Long-term Impacts of Deep-Sea Mining

Latest Results from Marine Scientific Research

July 2016

Objective

The JPI Oceans project 'MiningImpact' aims at assessing the long-term impacts of polymetallic nodule mining on the deep-sea environment. Core of the project are three marine research campaigns conducted in 2015 visiting several license areas and two Areas of Particular Environmental Interest (APEIs) in the Clarion-Clipperton Zone (CCZ) as well as the DISCOL benthic impact experiment in the Peru Basin

The main research questions addressed by 'MiningImpact' are:

- How did the deep-sea ecosystem (species biodiversity, community structure, biogeochemical functioning) in various disturbed areas in the CCZ and DISCOL evolve several decades after the impact?
- Can APEIs and seamounts fulfill their anticipated role as conservation areas for nodule-associated species?
- How large is the expected spatial and temporal footprint of deep-sea mining operations?
- What is the long-range connectivity of species in the CCZ and how is it affected by mining?

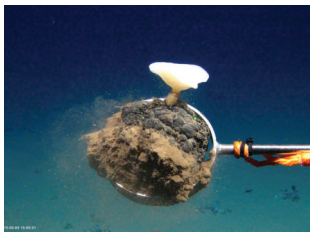
CCZ license areas & APEIs

In the CCZ the project studies ecosystem biodiversity across productivity gradients and species connectivity by comparing different license areas and the APEIs 3 & 4. In each study area, the abundance and composition of faunal communities, biogeochemical functions, and oceanographic conditions inside and outside nodule fields, at seamounts, and at decade-old disturbance tracks are analyzed.

DISCOL experimental area

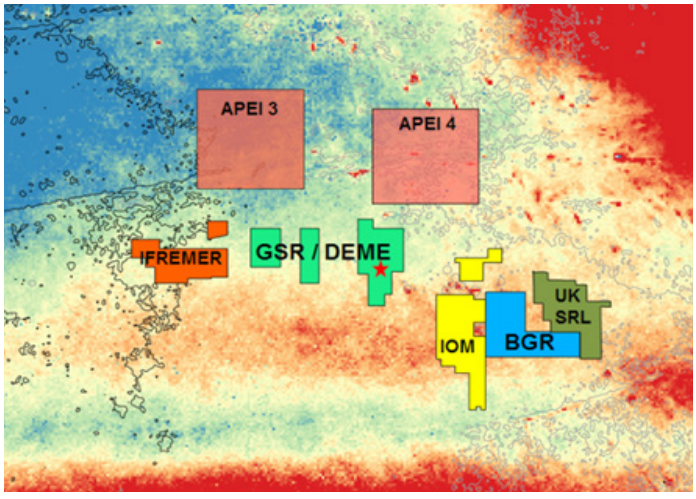
In the Peru Basin the DISCOL experimental area was revisited, where scientist have conducted a "DISturbance and reCOLonization" experiment in 1989 by ploughing approximately 20 % of the seafloor within a 11-km2 large nodule field.

Sponge covered with sediment next to disturbance track

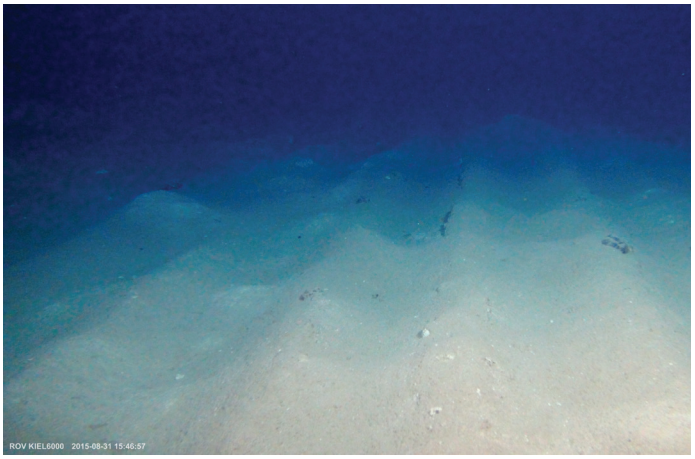


Polymetallic nodule

AUV-based habitat mapping was complemented by video surveys and box-core sampling to compare abundances of sessile and mobile fauna in the impacted area with those at reference sites. ROV-based in situ investigations aim at assessing the induced changes in biogeochemical functions of the ecosystem.



Study areas in the CCZ: APEIs 3 & 4, contract areas of Germany, France, Belgium, UK, and IOM.

