NKI Research

Research results of the
NKI - Institut für nachhaltige Kapitalanlagen

NKI
Institut für
nachhaltige Kapitalanlagen

Issue 11 / April 2026

Deep-Sea Mining

ESG risks of deep-sea mining and their significance on the financial market

Editorial

Dear readers,

Despite all efforts to promote a circular economy, the global economy's hunger for "fresh" raw materials remains virtually unchecked. In the search for new deposits, the focus is increasingly shifting to the deep-sea floor, where polymetallic manganese nodules and sulphides, cobalt-rich crusts and other raw materials are found. Among other things, these are of great importance for the introduction of low-carbon technologies, such as solar and wind power plants, and thus for the achievement of international climate targets. However, the ecological consequences of mining in the largely unknown and untouched deep sea – only 0.001 per cent of which has been explored to date – have not yet been comprehensively researched, for example with regard to possible damage to deep-sea biodiversity and ecosystems. Furthermore, the social, cultural and human rights risks of deep-sea mining have not yet been adequately considered.

Against this backdrop, states and civil society organisations, as well as companies, banks and investors, are calling for a moratorium on deep-sea mining. On the one hand, stopping commercial mining activities is intended to prevent irreversible ecological damage. On the other hand, the aim is to gain time to gather sufficient scientific knowledge about the effects of deep-sea mining, which will then form a solid basis for the definition of generally accepted rules for deep-sea mining by the International Seabed Authority (ISA).

The reasons for such a moratorium – the ecological, social, and economic impacts associated with deep-sea mining – are the focus of this issue of the "NKI Research" series. These include damage to deep-sea ecosystems and the species that live there, the impact on the water column, possible changes to major ocean cycles, the granting of mining rights, and the equitable distribution of revenues from deep-sea mining. It also highlights the social, cultural, and human rights implications, which pose a particular threat to the rights of indigenous peoples.

In addition, we present important fundamentals of deep-sea mining, examine activities at the political level, and explore the significance of this issue for the financial market. In doing so, we present various initiatives that address the consideration of sustainability criteria in the financing of maritime activities and the management of the risks of deep-sea mining.

We are delighted to have gained the AKI (Arbeitskreis Kirchlicher Investoren, Working Group of Church Investors) as a cooperation partner for the study. The AKI has conducted a comprehensive analysis of the ecological and social risks of deep-sea mining and, as a result of this analysis, is campaigning intensively for it to be stopped. A special contribution by Brot für die Welt, Misereor and Ozeanien-Dialog highlights the clear reasons for halting deep-sea mining, using the example of deep-sea mining in the Pacific to illustrate how it threatens the human rights of present and future generations.

We hope this publication will provide you with valuable insights into deep-sea mining.

Rolf Häßler

Rolf D. Häßler

Contents

The study was conducted in cooperation with

AKI ARBEITSKREIS KIRCHLICHER INVESTOREN

Foreword by the Arbeitskreis Kirchlicher Investoren (AKI)

Deep-sea mining is an issue that uniquely lies at the intersection of the churches' ecumenical commitment to justice, peace and the integrity of creation. The understanding of sustainability underpinning this aligns with the UN Sustainable Development Goals (SDGs). Deep-sea mining contravenes two-thirds of these 17 Sustainable Development Goals, making it a high-profile issue for the churches to engage with.

1. The deep sea is the ecosystem on Earth that science understands the least. All we know so far is how incredibly slowly it recovers from human interference. Therefore "it can be reasonably expected that deep-sea mining will result in a net loss of biodiversity in the direct mining footprint and for some distance around it. These losses may well be irreversible on timescales relevant to management and possibly for many human generations"[1]. So this concerns SDGs 6, 13, 14 and 15, which relate to the biosphere:

- the destruction of habitats and ecosystems that remain largely unexplored;
- the loss of biodiversity on an incalculable scale;
- the weakening of the oceans' role as the largest carbon sink, thereby exacerbating the climate crisis.

2. For church organisations, social and human rights considerations further complicate the situation. This particularly concerns the protection of the rights and cultural identity of people who depend on the oceans. The SDGs affected are therefore 1, 2, 8, 10, 11, 12 and 16, for example through:

- the threat to fisheries and, consequently, to food security in coastal communities;
- further negative impacts on the social and cultural human rights of local communities;
- a general exacerbation of social and economic inequalities: under international law, the deep sea is considered the common heritage of mankind. However, the damage occurs in the Global South, whilst industrialised nations in particular benefit from the trade in raw materials.

3. Finally, deep-sea mining is a highly topical and politically contentious issue, where decisive action can still avert far-reaching damage to people and the planet.

This study brings together, in an innovative and pioneering way, the expertise of the NKI – Institut für nachhaltige Kapitalanlagen, the Arbeitskreis Kirchlicher Investoren (AKI) and church-based aid agencies. They are all united by the goal of influencing the economic prospects of future deep-sea mining through their commitment. To ensure that the deep sea remains as untouched as possible, we, as church investors, together with Brot für die Welt and Misereor, are approaching companies in the financial and real sectors with a clear expectation:

Refrain from any activities related to deep-sea mining throughout your entire supply chain and make this decision public!

Church-affiliated investors can encourage companies in the real economy not to source raw materials from the deep sea. The more companies commit to this now, the greater the pressure on deep-sea ecosystems will be reduced. In our engagement dialogues with banks, asset managers and (re)insurers, we express our expectation that companies will publicly distance themselves from economic activities related to deep-sea mining and advocate for a moratorium. We express our expectation to companies across all sectors that they will endorse the "Business Statement Supporting a Moratorium on Deep Sea Mining"[2].

In our campaign against deep-sea mining, we as church representatives are not alone, but are working with partners such as the NKI who share our understanding of sustainability. A window of opportunity is currently opening in which a broad alliance of business, science, politics, civil society and churches can succeed in permanently protecting the deep sea and preserving it for future generations. Let us make the most of it together!

