# SO-250

## KuramBio II

### 1. Weekly Report

### (16.08. – 1.08.2016)


**FS. SONNE**

43°48´N / 151°47´E

Fourty scientists from of nine nationalities (17 Germans, twelve Russians, three Japanese, each two French and Polish, and each one South Korean, Czech, Mexican, and Spaniard) embarked the research vessel *Sonne* for the deep-sea expedition KuramBio II (SO 250) in Tomakomai (Japan, Hokkaido) on August 15. In the afternoon of the same day we started unpacking our cargo as well as assembling gears and setting up the labs. All instruments, computers and other devices that we would need later had to be installed and well secured to withstand the movements of the ship exposed to the swell of the open Pacific Ocean, especially because it is Taifun season.

On August 16. at 9 am sharp RV *Sonne* left port in foggy Tomakomai. Already three hours later, the scientists were happy to spot a pod of sperm whales by their blows are repeatedly surfacing heads and backs. The same day, obligatory savety drills were held in order to introduce everybody on board with safety and emergency procedures. Also, the labs were brought to a usable state and then there was only one more day to get accustomed with the movements of the ship until we would arrive at the first study site.

KuramBio II is already the fourth expedition to the Northwest Pacific that was conducted as a German-Russian collaborative enterprise. Initially, the fauna of the Sea of Japan (East Sea) was investigated during the Russian-German SoJaBio (Sea of Japan Biodiversity study) campaign in summer 2010 onboard the Russian vessel *Akademik M.A. Lavrentjev*. In 2012 the Northwest Pacific Abyssal Plain was investigated in the Kuril-Kamchatka region sailing onboard the previous RV *Sonne* in order to compare the open ocean with the semi-enclosed marginal sea. During this first KuramBio campaign, depths between 4700–5700 m were studied. The follow-up project SochoBio (Sea of Okhotsk Biodiversity study) took place in summer 2015, again with RV *Akademik M.A. Lavrentjev.* This marginal sea is characterized by a depth similar to that of the Sea of Japan (ca. 3500–3700 m), however, it has stronger exchange with the open Pacific through rather deep sills such as the Krusenstern Strait (1920 m) und Bussol Strait (ca. 2500 m). The Sea of Okhotsk is not only isolated from the open Pacific by the Kuril Islands but from the perspective of the benthos the Kuril-Kamchatka Trench (KKT) may represent another obstacle that may hinder migration and dispersal. It is up to 9500 m deep.

One of the major research questions in the KuramBio II project is therefore whether the KKT has a restrictive effect on the distribution of abyssal organisms inhabiting either the Sea of Okhotsk and Kuril Islands side or the Pacific side of the trench. We are testing this hypothesis on various taxonomic groups and size classes of organisms that cover various modes of reproduction and dispersal, from taxa with brood care to those with free-swimming larvae. To study the depth limits of their distribution, we will take samples at various depths, allowing us to draw conclusions about the biogeography of the whole region.

In our studies we are considering environmental aspects, such as sedimentological parameters, and investigate morphological as well as genetic data of all size classes of eukaryotes (Protists, Meio-, Macro-, and Megafauna) from the trench and neighboring abyssal and bathyal samples. Furthermore, the biodiversity estimates that we estimate based on our modern sampling techniques are to be compared to the biodiversity described by Russian scientists that studied the region extensively throughout the 20$^{th}$ century with the RV *Vitjaz*. So far, our results indicate a much higher diversity than known from the *Vitjaz* expeditions which could be partly due to the smaller mesh sizes that we use today. Additionally we are able today to differentiate between morphologically cryptic species using DNA based species delimitation methods.

The mechanisms that contribute to the generation of this diversity are another focus of our studies. Drivers limiting gene flow thus leading to divergence and eventually speciation are poorly understood, especially for the deep-sea fauna as well as the most important selection factors. This pioneering character makes studying diversity in these great depths so fascinating and with every sample we gain new insights and understanding about the organisms of the deep-sea floor.

The first study area A8 and first station were reached already on Thursday the 18. of August at midnight. It was located at 43°82N 151°76'E in 5130 m depth. We decided to begin our

