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German Industry

Position Paper

The opportunities of deep-sea mining for Germany's raw material strategy

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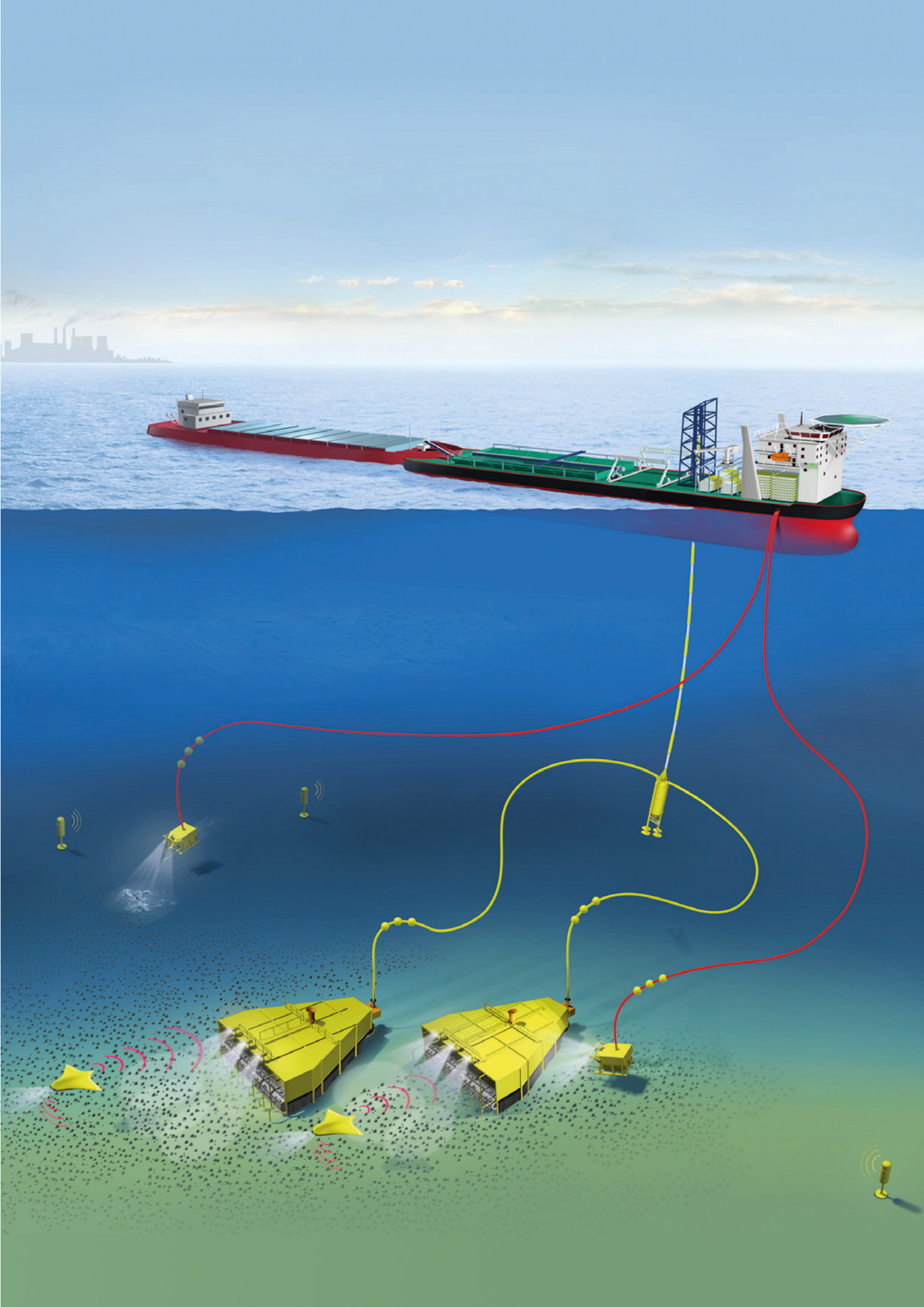
Background

