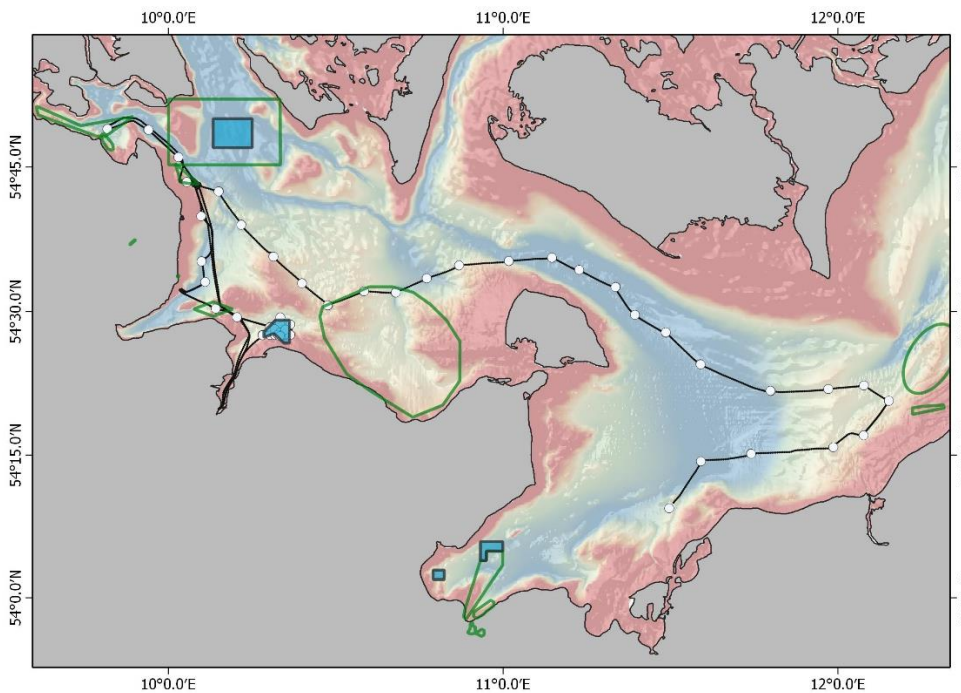


Weekly Report AL548 / MineMoni II

3rd November to 17th November 2020

Aim of the cruise: Marine Munition is a worldwide threat to marine safety and travel and construction but also to the environment as marine munition releases toxic substances into the environment. To study this impact, the UDEMM project (2016 – 2019) developed monitoring strategies for mapping munition containing areas (dump grounds) with hydroacoustic (multibeam), optical (towed camera and AUV-based) and geochemical methods (water sampling and onshore analyses) to establish the contamination risks. Following the UDEMM project two EU funded projects, BASTA and ExPlOTect (Dec. 2019 – Nov. 2022) are aiming at better, faster and more reliable munition detection using high res multibeam combined with AUV-based optical and magnetic object verification and AI-supported predictions (BASTA; <https://www.basta-munition.eu/>) as well as sophisticated and unique near-realtime explosive compound analyses using online preconcentration and direct injection into a mass spectrometer (ExPlOTect; <https://www.explotect.eu/>).

With cruise AL548 we continue the studies of UDEMM and particularly cruise POS530 (MineMoni I) from 2018. A CTD transect with water sampling for explosive compounds from Flensburger Förde to Lübecker Bucht is being repeated and additional multibeam data have been/will be acquired in Kolberger Heide and Lübecker Bucht. As new area we surveyed already Falshöft with multibeam, AUV ANTON and AUV LUISE and will take a peek at the Trollegrund to support the EOD from Mecklenburg-Vorpommern.



Overview map of the cruise track and CTD stations (white circles) sampled by noon on Sunday the 8th November.

