Berlin, July 2023
Division Analysis and Consulting

KONRAD ADENAUER STIFTUNG

MONITOR

SUSTAINABILITY NO. 02 / 2023

Deep-Sea Mining

Balancing resource opportunities with the ecological risks

André Algermißen

- Rising demand for critical raw materials is causing the focus to increasingly shift to the deep sea with its mineral wealth.
- Deep-sea mining is controversial because, while new sources of raw materials can be accessed, severe damage to a highly sensitive and complex ecosystem is to be feared.
- The International Seabed Authority (ISA) has the task of regulating deep-sea mining. A set of rules, the so-called "Mining Codes", is currently being developed.
- Germany advocates avoiding deep-sea mining until the risks have been sufficiently researched and appropriate mining rules elaborated.

Table of contents

The search for critical raw materials

The scramble for critical raw materials commenced at the latest with the "energy transition" and the planned switchover to climate-neutral technologies. Demand for metallic raw materials will inevitably increase in tandem with the production of wind and solar plants as well as battery and hydrogen storage. At the same time, a surging world population can be expected to also correlate with a growing demand for raw materials. A sustainable supply of raw materials has consequently moved high up on the agenda for political decision-makers.

In the search for raw material sources and as an alternative to land mining, the focus has in recent years increasingly turned to the deep sea, where various mineral aggregates are to be found at depths of around 2,000 to 6,000 metres. The realisation that the deep sea has enormous reserves of raw materials is by no means new: as early as 1873, an expedition by the British research vessel *HMS Challenger* discovered raw materials in the ocean depths. In his trailblazing book The *Mineral Resources of the Sea,* the American mining engineer John L. Mero rightly concluded that manganese nodules constitute a virtually inexhaustible resource due to their high manganese content and the enormous scale of their deposits in the deep sea.[1]

However, economic exploitation of the deep sea is locked in legal limbo because a code of rules, the so-called "mining codes", has yet to be introduced. Due to the potential ecological risks posed, planned mining projects are also surrounded by controversy. Once again, it is evident that our oceans are caught in the line of fire between economic interests and the imperative of sustainable environmental protection.

The treasures of the deep sea

Three mineral aggregates in particular can be found in the ocean depths: Manganese nodules, massive sulphides and cobalt crusts. These are formed by chemical and geological processes on the seabed, whereby manganese nodules and cobalt crusts take millions of years to evolve, while massive sulphides are formed over thousands of years.[2]

Manganese nodules are found at water depths of 3,000 to 6,000 metres in sediment-covered deep-sea plains in all the oceans. Metals can be extracted from these nodules,–such as nickel, copper and cobalt, which are needed for batteries as well as for high-tech environmental energy systems and equipment.[3] The advantage of manganese nodules, according to marine geologist Carsten Rühlemann, is that each tonne of manganese nodules on average contains twice as much manganese, copper, nickel and copper as a tonne of ore rock on land.[4] Many manganese nodules are present, for example, in the Clarion-Clipperton Zone (CCZ) in the Pacific between Mexico and Hawaii, which has been the focus of many exploration projects for a number of years. According to scientists, there is more manganese, nickel and cobalt in this zone than can be mined on land.[5]

Cobalt crusts, also referred to as polymetallic crusts, form on the slopes of seamounts created by volcanic activity on the seabed over a period of millions of years. Experts estimate that there are up to 33,000 seamounts worldwide.[6] These cobalt crusts contain not only large amounts of cobalt, but also nickel, manganese and other metals. These are also needed in environmental and energy technology. Unlike manganese nodules, cobalt crusts cannot be lifted from the seabed, instead having to be separated from the subsoil in a complex process.[7] Another special aspect is that many cobalt crusts are not located in international waters, but rather in the territories of littoral states.[8]