As a result of the rising global need for raw materials and the declining quality of the known deposits, exploiting new sources of raw materials is gaining importance for securing the long-term supply of natural resources. In this context, the potential of marine mineral resources on the seafloor is particularly interesting. For this purpose, Germany's Federal Institute for Geosciences and Natural Resources (BGR) applied at the end of 2013 to the International Seabed Authority (ISA) for a licence to explore massive sulphides on the deep seafloor of the Indian Ocean. From as far back as 2006 Germany has been in possession of a licence for two areas in the central Pacific, concentrating on the exploration of manganese nodules. The findings so far are highly promising: The manganese nodules, the massive sulphides and the cobalt-rich iron-manganese crusts, which are located in a depth of 1000 to 5000 metres, contain numerous metallic raw materials. For example, apart from manganese and iron, the economically interesting elements copper, nickel and cobalt are to be found in manganese nodules and, moreover, in much higher concentrations than in deposits on land. Apart from non-ferrous metals, massive sulphides also contain trace elements such as antimony, germanium, selenium, tellurium and indium which are required in many high-tech areas, renewable energies being one example.

Since the deposits are situated outside any nation's territorial waters, all activities are subject to international law and to the control of the global international community. The "administrative body" is the International Seabed Authority (ISA) of the United Nations, which was founded in 1994 and regulates access to and the responsible handling of deposits on the seafloor. The Federal Republic of Germany is a member of this body, holding the chair in the ISA council in 2013 and 2014. The mining codes laid down by the ISA have so far covered the exploration and extraction of manganese nodules, massive sulphides and cobalt-rich iron-manganese crusts. The rules for the (commercial) mining of natural resources in the deep sea have yet to be defined. A central component of the decision on future mining will be the obligation to present an environmental impact assessment. A study of economic feasibility and the proof of technical implementation (at least one mining component test) must also be supplied. In addition, during the 15-year exploration phase the licence holder is already under an obligation to collect data on the composition of species and the population density of the seafloor fauna in order to enable resettlement to be carried out at a later stage after the mining process. These reference data are an integral part of the environmental management plan of the Sea Bed Authority.

Picture Credits: Concept of Aker Solutions for the mining of manganese nodules; *Source: Aker Solutions*



Challenges

Before the start of commercial mining of those marine mineral raw materials mentioned above, there are three central challenges to be overcome. These are the extraction of the resources in an ecologically sensitive way, the fusing of the various individual technologies into an overall process which can be deployed at great water depths and, not least, production at economically viable costs.

In the case of manganese nodules, the basic technology for collecting them from the sea bed is already in place, yet its long-term and environmentally friendly application at depths between 3,000 and 5,000 metres has still to be tested and further developed. So first of all intensive research efforts are still necessary in this area. Admittedly, efforts will proceed on the assumption that the costs of production, including transport to land, will be lower than the prices that can be achieved for the value of the metal content. However, the metallurgic processing of the nodules constitutes an unknown cost factor which means that at present the economic viability of the production as a whole is hard to judge. That is why for the mining of manganese nodules, apart from the actual production, above all the development of an effective procedure for the metallurgic processing of the manganese nodules is of crucial importance. In the case of massive sulphides and iron-manganese crusts, sub marine surface mining is a greater technical challenge since these ores are enriched in the subsoil or adhere firmly to the seafloor.

