

Project information

Keywords

Arctic, deep-sea mining, ecosystem-based management

Project title

ECOMINA - Ecosystem-based management for areas targeted by deep-sea mining in the Arctic: a pilot study

Year

2015

Project leader

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Flagship

MIKON

Funding Source

ECOMINA received funding from the MIKON flagship, as well as contributions from NIVA, NGU, IMR, UiT and Uni. Southampton.

Summary of Results

Deep-sea mining is an emerging industry exploring for mineral resources on the deep seafloor, on continental margins (phosphate sands), abyssal plains (manganese nodules), seamounts (cobalt crusts) and hydrothermal deposits (seafloor massive sulphides, SMS). Commercial deep-sea mining has yet to begin globally. We are, thus, in front of a unique opportunity to implement strategies, nationally and internationally, that will minimise impact on the system prior to the onset of industrial activities (Mengerink et al., 2014). SMS will be the first deep-sea mineral resource to be exploited, by Nautilus Minerals activities in Papua New Guinea in 2016. In the Arctic Mid-Ocean Ridge (AMOR), as in other regions within and outside national jurisdiction, interest for mineral resources is gradually growing, and with it, environmental guidelines and regulations are being developed.

In the ECOMINA pilot project (12 months), the aim was to strengthen communication and links amongst national researchers with expertise in hydrothermal vents and deep-sea mining issues in the North and identify knowledge gaps that need to be addressed to develop robust ecosystem-based management for deep-sea mining in the AMOR. The project was structured in 3 objectives and the results are described below for each objective.

Objective 1. Consortium

1. Kick-off meeting: 13 April 2015, Skype. The partners from different backgrounds (geology, resource geology, ecology, socio-economics) established first contact and discussed the details of the ECOMINA project plan.

2. Progress meeting: 11-13 May, Bergen. ECOMINA researchers from NIVA, IMR, NGU, NTNU and Uni. Southampton met in Bergen during the UiB workshop “From Seafloor Hydrothermal Systems to the

Sustainable Exploitation of Massive Sulfide Deposits: Myths & Realities of the deep sea”. During this workshop, ECOMINA progress was discussed and initial discussions about a national network for deep-sea mining environmental issues was discussed with colleagues from GRID-Arendal, IRIS and UiB. ECOMINA was also briefly discussed with a representative from Miliødirektoratet.

3. Network brainstorming meeting (ECOMINA spin off): 18 August 2015, GRID-Arendal. Following initial discussion during the Bergen meeting in May, NIVA and GRID-Arendal organised a brainstorming meeting to discuss the needs, benefits and potential goals of a Norwegian network on deep-sea mining issues. Representatives from NIVA, GRID-Arendal, IMR and IRIS were invited. The group concluded that there was a need to address the communication gap between scientists and authorities, to ensure that scientific results can be translated into robust information from which decision makers develop environmental management regulations. The need to raise civil society’s awareness of remote deep-sea ecosystems and deep-sea mining was highlighted. The group decided to approach the Ministry of Industry, Trade and Fisheries to enquire about their interest in such a network and, following a positive response, a memo has been sent (Sept. 2015).

4. International contacts: additionally to the national initiative for an expert network, the partners in ECOMINA have strong links with international bodies and initiatives, including representatives of the ISA Technical and Legal Commission (Dr Billett, Dr Escobar), IUCN (Kristina Gjerde), ICES, OSPAR, DOSI (Ramirez-Llodra member of the Advisory Board) and INDEEP (Ramirez-Llodra principal investigator), amongst others. To further strengthen this international network and assess possibilities of further collaborations with international colleagues, E. Ramirez-Llodra participated in the 14th Deep-Sea Biology Symposium. The first session of the 14DSBS was dedicated to Deep-Ocean Stewardship, with a strong focus on deep-sea mining, and an additional side meeting on deep-sea mining was held. Discussions held at the symposium partially led to the participation of Dr Cindy Van Dover (Duke Uni., USA) in the new ECOMINA proposal for a full-scale project submitted to MIKON in November 2015.