What we did so far: We left Kiel after the installation of the USBL pole at about 10am on Tuesday, after all cruise participants got their negative corona results from the testing the day before. The first station happened only 1.5h later in the Kolberger Heide. A CTD acquired a sound velocity profile and collected the first water sample before both AUVs were put into the water. Work in Kolberger Heide continued with several AUV deployments, denser CTD sampling and additional mapping before we did a few multibeam lines over the Boknis Eck monitoring tower after lunch on 5th November. We did this to support an enquiry of our colleague Helmke Hepach. A 3D visualization of the site shows the tower in good shape at the location it should be. After that we moved on to Falshöft and started mapping during the night. Falshöft was used as munition dumping ground for large munition objects and small grenades (so the assumption). Large objects we found rather easily in the bathymetric data and were confirmed by optical and magnetic investigations by AUV. We used the video CTD as explorational tool while the AUVs were surveying and performed several video transects across the potential hot spot areas of munition dumping. Neither in the AUV nor the video CTD footage we found signs of grenades. Why is this a good sign? Typically, conventional munition is dumped in the German Baltic Sea and only minor amounts of chemical munition have been initially dumped in the Baltic; much of it was moved and dumped again at other places later on. To rule out that chemical munition has been wrongly dumped in Falshöft (chemical munition was shipped from Flensburg for disposal), we performed our optical surveys. Chemical munition is used in grenades, finding no grenades means that chemical munition is unlikely in the surveyed area.

After Falshöft, a looong night of CTD stations with water sampling followed and was performed by our two colleagues from the ExPloTect projects. Despite offers from all other participants to help, Aaron and Mario bravely sampled through the night until 11:00 on 8th November. The CTD stations are repetitions of the stations undertaken in 2018 during POS530. Analyses of the 2018 samples showed that low concentrations of the explosives TNT, RDX, and DNB are omnipresent in the Baltic Sea. The newly collected samples will help us understand the persistence and temporal variability of this widespread contamination.

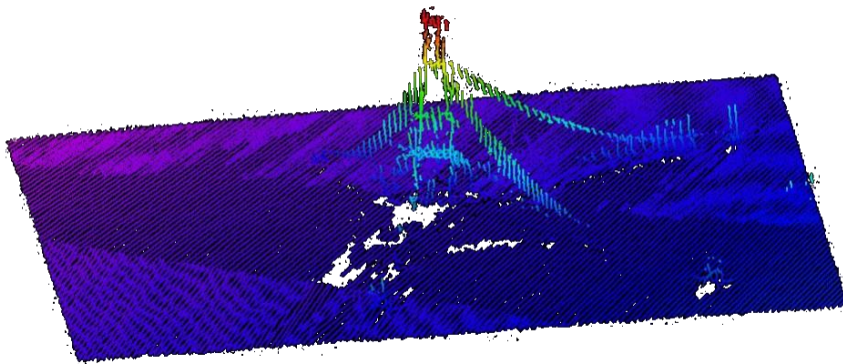
Currently we are heading to the first AUV station in Lübeck Bay. We will stay in this area for several days with an exchange of scientific personnel the 10th in the morning.

How are we doing: All on board are well. Unfortunately, we had to go back Kiel for the exchange of one of the crew members. This took only 7 h and also allowed to bring a second, strong computer for the photomosaiking and some needed spare parts for the AUV camera.

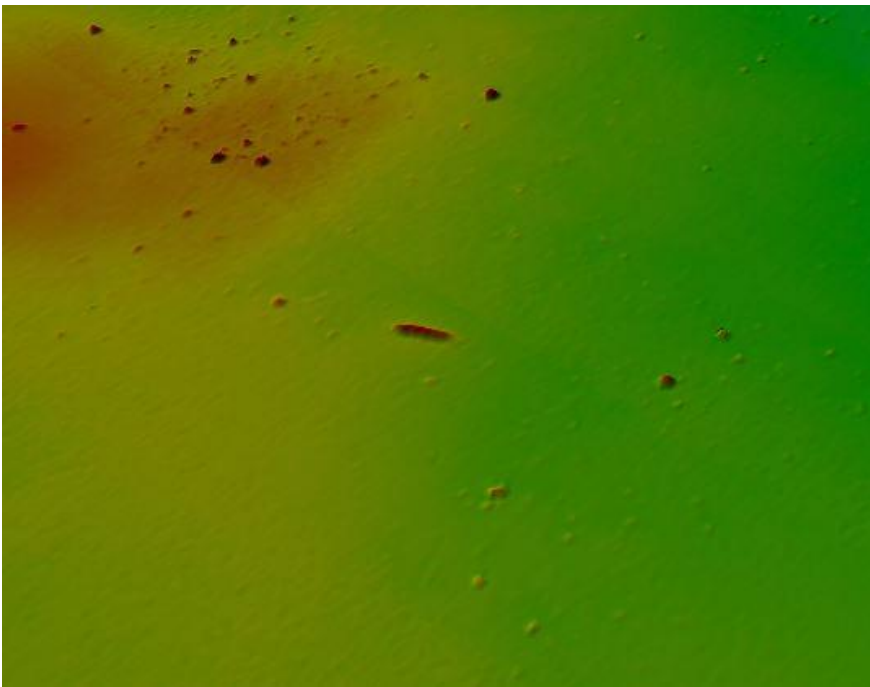
With the best greetings from all of the scientific crew: Mareike, Sylvia, Patrick, Daniel, Aaron, Mario, Nikolaj and myself,

