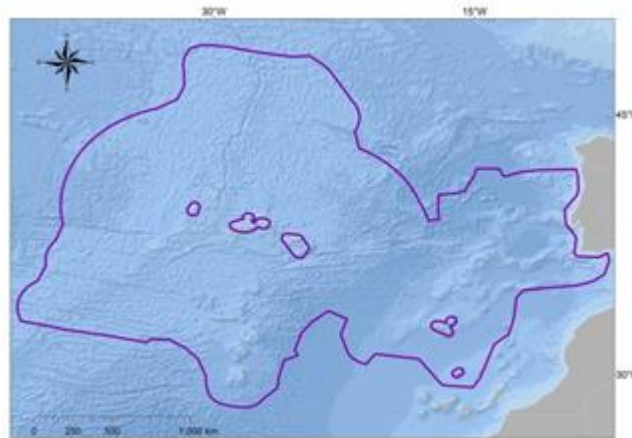
Territorial Sea



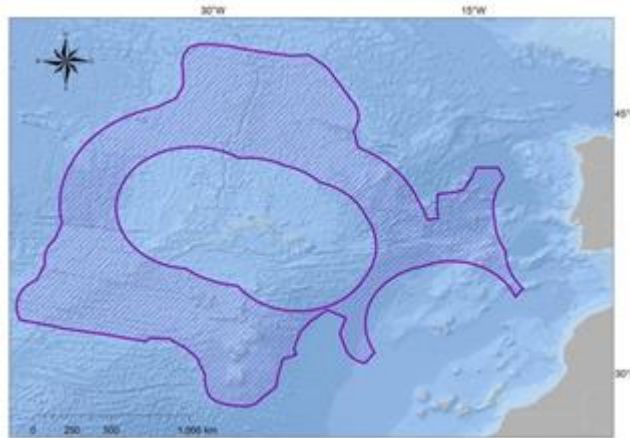
Exclusive Economic Zone



Continental Shelf (Geological Concept)