Objective 2. Knowledge review

The initial aim for this objective had to be revised and modified during the course of ECOMINA. The Geobiology research group at UiB has been pioneer in the exploration and investigation of hydrothermal systems in the AMOR since 2005 (Pedersen, et al., 2005). The goal for ECOMINA’s objective 2 was to review the published knowledge of the AMOR region to identify gaps where further research is needed in order to develop robust ecosystem-based management measures related to deep-sea mining. Following discussions with UiB colleagues, we learnt that UiB is preparing a special volume of scientific publications where all data collected from the AMOR in the last decade will be presented. This meant that our proposed review would be incomplete and obsolete and it was thus decided to modify the type of publication for ECOMINA. In terms of publications, ECOMINA will produce a “facts brochure” aimed at informing authorities and civil society about deep-sea mining issues in Norway. We will contribute also to an international publication and lead a second one, in

both of which ECOMINA will be acknowledged:

1. Fact brochure: Arctic mining for seafloor massive sulphides: what is at risk? This brochure provides briefly the current knowledge on AMOR ecology, facts about SMS mining, potential impacts and the current legal framework. It is addressed to the civil society and authorities.

2. Scientific publication: Defining significant impact for deep-sea mining. This multi-authored publication is an international effort being developed within the Deep-Ocean Stewardship Initiative (DOSI, of which Dr Ramirez-Llodra is a member of the Advisory Board), following a workshop that took place in March 2014 in Scripps, USA. The first author is Kathryn Mengerink and the co-authors are: Levin, L., Van Dover, C., **Ramirez-Llodra, E.**, Gjerde, K., Lilly, H., Smith, C., Clark, M., Rowden, A., Armstrong, C., Currie, B., Gallo, N., Muslow, S., Squires, D (the authors order may change). E. Ramirez-Llodra drafted the section on SMS. A first draft of the whole manuscript is being reviewed by all co-authors. Submission is expected in December 2015. ECOMINA and MIKON will be acknowledged.

3. Scientific publication: Ecosystem services and deep-sea mining. Following on discussions during the DOSI workshop in Scripps (March 2014), and further discussion during the ECOMINA workshop in Oslo (Sept. 2015), Dr Armstrong and Dr Ramirez-Llodra have proposed to take forward the suggestion of writing a paper that will review and provide expert knowledge on deep-sea ecosystem services and mining for deep seafloor resources. A draft structure for a potential manuscript has been prepared and the writing will be conducted in the upcoming months. The aim is to submit the paper to a high impact factor journal such as Proceedings for the Royal Society B or Journal on Ecosystem Services in mid-2016. ECOMINA and MIKON will be acknowledged.

Objective 3. MIKON Research Proposal

On 14-15 September 2015, ECOMINA organised a **workshop** in NIVA (Oslo) to discuss the ECOMINA results and define the goals and structure of a MIKON proposal for a full-scale research project.

The **participants** included: Eva Ramirez-Llodra (NIVA, organiser), Steinar Ellefmo (NTNU), Odd Aksel Bergstad & Tina Kutti (IMR), Tom Heldal (NGU), Claire Armstrong (UiT) and Rolf B. Pedersen (UiB).

The programme included **presentations** from Eva Ramirez-Llodra (ECOMINA and MIKON); Steinar Ellefmo (MARMINE BIA project: Exploitation technologies for marine minerals on the extended Norwegian continental shelf); Rolf B. Pedersen (Research on the AMOR: Geobiology Centre of Excellence and new Deep-Sea Research Centre); and Odd Aksel Bergstad (outcome of the brainstorm meeting for a national network on deep-sea mining). These talks were followed by **discussions** on what key issues need to be addressed to ensure the development of knowledge-based management measures under an ecosystem approach and how these could form the basis for a **proposal** to MIKON. Although further research on key aspects of vent ecosystems (including, amongst others, exploration for new vent fields, biodiversity and biogeography, population connectivity, resilience) is necessary, field work on the AMOR is beyond the scope of available funding through MIKON. Thus, and based on current scientific knowledge, both in the AMOR and internationally, and current developments in the international arena regarding ecosystem-based management for deep-sea mining, the ECOMINA group identified a need for environmental management plans (EMP) and strategic environmental management plans (SEMP) to be proposed for areas of potential interest to the mining industry in the AMOR. This proposal has been submitted to the MIKON call with deadline

on 1st November 2015.