Massive sulphides are a third mineral resource containing metals. These are found in ocean depths of around 1,000 to 4,000 metres and are formed through interaction between volcanic activity and seawater in the vicinity of active plate boundaries.[9] The metals copper and zinc, which are needed for components in the field of communication technology, can be extracted from massive sulphides. Only a few of the known massive sulphide deposits are large enough to be economically viable, however.[10] Similar to cobalt crusts, many deposits are not only located in international waters, but in the Exclusive Economic Zones (EEZs) of various island states.[11]

The various mineral aggregates also differ in terms of the different mining methods needed to extract them. The mining of nodules, for example, is performed with the help of a collector that is lowered to the seabed. There it digs through the upper layer of soil, transporting the manganese nodules via an airlift process or by means of thick matter pumps on board a ship or a platform. The manganese nodules are then flushed out and loaded onto bulk carriers for transport over land. In the case of cobalt crusts and massive sulphides, processes must be utilised to first break out or cut out the rock. In addition, mining processes are associated with high costs.

Underlying legal framework

Protection of the world's oceans is ensured by the United Nations Convention on the Law of the Sea (UNCLOS), which was adopted by the UN Conference on the Law of the Sea in 1982 and ultimately entered into force in 1994. The Convention is commonly referred to as the "Constitution of the Seas"[12].

Article 136 of the UNCLOS refers to the seabed as the "common heritage of humankind" above and beyond the limits of national jurisdiction. Contrary to what is often suggested, the Convention on the Law of the Sea regulates the use of the oceans, but does not explicitly provide for protection of marine biodiversity.

It was not until 5 March 2023 that an internationally binding treaty on "Biodiversity Beyond National Jurisdiction" (BBNJ) seeking to protect the world's oceans was concluded. The Convention on the Law of the Sea also provided for the establishment of the International Seabed Authority (ISA), an independent international organisation, in 1994. The Jamaica-based authority, which only has around 40 employees, administers the world's oceans and also has the task of regulating mineral extraction and ensuring environmental protection. To perform all this, the ISA is outfitted with extensive powers. For example, it decides who is to receive a prospecting licence to explore the seabed and regulates the conditions for access to the seabed using its legislative powers.[13] The application process is as follows: For a fee of US $ 500,000 and by submitting a work plan, both state and private enterprises can select an area of 150,000 square kilometres and apply for a 15-year exploration licence, with an option to extend it an additional five years. One precondition here, however, is that applicants receive the support of their home state, which for its part must have previously ratified UNCLOS.[14]

In the wake of an application for deep-sea mining filed by the island state of Nauru in 2021, there is now movement in the long-stalled process of legal regulation. In collaboration with the Canadian Start-up *The Metals Company (TMC),* the island state wants to mine manganese nodules in the Clarion-Clipperton Zone. The application has triggered a two-year deadline under a clause laid down in the UN Convention on the Law of the Sea stipulating that rules ("Mining Code") are to be adopted for the different types of resources. If no code is adopted for commercial deep-sea mining by the July 2023 deadline, mining projects will have to be approved on the basis of existing regulations. The ISA has already prepared 17 preliminary agreements for mining in a base area encompassing 1.3 million square kilometres.[15] An attempt by the Council of the International Seabed Authority, which comprises 36 states, to adopt a corresponding set of rules failed to gain approval at a Council meeting held at the end of March 2023. No new meeting has been planned before the expiry of the deadline. Lines of conflict can be identified, *inter alia* in the method of calculation and the amount of levies that the ISA is to receive in the event of future mining. It is still unclear, for example, whether it is the profits that are to be taxed or whether the levy should instead be based on the value of the metal in the tubers.[16] Moreover, many Member States, for example Germany and France, have given voice to environmental concerns.