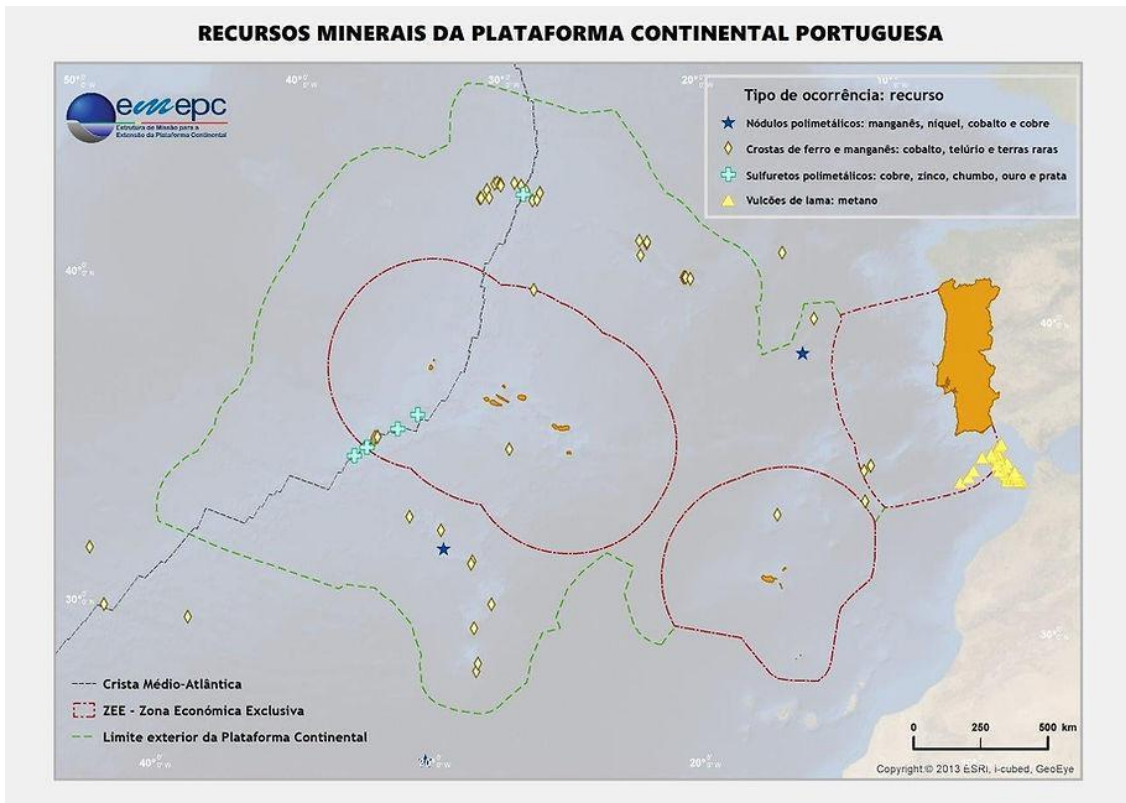


Continental Shelf (Legal Concept)



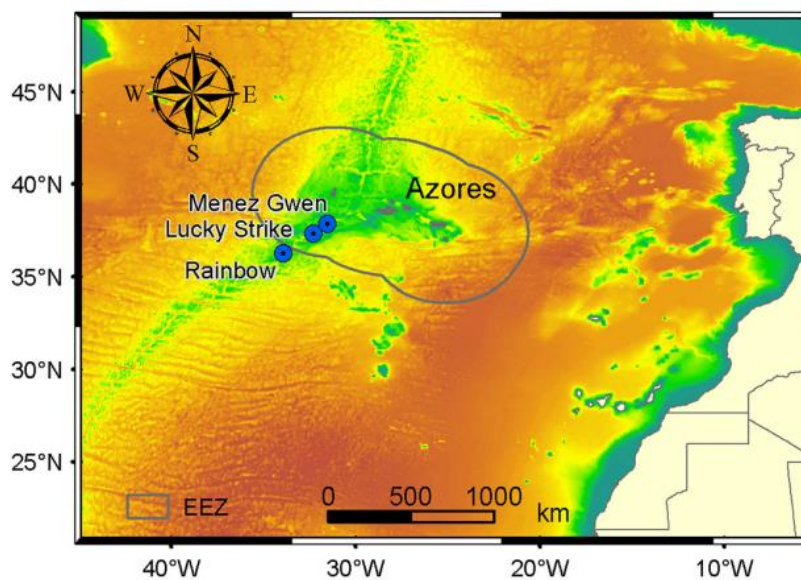
Source: Directorate-General for Natural Resources, Safety and Maritime Services, <https://www.dgrm.mm.gov.pt/en/web/guest/am-ec-zonas-maritimas-sob-jurisdicao-ou-soberania-nacional>, accessed August 2022

Exhibit 6 Mineral Resources of the Portuguese Continental Shelf



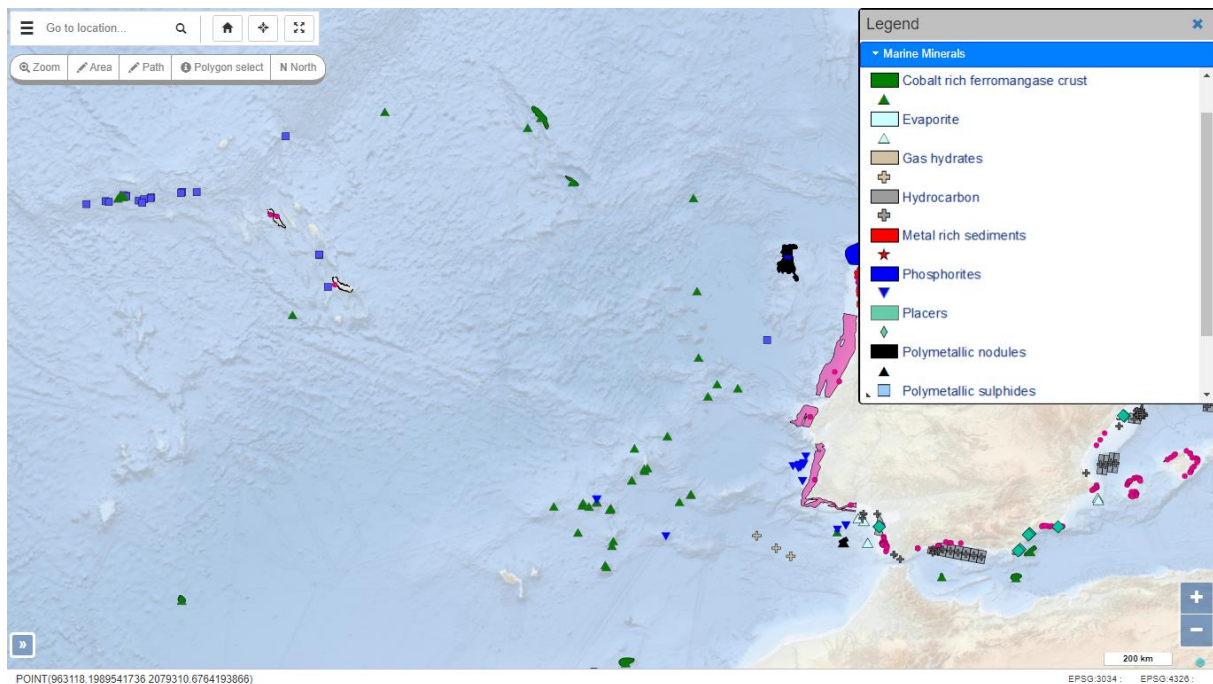
Source: Portuguese Task Group for the Extension of the Continental Shelf, <https://www.emepc.pt/recursos-marinhos>, accessed August 2022