Jens

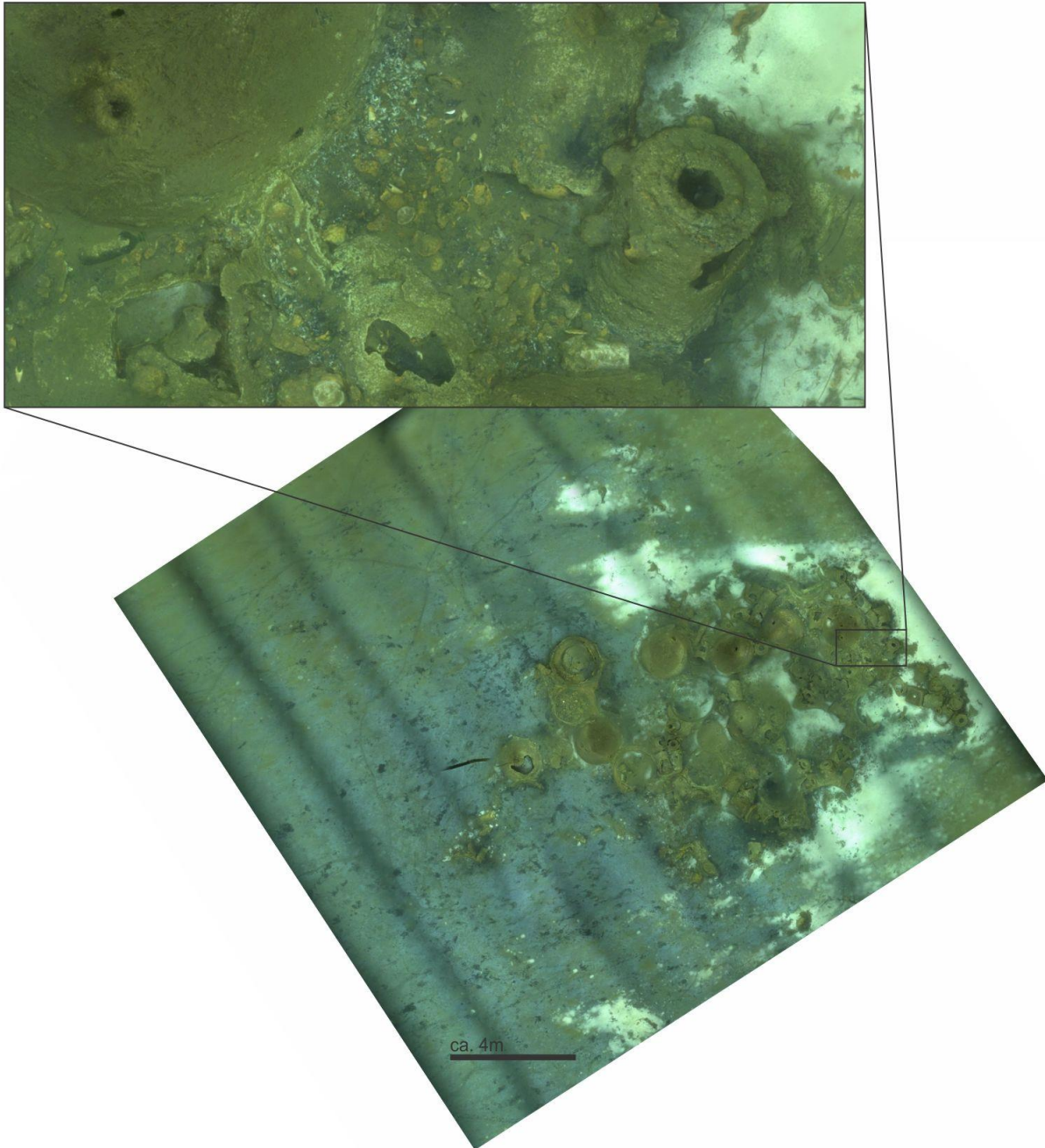
Some highlights: Yes! We have highlights. First, the data collection is running very well. Having reliable and proven systems as CTDs and multibeam is almost a guarantee for good data. However, the still ongoing improvement of multibeam technology and the use of RTK navigation is impressive. What is slightly more impressive, are the directly onboard processed 3D reconstructions and photomosaiks of the AUV imagery. The GEOMAR developed and built camera system CORAMO of the AUV team did a splendid job and took up to now already 107,000 images (481 GB). These are stitched together into a 3D reconstruction of the seafloor, which is used to calculate an orthomosaik of the seafloor (how the seafloor would look like with a plan view from top). Some first examples are shown below. The resolution is in the order of 3mm/pixel and will open up new ways of doing ecological studies, monitoring of environmental change or just getting a correct understanding of the heterogeneity of the seafloor. In our case, we will use this technology to investigate the ongoing corrosion of munition shells as well as the dissolution of chunks of open explosives.



