

Seafloor Photo Mosaic from 4,000m Depth



The joint European project called 'Ecological Aspects of Deep-Sea Mining' is aimed at exploring the ecological consequences of mining manganese nodules. In August 2015, an international team of scientists led by the GEOMAR Helmholtz Centre for Ocean Research Kiel, Germany, investigated manganese nodule fields in the eastern Pacific Ocean with the German research vessel *Sonne*. The team brought back some amazing images and data from the seabed.

Future mining of the deep sea could look like unmanned crawler vehicles move along pre-programmed paths on the seafloor and rake the soft ground in search of polymetallic nodules. But how profoundly will such mining activities influence the ecosystem of the seafloor? How long will it take nature to heal these wounds? These are the fundamental

questions addressed by the joint European research project "JPIOceans - Ecological Aspects of Deep-Sea Mining". From the end of July to the end of August 2015, scientists from Germany, Portugal, the United Kingdom, Belgium and the Netherlands worked onboard the German research vessel *Sonne* in the eastern equatorial Pacific to find answers to those questions. With the autonomous underwater vehicle AUV *Abyss* they created one of the largest high-resolution photo-mosaics of the ocean floor so far. Cruise chief scientist Professor Dr. Jens Greinert of the GEOMAR Helmholtz Centre for Ocean Research Kiel described both the technology used and the results as "remarkable".

Long-term Impact

The so-called DISturbance and re-COLonization experiment (DISCOL) area was the destination of the *Sonne* expedition with the official number SO242/1. The area is part of the more than 4,000m deep Peru Basin. In 1989, German scientists ploughed about 2.5km² of a well-defined, 11km² large area, where manganese nodules occur on the ocean floor. The aim was to study the long-term impact of such activities in the deep sea.

In the years 1992 and 1996, expeditions followed to monitor the ecosystem's response in the ploughed grounds. 19 years after the last cruise to the DISCOL area, an international research team on RV *Sonne* had the opportunity to take a close look at the seabed again.

High-resolution Colour Images

Among the technologies that were not available in the 1990s are autonomous underwater vehicles such as the AUV *Abyss* of GEOMAR. In up to 6,000m depth it can follow pre-programmed courses for more than 20 hours, mapping the seabed minutely with multibeam echosounders and side-scan sonar. A newly developed lighting technology also permits the researchers to take color images of the seabed. During the expedition, the AUV took several hundred thousands of photos of the seabed at close range. The scientists assembled them to a photomosaic of the seafloor in high resolution.

Another advantage of the AUV is that it saves valuable time. While the device works autonomously in the deep, RV *Sonne* could take samples elsewhere.

As with all scientific expeditions, the data, maps, photos, and samples collected must now be analysed in detail. The plough tracks of 1989 can still clearly be seen and the disturbed regions have not been recolonised yet. At the same time, the images show that a few decimetres from the plough tracks, normal deep-sea life exists.

Follow-up

Currently, a follow-up team of the JPIO project led by Prof. Dr. Antje Boetius of the Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research is working in the DISCOL area. During this leg of the cruise, which lasts until early October, detailed biogeochemical investigations of the disturbed habitats are the primary objective. In a joint project blog, the participants report about their activities onboard.

Image: One of several hundred thousands of photos of the seabed taken by the AUV Abyss. Plough marks of 1989 can be seen as well as tracks of a current sampling in the centre. Image courtesy: AUV team, GEOMAR.