Arguments against deep-sea mining

"If we actually have to go to deep-sea mining, it will mean a gigantic intervention in the biodiversity of the deep sea, in habitats that have been largely undisturbed so far."[17] (Prof. Dr Antje Boetius)

Scientists all agree that our knowledge about the deep sea is still insufficient. Estimates suggest that only about 0.0001 per cent of the deep sea has been explored.[18] Only 20.6 percent of the world's seafloor had been mapped by geologists as of June 2021, and two-thirds of the organisms living there cannot be assigned to any group known to date.[19] It is undisputed, however, that the deep sea is a complex ecosystem and the species adapted to living conditions there are highly sensitive. The environmental damage that deep-sea mining would cause "primarily involves loss of seabed habitat, greatly reduced population densities in all faunal classes from microorganisms to megafauna, altered composition of the faunal community, and diminished ecosystem functions such as productivity and nutrient fluxes."[20]

The German Federal Agency for Nature Conservation also states that "both sediment clouds and pollutants released in the process of deep-sea mining [...] may have negative effects on the environment and living organisms and also pollute other locations over a wide area due to ocean currents."[21] The mining of nodules thus also goes hand in hand with loss of deep-sea fauna, which function, for example, as spawning habitats for rare species. Moreover, the top layer of soil is completely dug up.[22] The mining of cobalt crusts and massive sulphides is aggravated by the noise and vibrations caused by extraction of the rock, the negative effects of which have not yet been researched for many rare species.[23] Long-term research projects have also shown that it is difficult to regenerate the ecosystem: in 1989, German scientists ploughed up an area of around ten square kilometres of seabed in the so-called Peru Basin to investigate the impact of deep-sea mining on fragile biotic communities.[24] In 2020, a study re-examined the area in the Peru Basin. The researchers still found plough marks and determined that microbial activity in the affected areas had been reduced by up to a factor of four. The study underscores constraints on the maintenance and restoration of ecological integrity during tuber degradation.[25]

In addition, it can be argued that deep-sea mining would frustrate international commitments to more nature conservation and marine protection. The World Biodiversity Conference held in Montreal, Canada in December 2022 determined that 30 per cent of the world's oceans are to be designated as protected areas by 2030, and the Biodiversity Beyond National Jurisdiction (BBNJ) Treaty concluded in March 2023 also assigns high priority to the protection of marine biodiversity. It remains unclear how these objectives can be reconciled with deep-sea mining. Furthermore, 2030 Agenda has also set out the aim of conserving and using oceans, seas and marine resources in a sustainable manner.

Arguments for deep-sea mining

So far, the extraction of raw materials has taken place almost solely on land. Mining conditions – especially in the sector of small-scale mining – are anything but sustainable: many raw materials are located in developing countries where requirements relating to human rights and environmental protection are lax. This results in exploitation and conflicts over resources. Mining often takes place without regard for labour, children's and women's rights, while in some regions of the world there is a causal link between small-scale mining and the financing of armed conflicts, organised crime and corruption.[26] These areas of conflict would not exist in deep-sea mining, as mining would be performed using technical methods and equipment. Coincidentally, land mining also has a severe ecological impact: Air pollution from dust containing heavy metals and radioactivity, lowering of the groundwater table and water pollution from acid mine run-off and drainage are just a few of the many negative effects associated with land mining.[27] Maritime law expert Uwe Jenisch concludes "that the overall environmental balance of deep-sea mining can be better than that of conventional land mining if intelligent and environmentally friendly technology is used."[28] Germany is recognised as a leading country in the development of innovative technologies. Another spill-over is that deep-sea mining could also advance marine technology and stimulate shipbuilding.

The Russian invasion of Ukraine has been a seismic event, underscoring that unilateral dependencies must be avoided and that our trade and economic relations need to be further diversified. This means that we must obtain our supplies of raw material from as wide an array of sources as possible. This imperative is also reflected in the European Commission's proposals for a secure and sustainable supply of critical raw materials for the EU, which among other things emphasise the aim of "diversifying imports of critical raw materials into the EU in order to reduce strategic dependencies"[29].