Exhibit 7 Some of the hydrothermal vents rich in minerals in Portuguese waters



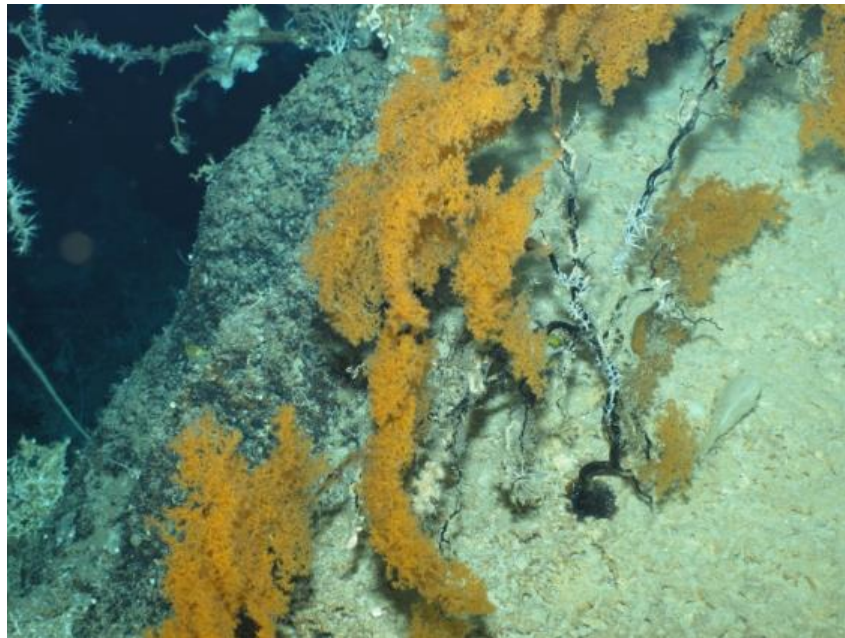
Source: C.L. Lopes et al. / Science of the Total Environment 650 (2019) 2294–2306. Development of physical modelling tools in support of risk scenarios: A new framework focused on deep-sea mining.