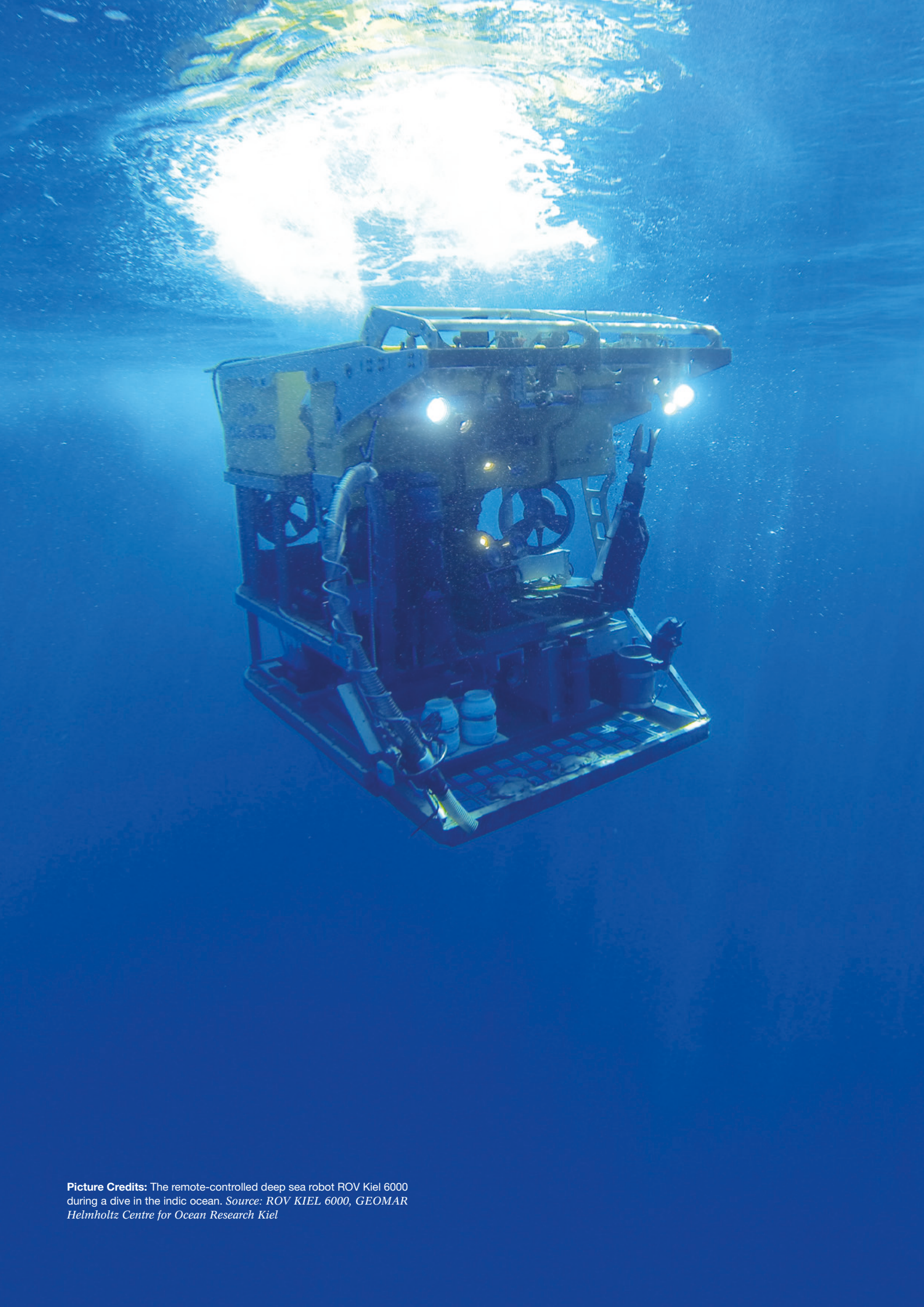
Opportunities

In view of increasing global demand for raw materials and the greater efforts and costs involved in exploiting the existing deposits on land, new sources of natural resources in the deep sea can make an important future contribution to the long-term security of supply of strategic raw materials. Since a major part of the marine minerals lies outside national territorial waters, they are not state-owned but as "heritage of humankind" they are administered by a multilateral system, namely the International Seabed Authority. One factor that should also be considered is that the transport of the marine minerals does not require the construction of (immobile) infrastructure and that therefore the problem of cross-border transport, especially through politically unstable areas, is likely to be far less of a significant factor. Consequently, raw materials from the deep sea constitute an interesting option for diversification of sources of raw materials.

Apart from the aspect of the strategic securing of raw materials, the use of marine minerals can yield benefits both from an economic and an ecological point of view. Owing to the declining quality of existing deposits, the future production of raw materials on land will involve both rising costs and a greater environmental load, whether, for example, through opening up new deposits in tropical forests or through more sophisticated, more expensive and above all more energy-intensive processing. In addition, deep sea mining is a mobile form of raw material extraction. The mining site can be completely dismantled and then reused in another area.