The example of cobalt aptly illustrates the pressing need for diversification: two-thirds of the 140,000 tonnes of cobalt extracted each year come from the politically unstable Democratic Republic of Congo.[30] The German economy in particular is dependent on imports of raw materials. An analysis carried out by the German Institute for Economic Research (DIW) concludes that imports account for over 90 per cent of the total value of Germany's raw materials.[31] According to other calculations, 80 per cent of Germany's net imports of cobalt, for example, could be obtained through deep-sea mining.[32] In the wake of the Russian invasion, German security policy needs to steer away from one-sided dependencies on raw materials; Germany could also leverage deep-sea mining to realise this objective.

Germany supports the Paris climate targets to limit global warming to well below 2 degrees Celsius compared to pre-industrial levels. To this end, policy-makers have determined that at least 80 percent of the electricity consumed in Germany is to come from renewable energies by 2030. Although the expansion of renewable energies ensures a decrease in fossil energies and unquestionably makes a decisive contribution to the reduction of greenhouse gas emissions, the incremented demand for raw materials attendant upon this development is underestimated. A modern photovoltaic system, for example, requires twice as much metallic raw material to produce the same output as a coal-fired power plant, and offshore wind turbines even require seven times as much metallic raw material.[33] It will therefore be necessary to tap into new sources of raw materials in order to be able to satisfy surging demand if increased energy efficiency and raw material substitution prove to be insufficient.

The political discourse in Germany

In recent years, the political focus has increasingly been placed on marine protection, with less attention being devoted to potential sources of raw materials. This trend has culminated with the creation of the office of marine commissioner, with scientist Sebastian Unger being appointed to the post. Through this move, "the Federal Government would like to underscore the growing importance of marine protection and an environmentally compatible use of the seas"[34]. The Coalition Agreement (2021 - 2025) already affirmed a commitment to marine protection, announcing the establishment of a marine commissioner office and a marine campaign: "We are launching a marine campaign to protect marine nature, formulate a coherent and reliable marine strategy, set up a marine coordination office headed by a marine commissioner and initiate a National Marine Conference."[35] At the same time, the coalition agreement stresses that the federal government is working internationally to encourage strict environmental standards and institute mandatory environmental compatibility reviews for deep-sea mining ventures, while continuing marine research to expand knowledge about the ocean depths.[36]

Prompted by the current debate on the avoidance of resource dependencies, the German government declared in November 2022 that Germany intended to more strongly advocate a precautionary approach in deep-sea mining and that it would not support any applications for commercial mining of raw materials in the deep sea for the time being. At the same time, the German government is calling for a "precautionary pause", i.e. to hold back from deep-sea mining until risks have been sufficiently researched and strict mining rules are in place that rule out serious environmental damage.[37] This position is by no means new, however, and can be dated back to the previous legislative period: In response to a parliamentary query forwarded by the FDP parliamentary group, the Federal Government at the time expressed the basic view that raw materials in the deep sea should not be extracted until the effects had been sufficiently investigated and it could be shown that there was no serious risk to the maritime environment.[38]

The German government does not categorically reject deep-sea mining, however. Its aim and objective, rather, is to intensify marine research. At the spearhead of this development, the German Alliance for Marine Research (DAM), founded in 2019, aims to "coordinate and strategically develop the activities of German marine research and thus make German marine research even more visible and effective internationally"[39]. Deep-sea mining was also included in the National Master Plan Maritime Technologies.[40] At the same time, Germany has concluded two exploration contracts with the International Seabed Authority (ISA) through the Federal Institute for Geosciences and Natural Resources to explore the deep sea in the Pacific and Indian Oceans (BGR).

Conclusion and recommended actions

The example of deep-sea mining once again reveals the tension existing between economic interests and the need to protect this unique and complex ecosystem. The following five conclusions can be drawn:

1. Deep-sea research must be further intensified in order to better understand complex ecological interrelationships and to be able to come up with a concept for the protection of marine biodiversity.