The Boknis Eck tower, upright and 'at position' in Eck Bay



Torpedo in the bathymetric data, 5m long, 60cm in diameter, grid cell resolution 10cm.



Photomosaik of the pile of German sea mines Anton photographed. Many crab tracks can be seen to the NW. The pile itself shows many crab shells; speculatively this is the 'secret moult-ground' of the crabs in the area. Thanks to the great work and preparation of the AUV team, images pour in tsunami-like, keeping the photomosaic-computers very busy. Making the mosaic takes longer than the dive itself (about 3-times. @Willi, can FB1s GPU cluster please help).

Our tools:



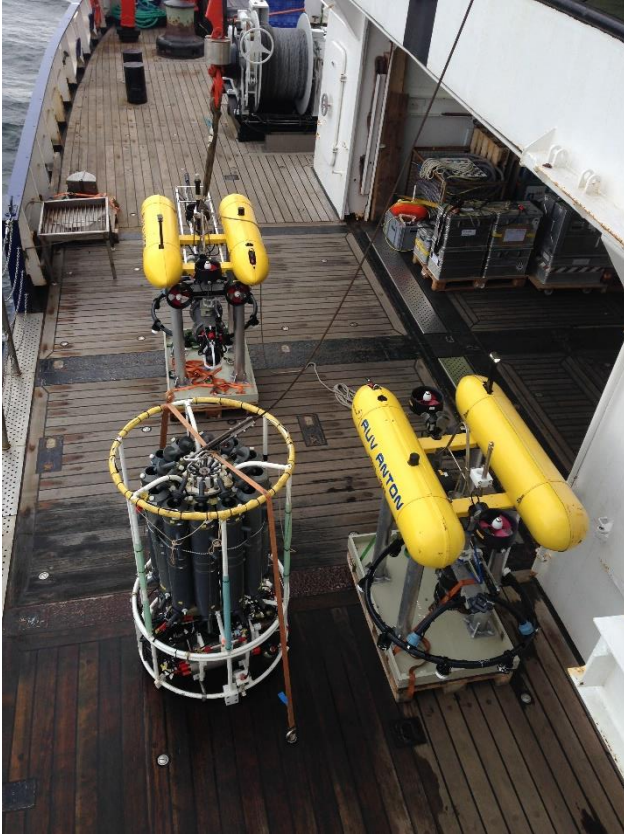
AUV Luise with magnetic 'horn' carrying two magnetic sensors above each other.



AUV Anton coming back from a camera survey.



Aaron and Mario proudly presenting the "ExPloTector".



Video CTD and both AUVs together on deck.