Exhibit 8 Cobalt rich crusts in Portuguese waters



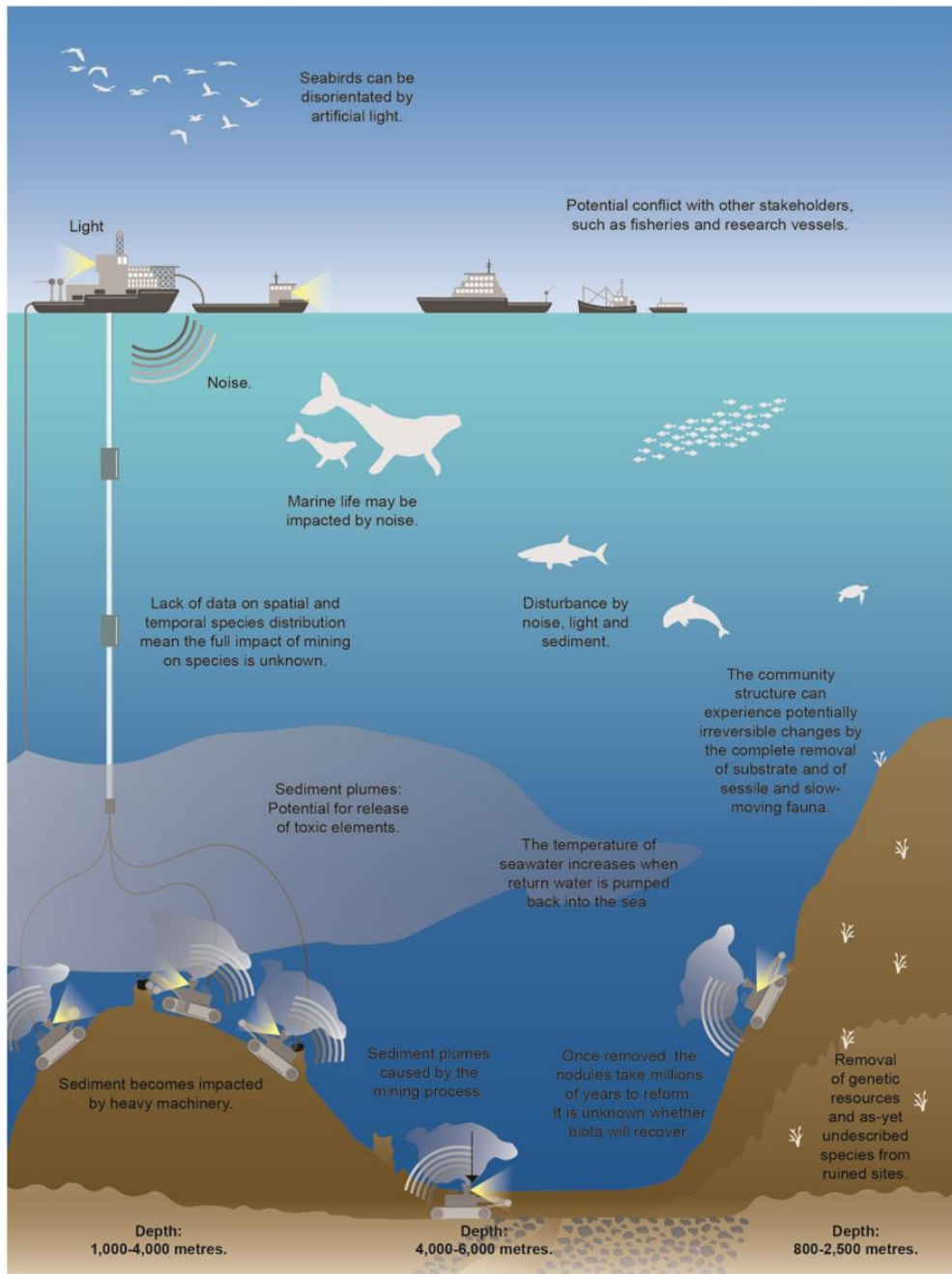
Source: European Marine Observation and Data Network, https://www.emodnet-geology.eu/map-viewer/?p=marine_minerals#, accessed August 2022

Exhibit 9 Millenia-lived black coral (*Leiopathes spp.*) in the deep Azorean waters