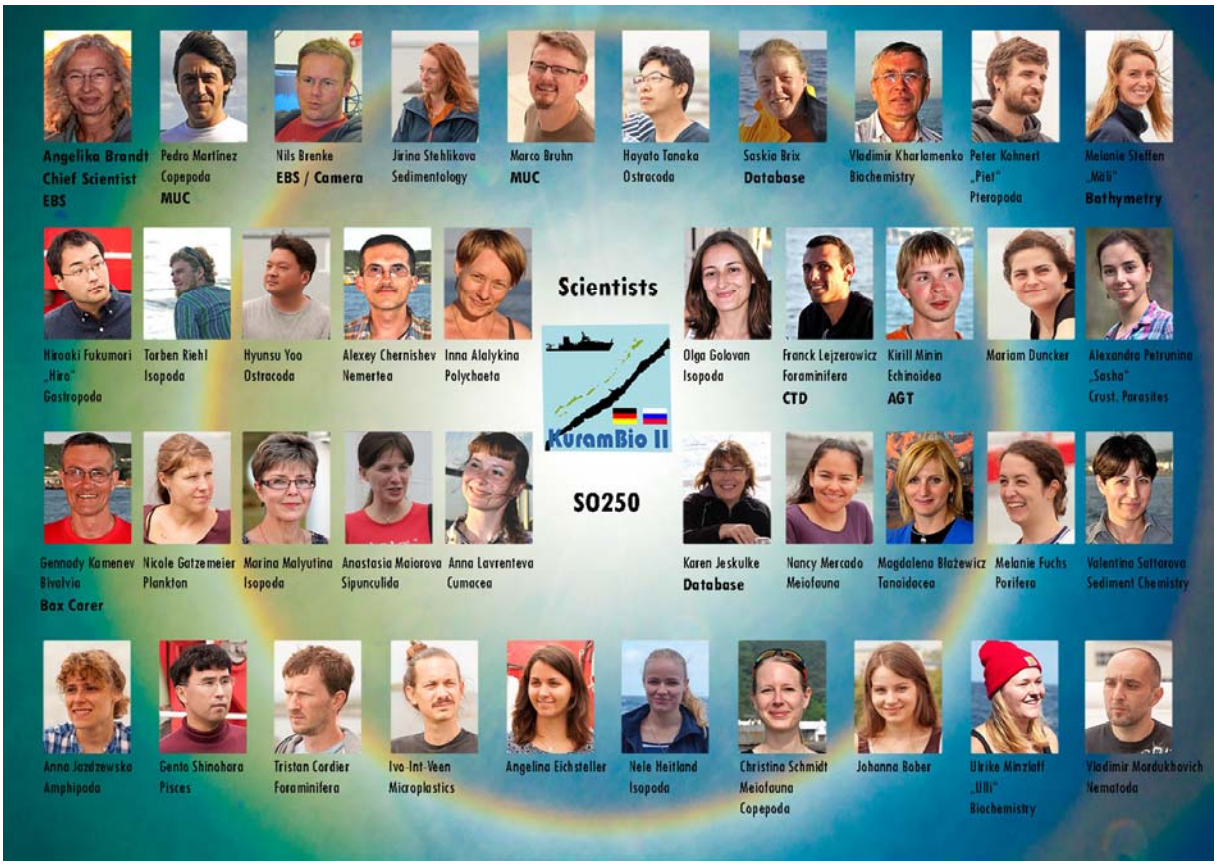
sampling at a “shallow” site, and not the deep A1 area with 8200 m in order to accelerate the initiation of our work flow on board which includes time-consuming sample sorting etc., as well as to establish routine in the deployment of the gears on an „easy“ site before operating them in over 8000 m depth.

Following the deployment of the CTD (a device measuring physical parameters of the water column) with a rosette of Niskin bottles (a water sampler) in 2000 m depth as well as a Multi-closing plankton net, specifically catching planktonic organisms at certain depths, the sea floor was scanned with an echo sounder to study the topography of the sea floor. Based in these maps, the benthos sampling stations were planned. The benthos gear included a Multiple Corer, A Giant Box Corer, a Camera-Epibenthos Sledge, as well as an Agassiz Trawl. The complete set of instruments was successfully operated and the scientists on board RV *Sonne* could be satisfied. Already, new species could be identified and DNA extractions were conducted. It is nice to look into happy faces after the first days were dominated by anxiety facing the first station. Besides a number of interesting organisms and new species we also already discovered interesting parasite-host relationships, and new records of species ocurrences expanding the previous knowledge of species distributions. These include for instance wood-boring isopod crustaceans of the genus *Limnoria*, which are typically occurring in coastal waters, and the rediscovery of a Ostracod crustacean family which was described based on KuramBio I material. The second catch of the Agassiz Trawl included a 85 cm long fish of the family Macrouridae (Grenadier) from more than 5000 m depth,, *Coryphaenoides acrolepis*. We were informed by our Japanese colleagues on board that this species previously had been known only from 300-3700 m depth. Besides, they mentioned that this particular species is the most delicious of the family, however, we decided to keep the specimen for research purposes ☺!