AKI ARBEITSKREIS KIRCHLICHER INVESTOREN

Pacific Blue Line regional alliance, 2022, in Fiji © Jan Pingel

1. Fundamentals of deep-sea mining

1.1. Definition

Mineral raw materials, such as aluminium, iron ore, gold, cobalt, copper, manganese, molybdenum and rare earths, are currently mined almost exclusively on land. A few mining activities take place in shallow waters within the territorial jurisdictions of countries, such as the extraction of sand, tin or diamonds. In these jurisdictions, known as “Exclusive Economic Zone (EEZ)”, which each cover a 200-mile zone, coastal states are allowed to exploit their own seabed resources. For some island states, such as Kiribati, Nauru and Tonga, the EEZ also includes areas of the so-called deep sea, which according to common definitions begins at a depth of 200 metres.

Deep-sea mining (DSM – also known as deep-seabed mining) is a sub-sector of experimental seabed mining that involves the extraction of minerals from the seabed at depths of between 200 and 6,500 metres. These areas, known as the deep sea, are largely devoid of light and cover around 88 per cent of the ocean’s surface.

Deep-sea mineral deposits are mostly located outside the 200-mile zone, i.e. more than 370 km from the nearest coast, in international waters where no single country has sovereign rights for the exploration or mining of minerals. The exploration and mining of deep-sea minerals in international waters is regulated by the International Seabed Authority (ISA, see chapter 4).

Interest in mining mineral resources in the deep sea is not new, but recent technological advances and rising global demand for metals and rare earths, which are needed for the expansion of electric mobility as well as solar and wind power plants, for example, are increasingly bringing deep-sea deposits into the focus of mining companies and commodity analysts.

Distinction from offshore drilling

This edition of NKI Research deals with the risks of deep-sea mining in the sense of extracting and producing solid mineral raw materials from the seabed. This must be distinguished from the extraction of oil and gas from undersea deposits, which is referred to as offshore drilling. In contrast to deep-sea mining in international waters, the extraction of oil and gas from the seabed has so far primarily taken place within the EEZ of countries.

1.2. State of the art

Deep-sea mining is currently still in the exploration and testing phase. Due to the high pressure, low temperatures and complex geological and hydrodynamic environments in deep-sea mining areas, mining involves numerous technical and logistical challenges.

Different mineral deposits require different mining techniques. The mining of massive sulphides and cobalt-rich crusts on the seabed requires the use of cutting and drilling tools to break up and extract the minerals, while polymetallic nodules are sucked up by vacuum cleaner-like collection vehicles.[3] The equipment is remotely controlled, and the collected material is pumped through pipes to a collection tank on board a mining vessel at the water’s surface. There, the minerals are separated from the water and sediment, loaded onto transport ships and processed on land. The process water and sediments are returned to the sea.

For economic reasons, potential deep-sea mineral mining areas usually cover very large areas. Both stationary and mobile extraction techniques and underwater vehicles are currently being researched and, in some cases, already tested.

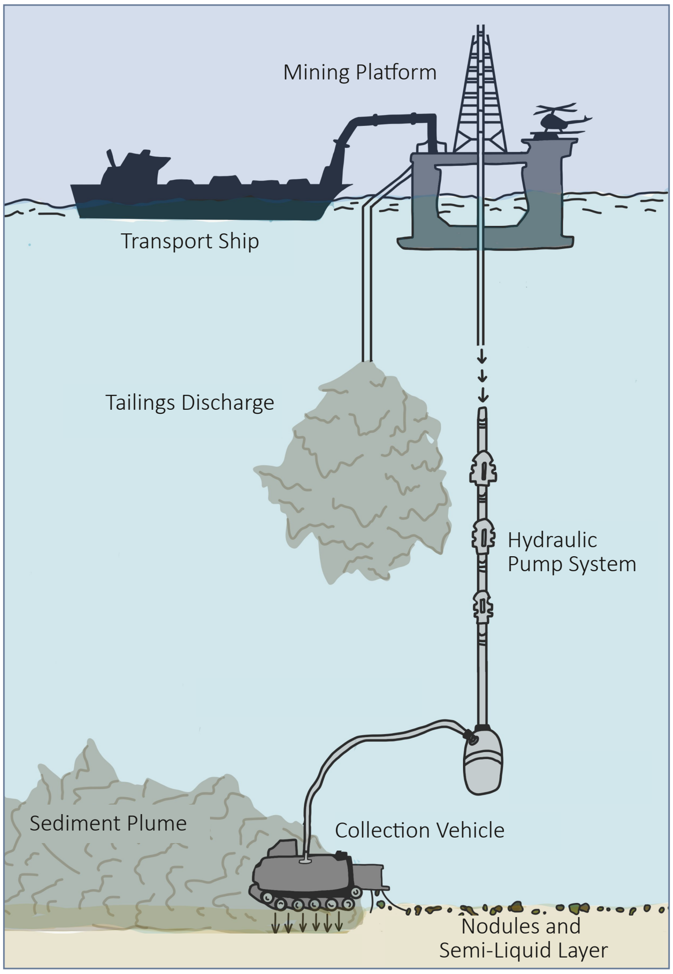


Figure 1: Illustration of manganese nodule mining on the deep-sea floor[4]

2. Economic importance of deep-sea minerals

2.1. The importance of deep-sea minerals for decarbonisation

The transition to net-zero emissions in the global economy and the limitation of global temperature rise to well below 2 °C in accordance with the Paris Climate Agreement require the comprehensive and widespread introduction of low-carbon technologies such as solar and wind power plants. Deep-sea minerals are of particular economic interest in this context due to their content of gold, cobalt, copper, manganese, molybdenum, nickel, platinum, rare earths, silver and zinc. All of these minerals currently have a limited and geographically concentrated supply, and most of them have low recycling rates. Key sectors, in particular solar and wind energy and electromobility, but also consumer electronics and the steel industry, are dependent on the above-mentioned critical minerals – and, in addition, on lithium in particular.