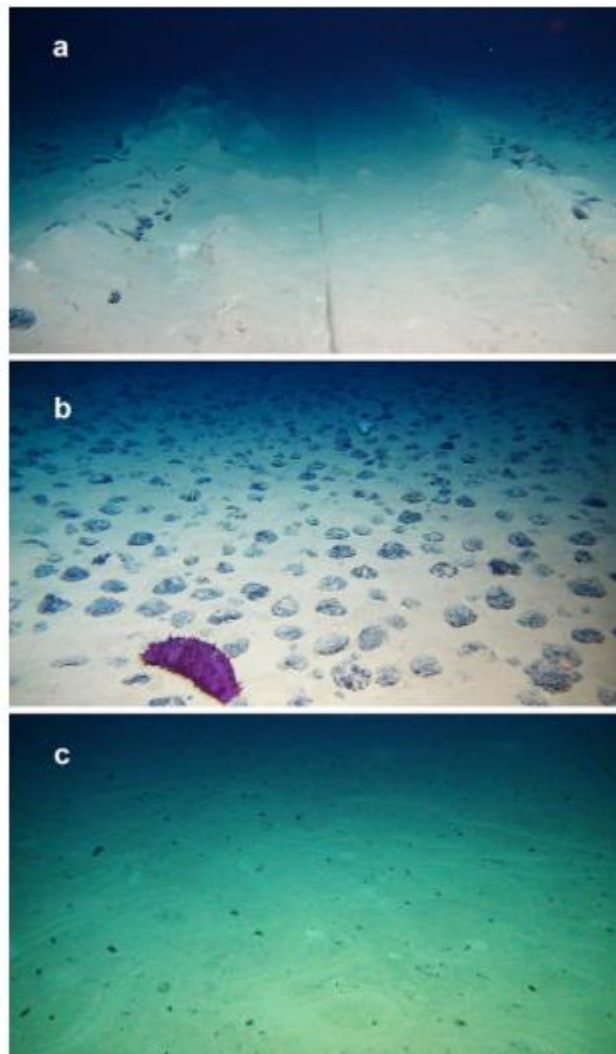
Source: 'Exploring pristine deep-sea walls to reveal hidden deep-sea biodiversity in the Azores', <https://cpaess.ucar.edu/sites/default/files/meetings/2018/aspire-documents/Carreiro-Silva-ASPIRE-white-paper.pdf>, accessed August 2022

Exhibit 10 Potential impacts of deep sea mining



Source: Miller KA, Thompson KF, Johnston P and Santillo D. (2018) An Overview of Seabed Mining Including the Current State of Development, Environmental Impacts, and Knowledge Gaps. *Front. Mar. Sci.* 4:418. doi: 10.3389/fmars.2017.00418

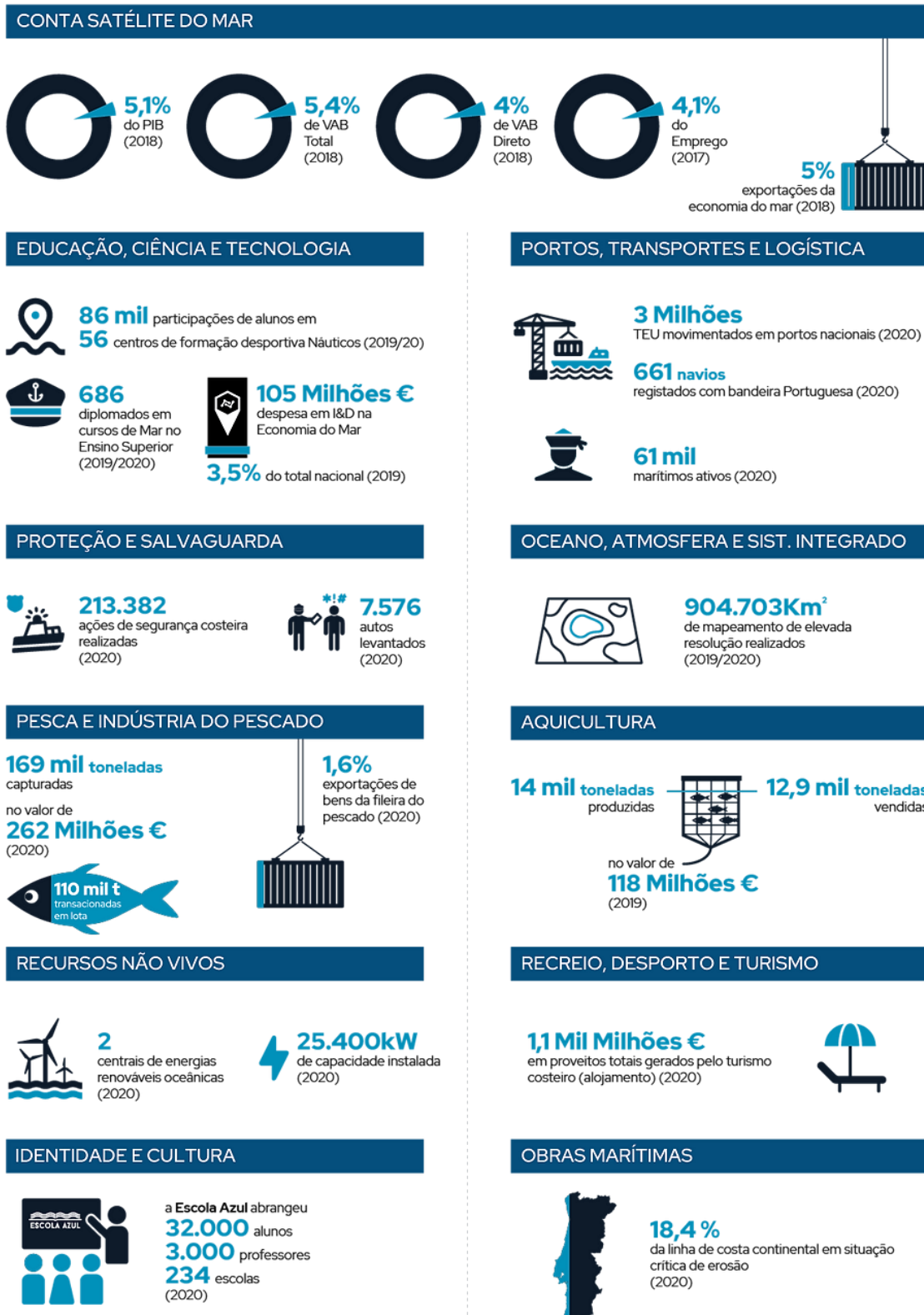
Exhibit 11 Impact of polymetallic nodule extraction on benthic fauna