Besides our scientific routine, we publish a daily log book
http://www.senckenberg.de/root/index.php?page_id=5253&blogEntryID=450

The first entry can be found here:
http://www.senckenberg.de/root/index.php?page_id=5202&PHPSESSID=8c69e8nl681vbeb511riu4q912&blogEntryID=459

Angelika Brandt, Centre of Natural History (CeNak), (Chief Scientist SO250) and the scientific party

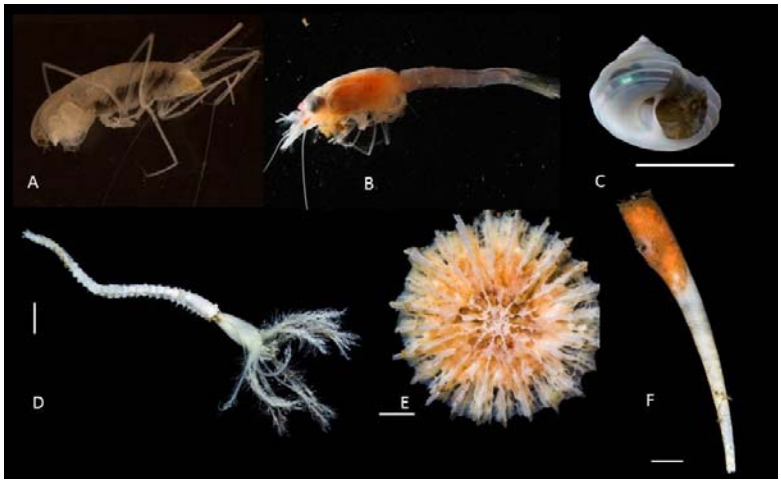



Scientists of the KuramBio II ( SO-250) expedition with RV *Sonne*.


RV Sonne in the harbor of Tomakomai.

Unpacking the containers on RV Sonne.

The epibenthic sledge.



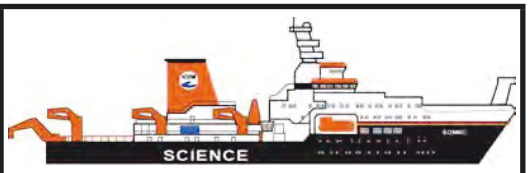

Invertebrates from the epibenthic sledge A, isopod, B, mysid; C, gastropod; D, polychaete; E, coral; F, scaphopod with the actinian *Anthosactis nomados* White, Wakefield, Pagels & Fautin, 1999, also known from the west coast of the United States of America.

Deepest record of wood boring isopod (*Limnoria* sp.).

Sea cucumber from the Agassiz.


Deepest record of *Coryphaenoides acrolepis* (T. H. Bean, 1884) a deep-sea macrourid.