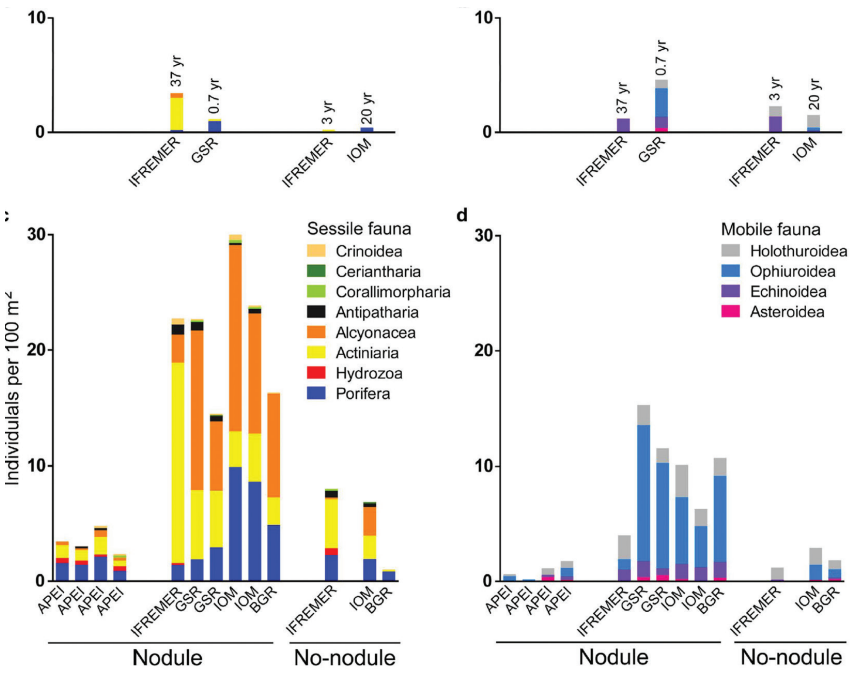


26-year old plough marks (DISCOL)

First Results

Sessile fauna

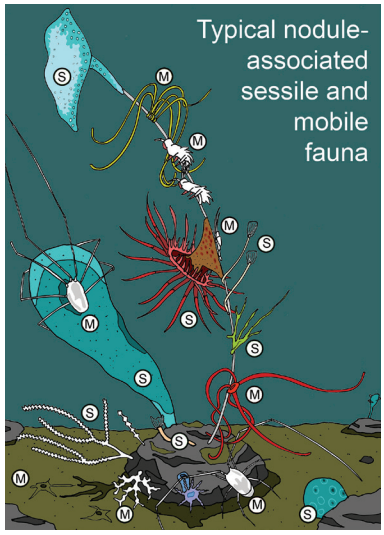
Mobile fauna



VANREUSEL ET AL. (2016) SCIENTIFIC REPORTS 6

COMPARISON BETWEEN OLD DISTURBANCE TRACKS (1979 OMCO TRACK, 1995 IOM-BIE, 2013 IFREMER EBS, 2015 GSR EBS) AND NORMAL DEEP-SEA FLOOR IN CCZ AREAS WITHOUT NODULES:

- Anthropogenic disturbances have left prominent marks on the seafloor, clearly visible many decades later
- Poor recolonization rates of epifaunal communities in the tracks: low diversity of macro- and meiofaunal communities, sessile & mobile fauna associated to nodules (e.g. sponges, ophiuroids) are basically absent
- Microbial metabolic activity is strongly reduced in the surface sediments.



Main findings

- **Nodule ecosystems consist of a highly diverse fauna of sessile and mobile species**
- **Faunal communities show high variability on small spatial scales**
- **Benthic fauna differs widely between seamounts and nodule habitats**
- **Disturbance impacts on nodule ecosystems last for many decades and include all ecosystem compartments and functions**
- **Nodule mining leads to a persistent reduction in biogeochemical remineralization processes and production potentials of seafloor communities**
- **Polymetallic nodules are required to preserve abyssal biodiversity**

Conclusions

- Conservation areas need to match habitat characteristics of mined areas (e.g. productivity, nodule coverage) to preserve abyssal biodiversity in the CCZ
- Seamounts and APEIs may not provide the anticipated services: additional MPAs are needed
- Appropriate monitoring technologies to assess mining impacts are available, but knowledge transfer from the scientific community to contractors / operators is required
- Minimizing large-scale impacts requires careful spatial planning of mining operations, establishment of marine protected areas, and the development of low-impact mining equipment

JPI OCEANS

The project is funded under the framework of JPI Oceans by National Research Ministries and Scientific Research Institutes from Belgium, France, Germany, Italy, the Netherlands, Norway, Poland, Portugal, Romania, Sweden, and the United Kingdom. The content of this publication does not necessarily reflect the official opinion of JPI Oceans. Responsibility for the information and views expressed lies entirely with the project partners.

Contact: Dr. Matthias Haeckel, GEOMAR Helmholtz Centre for Ocean Research Kiel (mhaeckel@geomar.de)
https://jpio-miningimpact.geomar.de