“Examples of seafloor morphology: (a) 37-year old OMCO track (IFREMER license area); (b) Nodule landscape (IFREMER license area); (c) Nodule-free landscape (IOM area).
Copyright: ROV Kiel 6000 Team/ GEOMAR Kiel.”

Source: Vanreusel, A., Hilario, A., Ribeiro, P. *et al.* Threatened by mining, polymetallic nodules are required to preserve abyssal epifauna. *Sci Rep* 6, 26808 (2016).
<https://doi.org/10.1038/srep26808>

Exhibit 12 Portuguese Blue Economy



Source: DGPM. “Blue Economy Observatory”. Accessed August 2022.

<https://www.dgpm.mm.gov.pt/observatorio>

CASE STUDY REFERENCES

- ¹ International Seabed Authority. “Exploration Contracts”. Accessed August 2022.
<https://www.isa.org.jm/exploration-contracts>.
- ² Miller KA, KF Thompson, P Johnston P and D Santillo. 2018. “An Overview of Seabed Mining Including the Current State of Development, Environmental Impacts, and Knowledge Gaps.” *Frontiers in Marine Science*. 4:418. <https://doi.org/10.3389/fmars.2017.00418>
- ³ European Files. 2017. “Blue Growth Strategy”. <https://www.europeanfiles.eu/wp-content/uploads/2017/06/The-European-Files-Blue-Growth-Strategy-June-2017-Issue-47.pdf>
- ⁴ European Commission. 2012. “Blue Growth opportunities for marine and maritime sustainable growth”. <https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2012:0494:FIN:EN:PDF>
- ⁵ Toro, Norman, Edelmira Gálvez, Manuel Saldaña and Ricardo I. Jeldres, 2022. “Submarine mineral resources: A potential solution to political conflicts and global warming”. *Minerals Engineering*, Volume 179, 2022, 107441, ISSN 0892-6875,
<https://doi.org/10.1016/j.mineng.2022.107441>.
- ⁶ The Government of the Republic of Nauru. “Nauru requests the International Seabed Authority Council to adopt rules and regulations within two years”. Accessed August 2022.
<http://naurugov.nr/government/departments/department-of-foreign-affairs-and-trade/faqs-on-2-year-notice.aspx>.
- ⁷ Smith, Craig R., Verena Tunnicliffe, Ana Colaço, Jeffrey C. Drazen, Sabine Gollner, Lisa A. Levin, Nelia C. Mestre, Anna Metaxas, Tina Molodtsova, Telmo Morato, Andrew K. Sweetman, Travis Washburn and Diva J. Amon. 2020. “Deep-sea misconceptions cause underestimation of seabed-mining impacts.” *Trends in Ecology & Evolution*.
<https://doi.org/10.1016/j.tree.2020.07.002>
- ⁸ Ramirez-Llodra, E., T. M. Shank and C. R. German. 2007. “Biodiversity and biogeography of hydrothermal vent species: Thirty years of discovery and investigations.” *Oceanography* 20, 30–41. <https://doi.org/10.5670/oceanog.2007.78>

⁹ Stop Ecocide. “Legal definition of ecocide drafted by Independent Expert Panel”. Accessed August 2022. <https://www.stopecocide.earth/legal-definition>.