For the Management

Interest on resources from the deep seafloor has been growing rapidly in the last decade, with the exploitation of seafloor massive sulphides on hydrothermal vents being the first that will see industrial exploitation in 2016. Commercial deep-sea mining has yet to begin globally and we are, thus, in front of a unique opportunity to implement strategies, nationally and internationally, that will minimise impact on the system prior to the onset of industrial activities (Mengerink et al., 2014). The Arctic Mid-Ocean Ridge (AMOR) lies mostly within Norway's national jurisdiction, between Jan Mayen and Svalbard. Exploration of the AMOR begun in 2005 and continuous investigations are providing a wealth of geological, geochemical and ecological data (Pedersen et al., 2010). In parallel, initial mineral resource estimations in the region indicate the existence of seafloor massive sulphide deposits that could be of interest to the mining industry. Further ridge exploration and research on the vent ecosystems of the AMOR is necessary to fully understand the composition, distribution, connectivity and functions of the Arctic vent fauna. However, it is essential also that, with the current knowledge, guidelines and regulations for environmental management plans for deep-sea mining are proposed. The ECOMINA pilot project, in collaboration with GRID-Arendal, has initiated discussions amongst scientists and relevant authorities (e.g. Ministry of Industry, Trade and Fisheries, Miliødirektoratet) for the creation of a Norwegian network on deep-sea mining knowledge and expertise. ECOMINA is also finalising a facts brochure summarising ecological knowledge on AMOR hydrothermal vents, potential deep-sea mining activities and expected environmental impacts. ECOMINA is participating in a paper on Significant Impacts of Deep-Sea Mining (Mengerink et al. in prep.) that will be submitted for publication in December 2015 and is leading the literature research for a paper on ecosystem services and deep-sea mining (Armstrong et al. in prep.). Finally, ECOMINA organised a workshop where the ECOMINA results were discussed in relation to other national and international activities and the goals and structure for a full-scale proposal to MIKON was agreed. This proposal was submitted to MIKON for the 1st November 2015 deadline.

Published Results/Planned Publications

Two scientific publications related to ECOMINA and where ECOMINA-MIKON will be acknowledged, are in preparation. The author lists and titles provided below are provisional. More details on the background and timing of both publications can be found in the "summary of results" section.

- Mengerink, K., Levin, Van Dover, C., Ramirez-Llodra, E., Gjerde, K., Lilly, H., Smith, C., Clark, M., Rowden, A., Armstrong, C., Currie, B., Gallo, N., Muslow, S., Squires, D. (in prep). Defining significant impact for deep-sea mining. To be submitted in December 2015.
- Armstrong, C., Rowden, A., Ramirez-Llodra, E. et al. (in prep). Ecosystem Services Associated with Deep-Sea Mining to Inform Policy. To be submitted in mid-2016.

A facts brochure on AMOR hydrothermal vent ecosystems and deep-sea mining is being prepared (see results section).

Additionally, initial contacts with the Ministry of Industry, Trade and Fisheries and Miliødirektoratet regarding deep-sea mining in Norway have been initiated.

Interdisciplinary Cooperation

The ECOMINA pilot project team was inherently multidisciplinary, including geologists (NTNU, NGU), ecologists (NIVA, IMR, Uni. Southampton) and a socio-economist (UiT). The creation of an expert network on deep-sea mining such as the one proposed by ECOMINA scientists and GRID-Arendal requires interdisciplinary cooperation. This is particularly true for research related to mid-ocean ridges, where the biology is intrinsically related to the geology and geochemistry of the habitat, which provide the energy for primary chemoautotrophic production by microorganisms.

Budget in accordance to results

The budget provided by MIKON and matching funds from the ECOMINA partners, together with additional funding from the partners (e.g. personnel time, travel) covered the costs of the proposed activities. The 3 proposed objectives have been reached satisfactorily. There was, however, a deviation in Obj. 2 (review publication). This deviation was not due to funding issues, but to an overlapping activity: special issue on AMOR research, which is being developed by an institution external to the ECOMINA group. We were not aware of this special issue until after the ECOMINA proposal was funded, as this information is not public.

Could results from the project be subject for any commercial utilization

No

Conclusions

ECOMINA has been a successful pilot project. One of the most important results has been the establishment of new and strengthening of existing collaborations amongst research groups in Norway with an interest on the AMOR and deep-sea mining. The new communication pathways established, including with UiB, GRID-Arendal and IRIS, are developing into a national expert network on deep-sea mining of interest to authorities relevant to deep-sea mining and environmental management. The conclusions of the pilot project support the importance of continuing the ECOMINA research activities and this forms the base of a full-scale proposal on ecosystem-based management measures for deep-sea mining in the Arctic, to be submitted to MIKON in November 2015.