Market forecasts predict that demand for these minerals will continue to rise in the coming years, particularly due to efforts to decarbonise economies by replacing fossil fuel technologies with renewable alternatives. According to the International Energy Agency (IEA), a typical electric car requires six times the mineral inputs of a conventional car, while an onshore wind turbine requires nine times more mineral resources than a gas-fired power plant.[5]

	Cobalt	Copper	Man-ganese	Molyb-denum	Nickel	Rare earths
Wind	●	●	●	●	●	●
Solar		●		●	●	
Geothermal energy		●	●	●	●	
Battery storage	●	●	●	●	●	●
Elektric motors	●	●	●		●	●
Hydro-power		●	●	●	●	

Table 1: Minerals required for relevant low-carbon technologies in connection with deep-sea mining[6]

Since 2010, the average amount of minerals required for a new unit of power generation capacity has risen by 50 per cent as the share of renewable energy in new investments has increased. In a scenario that meets the Paris Agreement targets, the share of renewable energies in total demand for minerals will rise significantly over the next two decades, according to IEA calculations, to over 40 per cent for copper and rare earth elements and 60-70 per cent for nickel and cobalt. Against this backdrop, deep-sea mining, which is cost-intensive compared to onshore mining, may become economically attractive. The focus here is particularly on the following raw materials:

Raw material	Use	Occurence
Cobalt	Half of the cobalt currently available is used for batteries, with the greatest demand coming from the automotive industry, followed by consumer electronics. Cobalt is also used in the manufacture of superalloys and steel alloys for applications in power generation, the automotive industry, aerospace and medical technology.	Cobalt-rich crusts
Copper	Copper is essential for all energy technologies. It is used in cables, inverters, transformers and motors, all of which are essential for generating and supplying electricity.	Polymetallic nodules
Manganese, nickel	Manganese and nickel are mainly used in the production of stainless steel and ferrous and non-ferrous alloys, particularly for the infrastructure sector, including renewable energy generation. Nickel is also used in the manufacture of batteries.	Polymetallic nodules
Rare earths	Rare earths comprise a group of 17 elements, some of which are particularly important for the transition to a low-carbon economy, e.g. neodymium. They are used, for example, in the manufacture of permanent magnets in wind turbines and electric motors.	Earth's crust

Table 2: Important deep-sea minerals and their applications; own illustration

While proponents of deep-sea mining point to this growing demand and its importance for climate protection, numerous studies[7, 8], emphasise that technological developments, material substitution and the circular economy could reduce the demand for critical minerals by up to 48 per cent by 2050. More efficient recycling, for example through higher collection rates and better mineral recovery techniques, could reduce demand for new raw materials by a further 10 per cent by 2050.

2.2. Commercial development of deep-sea mining

The first scientific expedition to explore the world's oceans and the sea floor was the Challenger expedition between 1872 and 1876. During this expedition in 1873, "several peculiar black oval bodies which were composed of almost pure manganese oxide" were brought to the surface.[9] However, economic interest in manganese nodules in the deep sea was not aroused until the 1960s. A consortium was formed, including Canada, France, Germany, Japan and the USA, with the aim of assessing the deposits of polymetallic nodules in the Clarion Clipperton Zone (CCZ) in the central Pacific, which stretches between Hawaii and Mexico and covers an area of approximately 4 million km², and developing possible extraction technologies.

Since the United Nations Convention on the Law of the Sea (UNCLOS) came into force and the ISA was established in 1994, the exploration of mineral resources in the deep sea has been regulated by exploration contracts. While exploration activities were originally carried out by state project developers, contracts have also been awarded to private companies since 2010. The ISA has not yet approved any mining projects due to the lack of a legal basis (see chapter 4).

The ISA has currently awarded 30 exploration licences to 21 contractors, including China, France, Germany, India, Japan, Korea and Russia. Germany is supporting two exploration projects in the Pacific and Indian Oceans through the Federal Institute for Geosciences and Natural Resources. The licences currently granted by the ISA are each valid for 15 years. Nineteen of these relate to the exploration of polymetallic nodules, primarily in the CCZ in the Pacific, seven to the exploration of polymetallic sulphides and four to cobalt-rich crusts. To date, exploration contracts have been awarded in the Western Pacific, the Central and South-West Indian Ridges, the Central Indian Ocean Basin and the Mid-Atlantic Ridge:

- Polymetallic manganese nodules are mainly found in the CCZ, the central Indian Ocean basin and the western Pacific. They are primarily of interest due to their cobalt, copper, manganese, nickel and rare earth content.
- Polymetallic sulphides are being explored in hydrothermal fields on the Southwest and Central Indian Ridges and the Mid-Atlantic Ridge. They contain large quantities of copper, gold, iron, lead, silver and zinc.
- Cobalt-rich crusts occur mainly within the territorial jurisdictions of countries and are being explored in the western Pacific. They are similar in composition to manganese nodules, but are of interest due to their higher content of cobalt, platinum and rare earth elements.