¹⁰ Miller KA, KF Thompson, P Johnston P and D Santillo. 2018. “An Overview of Seabed Mining Including the Current State of Development, Environmental Impacts, and Knowledge Gaps.” *Frontiers in Marine Science*. 4:418. <https://doi.org/10.3389/fmars.2017.00418>

¹¹ Laffoley, D, JM Baxter, DJ Amon, et al. 2020. “Eight urgent, fundamental and simultaneous steps needed to restore ocean health, and the consequences for humanity and the planet of inaction or delay.” *Aquatic Conserv: Mar Freshw Ecosyst*. 30: 194– 208. <https://doi.org/10.1002/aqc.3182>

¹² Deep Sea Conservation Coalition (@DeepSeaConserve). 2022. Twitter. August 3, 2022, 8:47PM. <https://twitter.com/DeepSeaConserve/status/1554916888752398339>

¹³ Friends of the Earth Europe. 2021. “Green mining” is a myth: The case for cutting EU resource consumption”. Accessed August 2022. <https://friendsoftheearth.eu/wp-content/uploads/2021/10/Green-mining-myth-report.pdf>.

¹⁴ European Environment Agency. 2021. “Growth without economic growth”. Accessed August 2022. <https://www.eea.europa.eu/publications/growth-without-economic-growth>.

¹⁵ The Government of the Republic of Nauru. “Nauru requests the International Seabed Authority Council to adopt rules and regulations within two years”. Accessed August 2022. <http://naurugov.nr/government/departments/department-of-foreign-affairs-and-trade/faqs-on-2-year-notice.aspx>.

¹⁶ Deep Sea Conservation Coalition. 2022. “Chile calls for a moratorium on deep sea mining”. Accessed August 2022. <https://www.savethehighseas.org/2022/06/20/chile-calls-for-a-moratorium-on-deep-sea-mining/>.

¹⁷ EMEPC. “Portuguese Task Group for the Extension of the Continental Shelf Mission”. Accessed August 2022. <https://en.emepc.pt/missao>.

¹⁸ CIIMAR. “DeepRisk”. Accessed August 2022. <https://www2.ciimar.up.pt/projects.php?id=187>.

¹⁹ Muiños, Susana, James Hein, Martin Frank, José Monteiro, Luís Gaspar, Tracey Conrad, Henrique Pereira and Fatima Abrantes. 2013. “Deep-sea Fe-Mn Crusts from the Northeast

Atlantic Ocean: Composition and Resource Considerations.” *Marine Georesources and Geotechnology*, 31:1, 40-70. <https://doi.org/10.1080/1064119X.2012.661215>

²⁰ Carreiro-Silva, M., A. Andrews, A. Braga-Henriques, V. de Matos, F. M. Porteiro and R.S. Santos, R. S. 2013. “Variability and growth of long-lived black coral *Leiopathes* sp. from the Azores”. *Mar. Ecol. Prog. Ser.* 473,. 189–199. <https://doi.org/10.3354/meps10052>

²¹ Governo dos Açores. “Áreas marinhas protegidas”. Direção Regional de Políticas Marítimas. Accessed August 2022. <https://portal.azores.gov.pt/web/drpm/%C3%81reas-marinhas-protegidas>.

²² Instituto Português do Mar e Atmosfera. 2021. “Plano de atividades”. Accessed August 2022. <https://www.ipma.pt/export/sites/ipma/bin/docs/institucionais/PA-IPMA-2021.pdf>.

²³ Agência Lusa. 2022. “Mineração do mar profundo vai afetar biodiversidade e pesca”. Observador. Accessed August 2022. <https://observador.pt/2022/06/29/mineracao-do-mar-profundo-vai-afetar-biodiversidade-e-pesca/>.