In the view of the German export industry, deep sea mining is a highly promising field of future operations. However, the conditions in the deep sea impose extreme demands on the technology with regard to eco-friendliness, economic viability and length of life (durability). German industry is capable of developing innovative production systems which fulfil these requirements. Both in the area of extraction and mining technology as well as in underwater technology and specialized shipbuilding, German firms command the necessary expertise and proven individual components. What is lacking in Germany is a tried and tested integrated system covering the whole process from extraction via transport to processing. In future, more research and capital investment for implementing a project aimed at extracting marine minerals will be required.

Should Germany succeed in developing an economical process for the environmentally compatible extraction of marine minerals and possibly even manage to achieve the technological leadership, this would help German industry to gain a special position in the international competition for raw materials. At present, there is practically no domestic metal mining going on in Germany and German companies only participate in individual projects abroad. In future, however, as an important technology partner for raw materials projects, Germany could secure fair access to raw materials and thus also safeguard the competitiveness of German industry in the long term.



Picture Credits: The remote-controlled deep sea robot ROV Kiel 6000 during a dive in the indic ocean. *Source: ROV KIEL 6000, GEOMAR Helmholtz Centre for Ocean Research Kiel*

Recommendations

Clear political commitment and support

Deep sea mining offers Germany a variety of opportunities which we should discuss openly and seize in a timely manner. Firstly, Germany plays an important role in the ISA Council which decides on the future mining code; in this body Germany can advocate high environmental standards and fair competition. In addition, German firms could succeed as the first nation developing the necessary technology for economically viable, environmentally friendly deep sea mining and thus set an international benchmark. With this know-how and technological lead, Germany would position itself as an important partner for future cooperation in the raw materials sector. For considerations not only of raw materials and economic policy but also for foreign policy reasons, the Federal government should recognize this opportunity and reflect it both in its political strategy as well as in its support for industry.

Metallurgy as a focus of research

The development of an efficient extraction process is a prerequisite for the commercial exploitation of marine minerals and ought to be a focus of research. It should also be researched which metals should be given priority in the metallurgic process, given estimations of their respective scarcity and price trends. This potential is decisive for determining the circle of interested buyers and investors and thus ultimately for the commercial feasibility. Relevant research programmes are Maritime Technologies of the Next Generation (Federal Economics Ministry), the European Innovation Partnership (EIP) Raw Materials of the EU, or the Knowledge and Innovation Communities (KIC) Raw Materials.

Ensuring environmentally friendly extraction

Apart from the economic extraction of raw materials, the future of deep sea mining depends above all on whether environmentally compatible production is practicable. With its documentation of the environmental conditions and the investigation of the possible environmental impact of mining marine minerals, Germany's Institute for Geosciences and Natural Resources (BGR) is doing pioneering work which is creating a vital basis for a possible commercial exploitation and should be continued in future. The BGR is also making a valuable contribution in this area for the drawing up of mining codes governing marine mining, which are determined by the ISA.

Networking research and presentation of an overall process

Whereas it is true that individual examples of German technologies and know-how in the field of marine engineering, mining and robotics along with concepts for production equipment already exist, nevertheless there is a lack of coordination of the individual research areas and also not least of a proven overall process. That is why efforts must continue to push ahead with more intensive cooperation between the various technology suppliers including the involvement of potential customers from industry. The goal should be to set up a pilot project in conjunction with the BGR to develop an integrated concept ranging from extraction to metallurgic processing in which the existing individual components are combined and further developed in line with the technical and environmental requirements.

Considering European cooperation

It is a great challenge that Germany has no longer at its command an international mining company of any substantial size (turnover > € 5 bn.), that is engaged in ore mining and able to invest in the development of deep sea mining and eventually could take the system leadership in a consortium of technology suppliers. That is why consideration should also be given to business cooperation with foreign partners. Possible partners within Europe would be, for example, the French mining and metallurgy group ERAMET, which is seeking to push ahead intensively with its activities in deep sea mining in French territory, in the French-Polynesia region. France would therefore appear to be an obvious ally in an internationally-based strategy for taking on the task of working out an integrated process for the extraction of marine minerals.

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