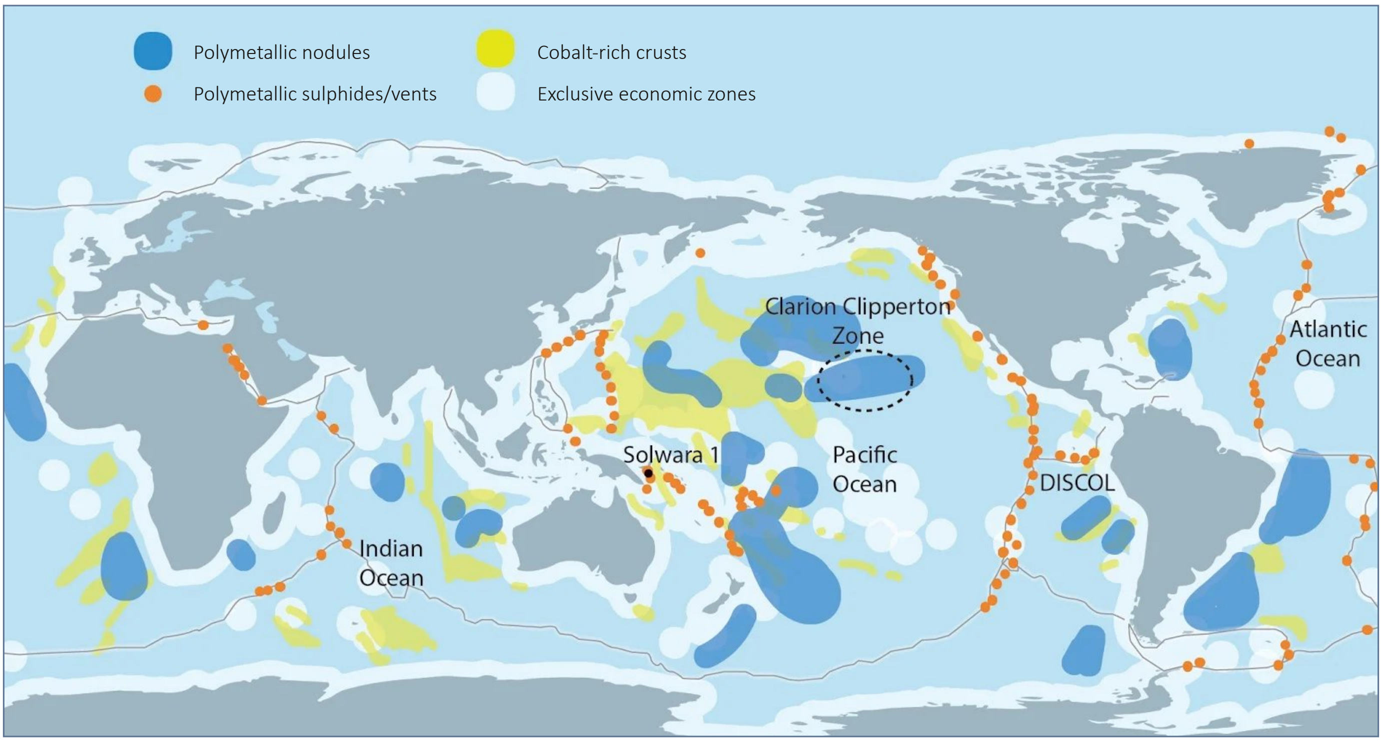


Figure 2: World map of mineral deposits in the deep sea[10]

Among all mineral deposits in the deep sea, polymetallic nodules stand out in terms of resource potential and economic viability. In addition to their metal content, the form in which they occur makes them an attractive deposit. The nodules are about the size of potatoes and lie at a depth of between 4,000 and 6,000 metres on the surface of the seabed or within the first 10 cm of the sediment cover. The CCZ in the central equatorial Pacific contains the world's largest known deposit of these nodules.

Companies active in deep-sea mining include:

- China Minmetals Corporation (China)
- Lockheed Martin (USA)
- Nautilus Minerals (Canada)
- Neptune Minerals (New Zealand)
- The Metals Company (TMC) (Canada)

In addition, companies operating in terrestrial mining are also continuing to develop their activities in this area.

3. ESG risks of deep-sea mining

Discussions about the risks of deep-sea mining focus on the risks to the little-studied biodiversity and ecosystems of the deep sea. According to current estimates, 95 per cent of the total seabed and 99.999 per cent of the deep-sea floor remain unexplored.[11] There are also discussions about the procedures for granting rights for deep-sea mining and the question of how revenues can be distributed fairly on a global scale.

3.1. Damage to deep-sea ecosystems

Deep-sea ecosystems have so far been largely undisturbed by humans. Researchers agree that they are highly vulnerable to change due to the very slow processes that take place there. Given the slow recovery rates of deep-sea ecosystems, it is unlikely that destroyed habitats will recover within human time scales.

Polymetallic nodules and metal sulphides at hydrothermal fields, which are of interest for deep-sea mining, often constitute an important part of the habitat of deep-sea species. At hydrothermal fields, seawater penetrates the hot basalt and magma zones located just below the seabed, creating so-called black smokers. The hydrothermal waters contain high levels of hydrogen sulphide and metals. Bacteria in particular use the hydrogen sulphide dissolved in the water for chemosynthesis. Many deep-sea species, including tube worms, mussels, crustaceans and snails, have perfected their adaptation strategies to such an extent that they live in symbiosis with these bacteria. Hydrothermal deep-sea vents are therefore classified as "Vulnerable Marine Ecosystems" (VMEs) by the Food and Agriculture Organisation of the United Nations (FAO).[12]

Polymetallic nodules have been shown to be key structures for a wide variety of species and play a crucial role in the integrity of the deep-sea food web. According to expert estimates, their extraction would therefore lead to a decline in biodiversity of at least 20 per cent in the CCZ, for example.[13] Fields with manganese nodules at depths of 3,000 to 6,000 metres are home to a locally abundant population of sponges, sea cucumbers, various species of octopus and numerous other benthic organisms that have adapted to the special conditions at depth.

3.2. Loss of biodiversity on the seabed

The deep sea is the largest habitat on Earth, but knowledge about its biodiversity is still limited. The highly specialised species that have adapted to the extreme conditions in the deep sea – darkness, cold (average temperature around 4 °C), enormous pressure and scarcity of food – are still largely unexplored. Scientists are only just beginning to systematically record and catalogue them. What is known so far is that deep-sea species are generally long-lived, reach reproductive age late and have low fertility rates. Due to their very slow natural recovery rates, damage caused by human activity can therefore be considered "permanent" by human standards.[14]

An international research group analysed over 100,000 records of deep-sea species in the CCZ in the Pacific and identified 5,578 different species, 92 per cent of which were previously unknown to science.[15] Only six of these species, including a sea cucumber, a nematode worm and a carnivorous sponge, have been observed in other regions. The research group estimates that there are up to 8,000 additional unknown species in the CCZ. Part of the CCZ has been recognised as an "Ecologically or Biologically Significant Area" under the United Nations Convention on Biological Diversity (CBD).[16]

A scientific analysis conducted in 2018 on the topic of "Deep-Sea Mining with No Net Loss of Biodiversity"[17] responded to proposals to compensate for biodiversity losses in the deep sea by restoring other ecosystem types, such as coral reefs, and analysed the goal of causing no net loss of biodiversity – in line with the common hierarchy of damage limitation (avoid, minimise, restore). The analysis shows that biodiversity loss from deep-sea mining is inevitable. The study authors emphasise that the focus must therefore be on avoiding and minimising damage.