²⁴ Miljutin, D., M. Miljutina, P. Arbizu and J. Galéron. 2011. “Deep-sea nematode assemblage has not recovered 26 years after experimental mining of polymetallic nodules (Clarion-Clipperton Fracture Zone, Tropical Eastern Pacific).” *Deep Sea Res. Part I Oceanogr. Res. Pap.* 58, 885–897. <https://doi.org/10.1016/j.dsr.2011.06.003>

²⁵ Agência Lusa. 2012. “Carlos César diz que lucros da exploração dos recursos marinhos têm que servir desenvolvimento”. Accessed August 2022. <https://www.acorianooriental.pt/noticia/carlos-cesar-diz-que-lucros-da-exploracao-dos-recursos-marinhos-tem-que-servir-desenvolvimento>.

²⁶ Tomás, Nuno Miguel. 2012. “Entrevista Professor Costa e Silva”. Ingenium. Accessed August 2022. http://cdn.fct.unl.pt/sites/www.dct.fct.unl.pt/files/entrevista_prof._costa_e_silva.pdf

²⁷ Pinto, Luísa. 2016. “Governo quer acelerar mineração no fundo do mar dos Açores”. Público. Accessed August 2022. <https://www.publico.pt/2016/09/18/economia/noticia/governo-quer-acelerar-mineracao-no-fundo-do-mar-dos-aco-res-1744381>.

²⁸ Parlamento Português. 2019. “Excerto do Diário Número 83. Anteproposta de Lei n.º 4/XI – “Altera a Lei n.º 17/2014, de 10 de abril, que estabelece as Bases da Política de

Ordenamento e de Gestão do Espaço Marítimo Nacional”. Accessed August 2022.

<https://app.parlamento.pt/webutils/docs/doc.pdf?path=6148523063446f764c324679626d56304c334e706447567a4c31684a53556c4d5a5763765247396a6457316c626e527663306c7561574e7059585270646d45765a54426a4e6a68694d6d51744d4456695a6930304d6a63304c574a6b5a6a67744f474d78596a41314f4745774e6a63304c6e426b5a673d3d&fich=e0c68b2d-05bf-4274-bdf8-8c1b058a0674.pdf&Inline=true>.

²⁹ Costa Silva, António. 2020. “Visão Estratégica para o Plano de Recuperação Económica de Portugal 2020-2030”. Governo de Portugal. Accessed August 2022.

<https://www.portugal.gov.pt/download-ficheiros/ficheiro.aspx?v=%3d%3dBQAAAB%2bLCAAAAAAABAAzNDAYtAQaziD%2fFAUAAA%3d>.

³⁰ Firmino, Teresa. 2021. “ICNF votou a favor de adiar a mineração no mar profundo”. Público. Accessed August 2022. <https://www.publico.pt/2021/12/10/ciencia/noticia/icnf-votou-favor-adiar-mineracao-mar-profundo-1988156>.

³¹ Donn, Natasha. 2022. “Minister of Economy & Sea rejects deep sea mining “completely””. Portugal Resident. Accessed August 2022. <https://www.portugalresident.com/minister-of-economy-sea-rejects-deep-sea-mining-completely/>.

³² Donn, Natasha. 2022. “UN Ocean Conference begins in Lisbon, with leaders ‘apologising’ to the young”. Portugal Resident. Accessed August 2022. <https://www.portugalresident.com/un-oceans-conference-events-begin-in-lisbon-with-leaders-apologising-to-the-young/>.

TEACHING NOTE REFERENCES

¹ Oxford University. 2020. “How to write case studies for public policy education”. Accessed August 2022. <https://www.bsg.ox.ac.uk/sites/default/files/2020-06/Note%20-%20How%20to%20write%20case%20studies%20for%20public%20policy%20education%20-%20June%202020.pdf>.

² Hatcher, William, Bruce D. McDonald III and Lori A. Brainard. 2018. “How to write a case study for public affairs”. *Journal of Public Affairs Education*, 24:2, 274-285. <https://doi.org/10.1080/15236803.2018.1444902>

³ Oxford University. 2020. “Building better judgement amongst policymakers using the case-study method”. Accessed August 2022. <https://www.bsg.ox.ac.uk/sites/default/files/2020-06/Note%20-%20Building%20Better%20Judgement%20-%20June%202020.pdf>.