2. Scientific findings are already drawing attention to the vulnerability of the deep sea. These findings need to serve as input in political decision-making processes to help ensure that marine conservation is not scrapped in favour of unregulated resource extraction. Business enterprises have a responsibility to develop sustainable mining methods that make minimally invasive interventions in the environment and thus avoid permanent damage to the ecosystem.

3. The importance of the International Seabed Authority (ISA) will continue to grow. Since the authority is not only responsible for the exploitation of raw materials, but also for environmental protection, it will only be able to fulfil its tasks if it is better equipped in terms of human and funding resources. At the same time, the ISA has a duty to communicate decisions more transparently and to involve civil society even more.

4. Although there are multiple economic benefits that speak for deep-sea mining, it is important to manage expectations: Deep-sea mining should not suggest that it can serve as a substitute for land mining. Rather, deep-sea deposits that are to be exploited should be seen as a possible complement to land mining.[41] Categorically ruling out deep-sea mining is not very effective against the backdrop of geopolitical challenges and an ambitious climate and environmental policy that is dependent on an ample supply of metallic raw materials.

5. Deep-sea mining must not be understood as a *carte blanche* for exorbitant raw material consumption. It is hence still necessary to strengthen the circular economy, further boost energy efficiency and research into raw material substitution in order to reduce raw material consumption. It remains questionable, however, whether this approach will suffice to cover mounting demand for raw materials in the long term.

The next few months will show whether the International Seabed Authority is able to succeed in the quest to adopt the so-called "Mining Codes" and lay down clear rules in these Codes that prevent ruthless exploitation of the oceans. One thing is clear, however: balancing economic and ecological interests is going to be a real tightrope walk.

[1] Luise Heinrich (2020): Tiefseebergbau. Ein Umweltproblem? In: Hydrographische Nachrichten 117. https://henry.baw.de/server/api/core/bitstreams/f78e8b2d-1b7d-403e-a3a2-458bee2b3046/content (last accessed 19 May 2023): 56.

[2] FAIR OCEANS (2019): Untiefen. Tiefseebergbau zwischen Umwelt und Entwicklung. Ein Diskussionsbeitrag. In: https://fair-oceans.info/wp-content/uploads/2020/07/Fair-Oceans-Tiefseebergbau.pdf (last accessed 19 May 2023): 2.

[3] GEOMAR Helmholtz-Zentrum für Ozeanforschung Kiel (2019): Mineralische Rohstoffe aus der Tiefsee. Entstehung, Potential und Risiken. https://www.geomar.de/fileadmin/content/service/presse/public-pubs/rohstoffbroschuere.pdf (last accessed 19 May 2023): 15.

[4] Sonja Fröhlich (2022): Caspers Knöllchen. In: FOCUS from 2 April 2022, No. 14: 78.

[5] Daniel Friedli (2022): Rausch in der Tiefsee. In: Neue Züricher Zeitung am Sonntag, 13 February 2022: 18-19.

[6] Bund für Umwelt und Naturschutz (2018): BUNDposition Tiefseebergbau. In: https://www.bund.net/fileadmin/user_upload_bund/publikationen/bund/position/tiefseebergbau_position.pdf (last accessed 19 May 2023): 9.

[7] GEOMAR Helmholtz-Zentrum für Ozeanforschung Kiel (2019): Mineralische Rohstoffe aus der Tiefsee. Entstehung, Potential und Risiken. https://www.geomar.de/fileadmin/content/service/presse/public-pubs/rohstoffbroschuere.pdf (last accessed 19 May 2023): 21-25.

[8] Bund für Umwelt und Naturschutz (2018): BUNDposition Tiefseebergbau. In: https://www.bund.net/fileadmin/user_upload_bund/publikationen/bund/position/tiefseebergbau_position.pdf (last accessed 19 May 2023): 9.

[9] GEOMAR Helmholtz-Zentrum für Ozeanforschung Kiel (2019): Mineralische Rohstoffe aus der Tiefsee. Entstehung, Potential und Risiken. https://www.geomar.de/fileadmin/content/service/presse/public-pubs/rohstoffbroschuere.pdf (last accessed 1 June 2023): 8-14.