A study from 2023 examines the differences in biodiversity loss between traditional land-based mining and deep-sea mining. According to the study, the negative impact of terrestrial mining on biodiversity could be mitigated by extracting minerals from the deep sea, but only at the cost of marine biodiversity loss, which is still difficult to assess.[18]

3.3. Effects along the water column

Deep-sea mining has potentially far-reaching ecological impacts not only at and around the deposit site, but also along the water column above it – especially in the deep mesopelagic zone (200 to 1,000 metres below sea level). The mesopelagic zone connects shallow and deep-water ecosystems and plays a key role in carbon export.[19] It is also home to a large reservoir of unique biodiversity and a significant proportion of global fish stocks.

Along the water column, the discharge of mining material from ore drainage, through which sediments and dissolved metals are introduced over potentially large areas, is of particular ecological importance. Middle waters generally have a very low concentration of suspended solids. Sediments and metals introduced there can remain suspended for several years and be transported over hundreds of kilometres. Many suspension feeders, i.e. organisms that filter small particles from the water for food, live in the midwater zone and form an important part of the ocean food web. Inorganic sediments released into the water could clog their feeding apparatus, while the release of metals and toxins could contaminate the waters and accumulate in the food web – right up to humans.

The turbidity of seawater and noise pollution along the water column can negatively affect the hunting and reproductive behaviour of animals in mid-water zones. Although the threshold values are not conclusively known, it is assumed that animals are likely to be highly sensitive to sediments due to the usually very low concentration of suspended matter.

3.4. Changes in major ocean circulation patterns

The oceans are the largest carbon sink worldwide and have stored around 40 percent of anthropogenic carbon dioxide (CO_2) emissions to date. The CO_2 is dissolved and stored in the oceans on the one hand, and absorbed by algae and bacteria suspended in the water, known as phytoplankton, on the other. Phytoplankton forms the basis of the aquatic food chain and is therefore distributed throughout marine biodiversity. When marine organisms die, some of this bound carbon sinks to the sea floor.

The deep sea is home to a large number of microorganisms that contribute significantly to the material cycle – such as the carbon and nutrient cycles. They extract organic material, which comes from dead phytoplankton and zooplankton, for example, convert it and make it available to the ecosystem again as nutrients. Dissolved sulphur compounds are also converted by bacteria and returned to the nutrient cycle.

Deep-sea mining activities can damage not only visible organisms but also tiny organisms such as microplankton in the water and microbes and worms in the soil, along with their functions in metabolic cycles and ecosystem services. This could lead to reduced primary production of nutrients and affect the marine food chain.

Individual studies conclude that deep-sea mining can also lead to the release of carbon stored in the deep sea and seabed, exacerbating climate change.[20] However, the majority of studies assume that the carbon in deep-sea sediments that is stirred up by activities on the seabed will not be remineralised, but will be deposited back on the seabed even after disturbance, and will therefore not affect atmospheric CO_2 concentrations in the near future. However, the effects of deep-sea mining on wildlife, which plays a key role in carbon processing, have not been conclusively assessed.

3.5. Granting of mining rights

The ISA is responsible for granting exploration and future mining rights for deep-sea mining, and its tasks are regulated by the UNCLOS. The Convention defines that the deep seabed, “The Area”, including the mineral resources contained therein, is the common heritage of mankind and that the proceeds from the extraction of the resources should benefit the international community.

Critics complain that the ISA’s powers and resources are not comprehensive enough to adequately monitor mining companies’ compliance with environmental standards. They point out that, in its current form, the ISA is a convening body rather than a functioning regulatory authority. It has no inspection or enforcement powers and its scope for action is limited by a lack of funding, conflicts of interest and restricted decision-making powers. Various organisations are also calling for the involvement of scientists and external independent experts in ISA processes.

Another criticism of the awarding of contracts is that all ISA contracts must be held or sponsored by an ISA member state. Contractors must be “effectively controlled” by their sponsoring states (UNCLOS Art. 153). However, little research has been done to date on how this relationship has been interpreted in individual sponsorship agreements, and there is also little public information available on contractual agreements and regulatory measures. Critics also point to unresolved issues in the awarding of licences, such as the calculation of the value of extractable raw materials and the resulting licence fees.

Finally, there is criticism that although all nations are supposed to benefit from the exploitation of raw materials, deep-sea mining does not generate substantial income for countries in the Global South, with most of the added value being created in industrialised countries.[21] Some organisations also point to the risk of corruption in the granting of licences, which is generally quite widespread in the mining sector.

SECTION 2. PRINCIPLES GOVERNING THE AREA

Article 136
Common heritage of mankind

The Area and its resources are the common heritage of mankind.

Article 137
Legal status of the Area and its resources

1. No State shall claim or exercise sovereignty or sovereign rights over any part of the Area or its resources, nor shall any State or natural or juridical person appropriate any part thereof. No such claim or exercise of sovereignty or sovereign rights nor such appropriation shall be recognized.
2. All rights in the resources of the Area are vested in mankind as a whole, on whose behalf the Authority shall act. These resources are not subject to alienation. The minerals recovered from the Area, however, may only be alienated in accordance with this Part and the rules, regulations and procedures of the Authority.
3. No State or natural or juridical person shall claim, acquire or exercise rights with respect to the minerals recovered from the Area except in accordance with this Part. Otherwise, no such claim, acquisition or exercise of such rights shall be recognized.

Article 138
General conduct of States in relation to the Area

The general conduct of States in relation to the Area shall be in accordance with the provisions of this Part, the principles embodied in the Charter of the United Nations and other rules of international law in the interests of maintaining peace and security and promoting international cooperation and mutual understanding.

Figure 3: Excerpt from UNCLOS[22]

Special contribution:
Deep-sea mining – an engagement project run by church investors and organisations

By making responsible decisions based on ethical and sustainable criteria, investors can have a decisive influence on the economic prospects of future deep-sea mining. To ensure that the deep sea remains untouched, church-affiliated investors and development organisations across different countries and denominations are approaching companies in the financial and real sectors with a clear expectation:

Refrain from any activities related to deep-sea mining throughout your entire value chain and make this decision public!

Churches and church-affiliated organisations are linked worldwide through international ecumenism. This is why a key distinguishing feature of church-based investors is their ability to approach investment opportunities on the basis of reliable information from partner church organisations. Above all, it is about safeguarding the rights and cultural identity of the people who depend on the seas. These challenges are currently coming into sharp focus in the Pacific, as demonstrated by the following ecumenically authored blog post by Brot für die Welt, Misereor and Ozeanien-Dialog.[23]

© Jan Pingel

Deep-sea mining in the Pacific – a threat to the human rights of present and future generations

By Francisco Mari (Brot für die Welt), Klaus Schilder (Misereor) and Jan Pingel (Ozeanien-Dialog)

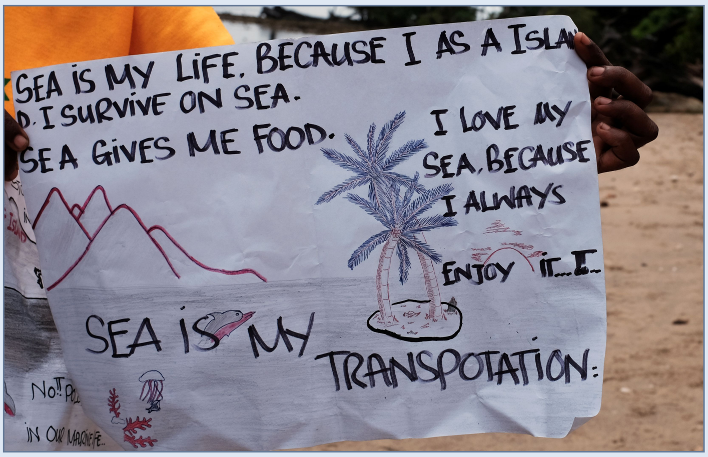
Across the Pacific, resistance to industrial deep-sea mining is growing. For many coastal communities, it does not offer new prospects, but instead evokes memories of a history of colonial exploitation, the consequences of which are still felt today. The trauma of nuclear testing in the region has had a particularly profound impact. Between 1946 and 1958, the United States conducted extensive tests in the Marshall Islands – including on Bikini Atoll. Entire communities were forcibly relocated, their habitats permanently contaminated. France, too, tested nuclear weapons in French Polynesia until the mid-1990s, for example on Moruroa. The health and environmental consequences were long concealed; many of those affected continue to suffer to this day.

These experiences are deeply rooted in the collective memory of many Pacific societies. They shape not only historical narratives but also the current relationship with external interventions in the environment and natural resources. The ocean has repeatedly become the scene of dangerous experiments by external powers – with serious consequences for people and nature. For the communities affected, this meant that they effectively became "guinea pigs", whilst the responsible states outsourced the risks geographically.

Experiences with extractive industries, particularly onshore mining, have also permanently shaken the trust of many communities. Promised jobs and development benefits often failed to materialise or benefited only a few. At the same time, there were repeated instances of human rights violations, environmental destruction and social tensions. Profits often flowed abroad or to national elites, whilst local communities bore the long-term costs.

It comes as no surprise that deep-sea mining in Oceania is met with widespread opposition. This is because it directly affects the region's unifying element: the ocean itself. The Tongan-Fijian author Epeli Hau'ofa summed this up succinctly: "We are the sea, we are the ocean." In Pacific societies, the sea is far more than a geographical space. It is simultaneously a basis for life, a cultural reference point and a spiritual space. Fishing provides food and income, whilst traditional practices are deeply embedded in social structures and cultural expressions. Concepts such as "moana" (ocean) and "vanua" (land) illustrate a worldview in which people and the environment are inextricably linked. Interventions in marine ecosystems therefore have not only ecological but also profound social, cultural and spiritual consequences.

© Jan Pingel



© Jan Pingel

There is strong evidence to suggest that the human rights principle of Free, Prior and Informed Consent (FPIC) must also apply to deep-sea mining. This is because, even if mining areas lie outside indigenous territories, the impacts can directly affect their rights. FPIC is binding on signatory states to Convention No. 169 of the International Labour Organization and is increasingly understood as part of customary international law. The UN Declaration on the Rights of Indigenous Peoples also underscores this obligation.
The potential consequences of deep-sea mining are serious. Scientific studies show that sediment plumes alone can have a significant impact on marine ecosystems. Shark, ray and tuna populations are particularly affected, as their habitats are disrupted. A decline in these populations would have a direct impact on food security for many coastal communities that depend on functioning marine food webs.
Furthermore, cultural practices closely linked to marine ecosystems are under threat. In the province of New Ireland in Papua New Guinea, for example, “shark calling” is an important rite of passage: young men head out to sea and lure sharks using traditional, spiritually-based methods. A decline in shark populations would mean not only ecological but also cultural losses. The same applies to other traditions in the Pacific, such as the symbolic role of marine animals in cultural practices like the Hawaiian hula.
Calls for a moratorium or ban on deep-sea mining are therefore not directed solely at individual projects. They raise fundamental questions about global justice and the perpetuation of colonial patterns: decisions regarding resources are often made without genuine involvement of the affected communities, economic promises remain unfulfilled, and the environmental and human rights costs are externalised.