[10] GEOMAR Helmholtz-Zentrum für Ozeanforschung Kiel (2019): Mineralische Rohstoffe aus der Tiefsee. Entstehung, Potential und Risiken. https://www.geomar.de/fileadmin/content/service/presse/public-pubs/rohstoffbroschuere.pdf (last accessed 1 June 2023): 8-14.

[11] World Ocean Review 3 (2014): Chapter 3: Mineralische Rohstoffe. In: https://worldoceanreview.com/de/wor-3/mineralische-rohstoffe/massivsulfide/ (last accessed 1 June 2023).

[12] World Ocean Review 3 (2014): Chapter 4: Umweltschonende Förderung und gerechte Verteilung. In: https://worldoceanreview.com/wp-content/downloads/wor3/WOR3_de_Kapitel_4.pdf (last accessed 19 May 2023): 120.

[13] Aline Jaeckel (2018): Klare Regeln für den Tiefseebergbau. In: Vereinte Nationen. Zeitschrift für die Vereinten Nationen und ihre Sonderorganisationen 4/2018. https://zeitschrift-vereinte-nationen.de/publications/PDFs/Zeitschrift_VN/VN_2018/Heft_4_2018/04_Jaeckel_VN_4-2018_30-7-2018.pdf (last accessed 19 May 2023): 154.

[14] Ulrike Kronfeld-Goharani (2020): Welthunger nach Rohstoffen. Soziale und umweltpolitische Konflikte um Ressourcen in der Tiefsee. In: Wissenschaft & Frieden. 4/2020. file://kas.zz/users/HOME/ALGERMISSEN-A/Downloads/UlrikeKronfeld-GoharaniWelthungernachRohstoffenin2020-4%20(3).pdf. (last accessed 19 May 2023).

[15] Christoph Hein (2022): Der Streit um die Tiefsee ist voll entbrannt. In: FAZ.NET from 2 July 2022.

[16] Bundesanstalt für Geowissenschaften und Rohstoffe (2022): Marine Rohstoffe. Newsletter. Marine Mineralische Rohstoffe an der BGR. https://www.bgr.bund.de/DE/Gemeinsames/Produkte/Downloads/Marine_Rohstoffe_Newsletter/Rohstoffwirtschaft/marine_mineralische_rohstoffe_2022.pdf;jsessionid=01D198C223647FC822D6EBF0D9DBB8C8.internet012?__blob=publicationFile&v=3 (last accessed 1 June 2023): 7-8.

[17] Mitteldeutscher Rundfunk (2022): YouTube video: Wann lösen wir das Rätsel Tiefsee, Frau Boetius? https://www.youtube.com/watch?v=oxnQdCzQ9gE (last accessed 5 June 2023).

[18] Louisa Casson: Conservation. For the global ocean. https://oceanographicmagazine.com/features/greenpeace-global-oceans/ (last accessed 1 June 2023).

[19] Deutsche Stiftung Meeresschutz: Licht aus? Tiefseebergbau – Die Tiefsee. https://www.stiftung-meeresschutz.org/tiefseebergbau/?gad=1&gclid=EAIaIQobChMInvaHr4ai_wIViwGLCh1C8AsdEAMYAiAAEgKNPfD_BwE (last accessed 1 June 2023).

[20] GEOMAR Helmholtz-Zentrum für Ozeanforschung Kiel (2019): Mineralische Rohstoffe aus der Tiefsee. Entstehung, Potential und Risiken. https://www.geomar.de/fileadmin/content/service/presse/public-pubs/rohstoffbroschuere.pdf (last accessed 1 June 2023): 27.

[21] Bundesamt für Naturschutz (2022): Meeresnaturschutzperspektive zum Tiefseebergbau. Die Tiefsee schützen – Biologische Vielfalt erhalten. https://www.bfn.de/sites/default/files/2022-10/2022-die-tiefsee-sch%C3%BCtzen-biologische-Vielfalt-erhalten-bfn.pdf (last accessed 1 June 2023): 22.