„Not needed, not wanted, not consented“[24] – This succinct slogan sums up the stance of many Pacific communities, churches and civil society organisations on deep-sea mining. It represents a clear rejection of an industry that is perceived as a continuation of historical inequalities. At the heart of the criticism lie human rights risks: the threat to livelihoods, cultural and spiritual rights, and the right to self-determination. Ultimately, this is not just about raw materials. It is about respect for fundamental rights – the right to self-determination, to food, to cultural identity and to an intact environment. And it is about the question of whether these rights should also apply to future generations in the Pacific.

4. International agreements and responsibilities

In accordance with the United Nations Convention on the Law of the Sea, mining activities are regulated by the ISA as described. Its mission is to “organize and control all mineral-resources-related activities in the Area for the benefit of humankind as a whole [...] and to ensure the effective protection of the marine environment from harmful effects.“[25]
As part of its responsibilities, it is in charge of the management of mining activities in seabed areas beyond national jurisdiction.
The ISA Mining Code contains comprehensive rules, regulations and procedures relating to the prospecting, exploration and exploitation of marine minerals in the Area.

Figure 4: Elements of the ISA Mining Code[26]

To date, the ISA has adopted three regulations governing the prospecting and exploration of polymetallic nodules (PMN, 2000, review 2013), polymetallic sulphides (PMS, 2010) and cobalt-rich ferromanganese crusts (CFC, 2012).[27] Since 2014, the ISA has been working on corresponding regulations for the exploitation of these resources. By 2025, binding rules for deep-sea mining should have been established, without which underwater mining cannot and should not begin.
The United States is one of the few countries that is not a party to UNCLOS, but all US administrations have largely respected the rules of the agreement to date. At the end of April 2025, however, US President Trump signed a decree allowing US companies to engage in deep-sea mining worldwide, including in areas located in The Area. A few days later, the US subsidiary of the Canadian company The Metals Company (TMC) applied for the world’s first commercial mining licence in international waters. The ISA condemns this unilateral national action and considers it a violation of international law. However, even at the ISA meeting in Jamaica in July 2025, no agreement could be reached on a set of rules for the extraction of raw materials in the deep sea. Among other things, there is still controversy over how environmental damage can be avoided and how underwater monitoring should be regulated.[28]
Due to the similarities between the processes, some project management and environmental quality standards from the offshore oil and gas industry can be transferred to deep-sea mining, but this does not apply to all standards. Environmental standards based on many years of research are mostly limited to shallow waters of the continental shelf (up to about 200 metres deep), but deep-sea environments pose different challenges. Numerous studies point to the current low level of knowledge about deep-sea ecosystems, their interconnectedness and critical thresholds for change. These uncertainties are a significant problem in assessing “effective protection of the marine environment” in the context of deep-sea mining and developing a regulatory framework for the extraction of deep-sea minerals.

The number of published studies in the field of deep-sea ecosystem research has increased significantly in recent years. However, many questions remain unanswered regarding impacts on biodiversity, the structure of species and habitats, relationships with ecosystem services such as nutrient provision, or the spread and persistence of sediment plumes on the seabed and in the water column resulting from mining activities. In the summer of 2023, the "Marine Expert Statement Calling for a Pause to Deep-Sea Mining" was published, which has now been signed by nearly 1,000 marine scientists from more than 70 countries. They justify their call for a moratorium on deep-sea mineral extraction by pointing to, among other things, the massive gaps in our knowledge of deep-sea biology and ecology and the risk of irreversible environmental damage.[29]
Support for a "precautionary pause" or moratorium is also growing at the national level. In 2022, Germany was one of the first industrialised nations to call for a halt to such activities. At the third UN Ocean Conference (UNOC), which took place in Nice in June 2025, more than 30 countries (including Germany) called for a moratorium on deep-sea mining. UN Secretary-General António Guterres also called on the United Nations to prevent the seabed from becoming a "Wild West" of uncontrolled exploitation and called for political determination to curb "dangerous practices". According to research by the Deep Sea Conservation Coalition (DSCC), a global alliance of over 130 NGOs, 40 countries worldwide now support a temporary moratorium or even a permanent ban on mining activities on the seabed.[30]
The UN High Seas Protection Agreement, also known as the Agreement on Biodiversity Beyond National Jurisdiction (BBNJ), which came into force on 17 January 2026, creates the first legally binding framework to effectively protect and manage international waters.[31] While it does not directly regulate deep-sea mining, it strengthens environmental standards and requires rigorous environmental impact assessments for activities affecting the seabed.

5. Significance of deep-sea mining on the financial market

The financial market also considers the risks of deep-sea mining to be so high that some initiatives are joining calls for a moratorium. The United Nations Environment Programme Finance Initiative (UNEP FI) concludes that "there is no foreseeable way in which the financing of deep-sea mining activities can be viewed as consistent with the Sustainable Blue Economy Finance Principles".[32] It points to significant regulatory, operational and reputational risks. In its publication "Deep seabed mining: WWF's guide for financial institution", the WWF recommends that financial institutions, in line with the position of UNEP FI …

- … publicly commit not to invest in pure-play deep seabed mining companies, or companies with a significant share of their revenue or activities within DSM;
- … engage with non-pure-play mining companies and use all available engagement tools with the clear ask of stopping activities linked to deep seabed mining;
- … engage with non-mining companies that are potential users of metals/minerals, in sectors such as consumer electronics, industrials, energy technology, asking them to sign the business call for a moratorium, develop proper monitoring systems, track minerals sourced and exclude DSM;
- … engage with financial institutions and other sources of DSM funding, including companies with ownership in DSM-related companies, to make them adopt similar policies.[33]

Various financial service providers and real economy companies are supporting a moratorium on deep-sea mining as part of the WWF's „Business Statement Supporting a Moratorium on Deep Sea Mining".[34] Among other things, they point out that the consequences of deep-sea mining for the functioning of the ecosystem and the impact on people, societies and industries that depend on a healthy ocean are not yet fully understood: "Before any potential deep seabed mining occurs, it needs to be clearly demonstrated that such activities can be managed in a way that ensures the effective protection of the marine environment."

Sustainable Blue Economy Finance Principles

The Sustainable Blue Economy Finance Principles aim to promote a sustainable maritime economy by directing investment towards a healthy, productive and resilient marine environment. They provide guidance for banks, investors and insurers on how to structure their decisions in a way that protects and restores marine ecosystems, creates social and economic benefits for current and future generations, and aligns with international sustainable development goals, in particular Sustainable Development Goal 14, "Life below water". The 14 principles were developed by the European Commission, WWF, the World Resources Institute (WRI) and the European Investment Bank (EIB) and are managed by UNEP FI as part of the Sustainable Blue Economy Finance Initiative.

They also call for urgent consideration of alternatives to deep-sea minerals, with a focus on reducing demand for primary metals, transitioning to a resource-efficient circular economy, and developing responsible terrestrial mining practices. Until key questions surrounding the environmental, economic, social and legal issues have been sufficiently clarified, they commit to not sourcing minerals from the deep sea, to excluding such minerals from their supply chains and to not financing deep-sea mining.
As part of the "Global Financial Institutions Statement to Governments on Deep Seabed Mining" around 40 institutional investors and asset managers with total assets of over 3.9 trillion euros are calling on governments to protect the oceans and not to proceed with deep-sea mining until the environmental, social and economic risks have been fully clarified and alternatives to deep-sea minerals have been thoroughly investigated.[35]

Sources

1 https://www.frontiersin.org/articles/10.3389/fmars.2018.00053/full
2 https://www.stopdeepseabedmining.org/statement
3 https://www.geomar.de/fileadmin/content/service/presse/public-pubs/rohstoffbroschuere.pdf
4 https://commons.wikimedia.org/wiki/File:Mining_implications_figure.png
5 https://www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions/executive-summary
6 https://wedocs.unep.org/bitstream/handle/20.500.11822/46623/critical_transitions.pdf
7 https://sintef.brage.unit.no/sintef-xmlui/handle/11250/3032049
8 https://www.greenpeace.de/publikationen/Greenpeace_Studie_Tiefseebergbau_0.pdf
9 https://www.isa.org.jm/exploration-contracts
10 https://www.stiftung-meeresschutz.org/tiefseebergbau
11 https://www.spektrum.de/news/tiefsee-99-999-prozent-des-meeresbodens-noch-voellig-unerforscht/2265775
12 https://www.fao.org/in-action/vulnerable-marine-ecosystems/definitions/en
13 https://www.nature.com/articles/s41598-021-91703-4
14 https://www.frontiersin.org/articles/10.3389/fmars.2018.00053/full
15 https://www.cell.com/current-biology/fulltext/S0960-9822(23)00534-1
16 https://www.cbd.int/ebsa
17 https://www.frontiersin.org/articles/10.3389/fmars.2018.00053/full
18 https://link.springer.com/article/10.1007/s10531-023-02558-2
19 https://www.pnas.org/doi/10.1073/pnas.2011914117
20 https://www.frontiersin.org/articles/10.3389/fmars.2020.00165/full
21 https://www.forumue.de/wp-content/uploads/2023/03/ArgumenteGegenTiefseebergbau2Auflage2023-2.pdf
22 https://www.un.org/depts/los/convention_agreements/texts/unclos/unclos_e.pdf
23 https://www.ozeanien-dialog.de/?p=4127
24 https://www.pacificblueline.org
25 https://www.isa.org.jm/about-isa
26 https://isa.org.jm/the-mining-code
27 https://www.isa.org.jm/the-mining-code/exploration-regulations
28 https://www.dw.com/de/interessenskonflikte-beim-tiefseebergbau-manganknollen-isa-meeresboden-batteriebau-energiewende-isa/a-69836791
29 https://www.seabedminingsciencestatement.org
30 https://deep-sea-conservation.org/solutions/no-deep-sea-mining/momentum-for-a-moratorium/governments-and-parliamentarians
31 https://deep-sea-conservation.org/entry-into-force-of-high-seas-treaty-marks-turning-point-for-deep-sea-protection
32 https://www.unepfi.org/publications/harmful-marine-extractives-deep-sea-mining
33 https://wwfint.awsassets.panda.org/downloads/wwf_briefing_financial_institutions_dsm.pdf
34 https://www.stopdeepseabedmining.org/statement
35 https://www.financeforbiodiversity.org/wp-content/uploads/Global-Financial-Institutions-Statement-to-Governments-on-Deep-Seabed-Mining_FfB-Foundation_19July2023.pdf

Issues of the “NKI Research” series published to date (in German)

02/2026: Autonomous weapon systems. Criticisms of AWS and how they are taken into account in investment decisions.
03/2025: The impact of sustainable investment. A review.
05/2023: Physical climate risks. Analysis and management with a focus on property finance.
08/2022: Sustainable investment among private investors: Results of a representative survey of financial decision-makers in private households in Germany.
01/2022: Change through dialogue: Companies’ experiences with dialogue strategies in sustainable investment.
10/2017: Sustainable investment among private investors: Results of a representative survey of financial decision-makers in private households in Germany.
05/2017: Climate criteria in the investment activities of German pension institutions.
03/2017: The best-in-progress approach in sustainable investment.
11/2016: Carbon Dividend® Concept.
05/2016: The hot potato in the portfolio – the carbon bubble and divestment.
10/2015: Dialogue strategies of sustainable investors in practice.

Legal notice

NKI – Institut für nachhaltige Kapitalanlagen GmbH
Hildesheimer Str. 265-267, D- 30519 Hannover
Editorial office: Rolf D. Häßler, Ines Schaffrath
info@nk-institut.de - www.nk-institut.de