[22] WWF (2021): Hintergrunddokument: Tiefseebergbau. Rohstoffabbau in der Tiefsee bringt kaum abschätzbare Risiken. https://www.wwf.de/fileadmin/fm-wwf/Publikationen-PDF/Meere/WWF-Hintergrunddokument-2021-Tiefseebergbau.pdf (last accessed 1 June 2023): 12.

[23] WWF (2021): Hintergrunddokument: Tiefseebergbau. Rohstoffabbau in der Tiefsee bringt kaum abschätzbare Risiken. https://www.wwf.de/fileadmin/fm-wwf/Publikationen-PDF/Meere/WWF-Hintergrunddokument-2021-Tiefseebergbau.pdf (last accessed 1 June 2023): 14.

[24] Christopher Schrader (2016): Meeresbergbau: Raubbau in der Tiefsee. In: Süddeutsche Zeitung, 27 March 2016. https://www.sueddeutsche.de/wissen/umweltschutz-narben-am-grund-1.2918500 (last accessed 11 April 2023).

[25] Tobias Vonnahme, Massimiliano Molari, Frank Wenzhöfer, Matthias Haeckel, Jürgen Titschack and Antje Boetius (2020): Effects of a deep-sea mining experiment on seafloor microbial communities and functions after 26 years. In: Science Advances 6 / 18 (2020). https://www.science.org/doi/full/10.1126/sciadv.aaz5922 (last accessed 11 April 2023).

[26] Federal Ministry for Economic Cooperation and Development (2023): Artisanaler und Kleinbergbau. https://rue.bmz.de/rue/themen/kleinbergbau-86610 (last accessed 19 May 2023).

[27] Deutsche Gesellschaft für Internationale Zusammenarbeit (2022): Der Nexus zwischen Umwelt und Menschenrechten im Bergbau. https://rue.bmz.de/resource/blob/117042/kurzinformation-umwelt-und-menschenrechte-pdf.pdf (last accessed 19 May 2023).

[28] Uwe Jenisch (2022): Tiefseebergbau als Beitrag zur „Green Economy". In: Schiff&Hafen 3 / 2022: 47.

[29] Vorschlag für eine Verordnung des Europäischen Parlaments und des Rates zur Schaffung eines Rahmens zur Gewährleistung einer sicheren und nachhaltigen Versorgung mit kritischen Rohstoffen und zur Änderung der Verordnung (EU) 168/2013, (EU) 2018/858, (EU) 2018/1724 und (EU) 2019/1020. In: https://eur-lex.europa.eu/resource.html?uri=cellar:903d35cc-c4a2-11ed-a05c-01aa75ed71a1.0003.02/DOC_1&format=PDF (last accessed 19 May 2023): 3.

[30] Sabrina Weiss (2021): Auf der Suche nach nachhaltigeren Metallen für den Batterienboom. In: Neue Züricher Zeitung, 17 July 2021: 56-57.

[31] Deutsches Institut für Wirtschaftsforschung (2022): Deutschland kann seine Versorgungssicherheit bei mineralischen Rohstoffimporten erhöhen. In: DIW Wochenbericht 50/2022. https://www.diw.de/documents/publikationen/73/diw_01.c.861649.de/22-50.pdf (last accessed 2 June 2023): 4.

[32] Sonja Fröhlich (2022): Caspers Knöllchen. In: FOCUS from 2 April 2022, No. 14: 78.

[33] Karl Urban (2022): Kritische Metalle. Die Energiewende bekommt ein Rohstoffproblem. https://www.spektrum.de/news/fuer-die-energiewende-werden-die-rohstoffe-knapp/2005387 (last accessed 2 June 2023).

[34] Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (2022): Neuer Meeresbeauftragter der Bundesregierung nimmt seine Arbeit auf. In: https://www.bmuv.de/pressemitteilung/neuer-meeresbeauftragter-der-bundesregierung-nimmt-seine-arbeit-auf (last accessed 19 May 2023).

[35] Coalition agreement (2021): Mehr Fortschritt wagen. Bündnis für Freiheit, Gerechtigkeit und Nachhaltigkeit. Koalitionsvertrag 2021 – 2025 zwischen der Sozialdemokratischen Partei Deutschlands (SPD), BÜNDNIS 90 / Die Grünen und den Freien Demokraten (FDP). https://www.bundesregierung.de/resource/blob/974430/1990812/1f422c60505b6a88f8f3b3b5b8720bd4/2021-12-10-koav2021-data.pdf?download=1 (last accessed 19 May 2023): 31.

[36] Coalition agreement (2021): Mehr Fortschritt wagen. Bündnis für Freiheit, Gerechtigkeit und Nachhaltigkeit. Koalitionsvertrag 2021 – 2025 zwischen der Sozialdemokratischen Partei Deutschlands (SPD), BÜNDNIS 90 / Die Grünen und den Freien Demokraten (FDP). https://www.bundesregierung.de/resource/blob/974430/1990812/1f422c60505b6a88f8f3b3b5b8720bd4/2021-12-10-koav2021-data.pdf?download=1 (last accessed 19 May 2023): 31.

[37] Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (2022): Schutz der Meere. Deutschland unterstützt bis auf Weiteres keinen Tiefseebergbau. https://www.bmuv.de/pressemitteilung/schutz-der-meere-deutschland-unterstuetzt-bis-auf-weiteres-keinen-tiefseebergbau (last accessed on 1 June 2023).

[38] German Bundestag (2021): Antwort der Bundesregierung auf die Kleine Anfrage der Abgeordneten Olaf in der Beek, Frank Sitta, Renata Alt, weiterer Abgeordneter und der Fraktion der FDP (printed matter 19/30249): Aktuelle Entwicklungen in der Forschung zu Risiken und Nutzen von Tiefseebergbau. In: https://dserver.bundestag.de/btd/19/307/1930759.pdf (last accessed 19 May 2023): 2.

[39] German Bundestag (2022): Unterrichtung durch die Bundesregierung. Bundesbericht Forschung und Innovation 2022. Printed matter 20/2400. https://dserver.bundestag.de/btd/20/024/2002400.pdf (last accessed 5 June 2023): 88.

[40] Federal Ministry for Economic Affairs and Energy (2014): Nationaler Masterplan Marine Technologien: Blaues Wachstum. Maritime Technologien. Nachhaltige Lösungen. In: https://www.bmwk.de/Redaktion/DE/Publikationen/Technologie/nationaler-masterplan-maritime-technologien-flyer.pdf?__blob=publicationFile&v=1 (last accessed 19 May 2023): 5.

[41] See also Carsten Rühlemann, Thomas Kuhn and Annemiek Vink (2019): Tiefseebergbau – Ökologische und sozioökonomische Auswirkungen. In: Bürger&Staat 4/2019: Ozeane und Meere. https://www.buergerundstaat.de/4_19/ozean_meere.pdf (last accessed 19 May 2023): 235.

Imprint

The author

André Algermißen is Policy Advisor for climate, agriculture and environment in the Department 2030 Agenda at the Konrad-Adenauer-Stiftung in Berlin.

André Algermißen
Climate, Agriculture and Environment Policy Advisor
Division Analysis and Consulting

T +49 30 / 26 996-3945

andre.algermissen@kas.de

Coordination of the publication series:
Gisela Elsner
Global Sustainability Policy Advisor
Division Analysis and Consulting
T +49 30 / 26 996-3759

gisela.elsner@kas.de

Publisher: Konrad-Adenauer-Stiftung e.V.
Design: yellow too, Pasiek Horntrich GbR
Produced with the financial support of the Federal Republic of Germany.