# SO-250 KuramBio II
# 2. Weekly Report
# (22.08. – 28.08.2016)



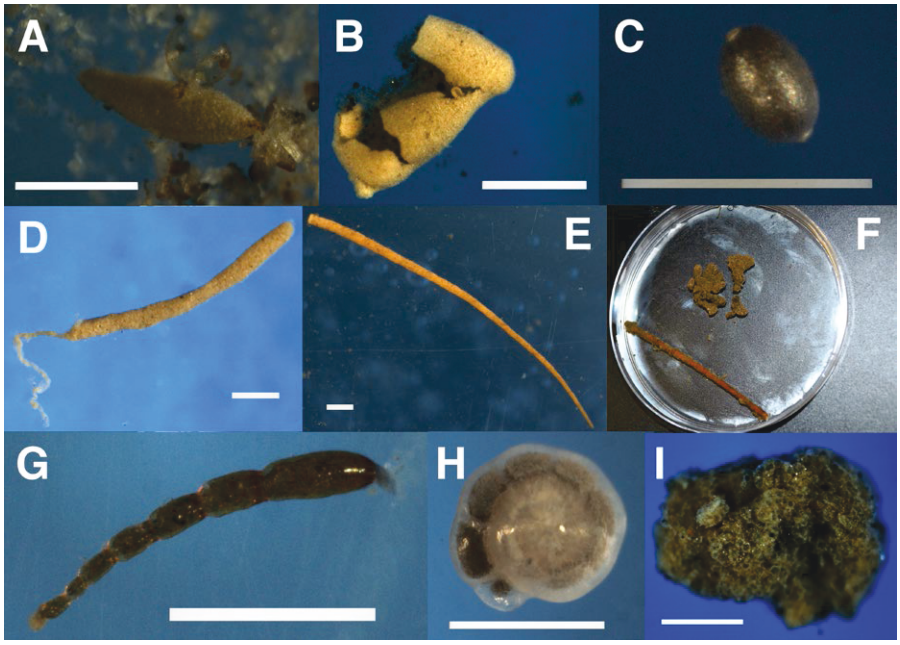

FS. SONNE
45°41´N / 152°49´E

Time flies by!
We are now two weeks aboard the RV Sonne, have finished the third station and started the fourth station in ca. 7000 m depth already. So far, we were very lucky! The weather is favourable, since we are steaming we have a swell of 2 m, maximum of 3 m, and can therefore work without interruption day and night. In addition, so far all gear deployments have worked, even in 8250 m, thus so we already have extensive and extremely interesting samples in our sampling jars or frozen ib cooling chambers (or freezers) at -20 ° C or -80 ° Celsius. In the last report we briefly outlined our questions. In order to answer these we deploy a , we use a number of various gear according to a standardized operating protocol in order to compare our data with those of the earlier KuramBio I expedition, but also with the other expeditions in the northwest Pacific like the last-week mentioned SoJaBio and SokhoBio expeditions or even the expeditions to the manganese nodule region of Clarion Clipperton Zone et al was examined under the JPI Oceans project as well as those projects performed under the umbrella of the Census of Marine Life in various deep-sea regions of the Atlantic, from the Arctic, Iceland (IceAGE), through the Southern Ocean (ANDEEP and SYSTCO).


Researchers and crew can't wait to see the latest catch brought on deck with the Agassiz Trawl. (c) Oliver Meyer

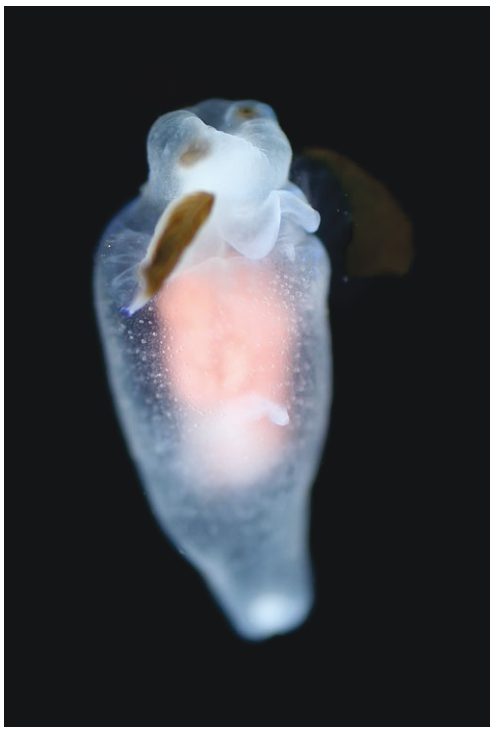
According to our work plan we start with the deployment of a CTD down to 1000 m depth, because we need water from different surface layers for biochemical analysis of the productivity in the area. Furthermore, Melanie Steffen needs the data for the calibration of the bathymetric mapping by means of the multibeam echosounder. In a trench system like the Kuril-Kamchatka Trench, the topography is very rough; we can find seamounts, steep slopes, ridges or troughs which might not allow us to deploy towed gear like the epibenthic sledge or the Agassiz trawl in some areas. We therefore need to map the seabed precisely and then – depending on the wind direction– define the spot from which we will start to tow these collection gears. Sometimes we have to slightly deviate from our planned stations because the sampling depths were selected on the basis of the previous superficial knowledge of the hadal ocean floor. For example, in area A6 we planned to sample at a depth of approximately 5100 m.
In fact, we had to work in about 6000 m, since in the vicinity of the planned coordinates we could not find a site that was flat enough for the towed equipment to be deployed. Thus this station took little longer than planned and we need to compensate for this additional shiptime at later stations. After mapping we deploy a multinet in order to sample plankton from different depth horizons in the water column, which is also partially used for biochemical analysis, but also for systematics and evolutionary biology, studies on biogeography and distribution of planktonic organisms or anatomic studies. After completing our work in the water column

we then focus on the seafloor and deploy two corer systems, the multiple corer and the giant box corer. Using these devices we can answer questions about the nature and composition of the sediments, or the occurrence of micro-plastics at these depths. We use the organisms from these corers for systematics of meiofauna and macrofauna and for solving evolutionary and ecological questions within these size classes. In addition, samples for biochemical analyzes are selected from all different gears, then these organisms are photographed and frozen for later analyses of fatty-acid patterns or the composition or of the stable isotopes of nitrogen and carbon in order to detect the diets and trophic position of the animals. The multicorer offers us excellent and undisturbed samples for the analysis of single-cell organisms such as foraminifera, but also meiofauna, mainly from the dominating Nematoda (roundworms) and Copepoda (copepods). Sometimes we find in the surface of the box-corer samples very well preserved macrofauna organisms such as molluscs (snails, clams), polychaetes or small crustaceans, especially from the group of Peracarida (mostly isopods, amphipods, tanaidaceans and cumaceans). The epibenthic sledge collects very well preserved macrofauna (animals of 1 mm up to 1 cm in size) and usually brings hundreds to thousands of small invertebrates on deck of the RV Sonne with each deployment. Thus sorting of this material is extremely tedious and time-consuming, but well worth the effort, because the animals from this gear are perfectly suitable for further analyzes, from taxonomy to genetics.

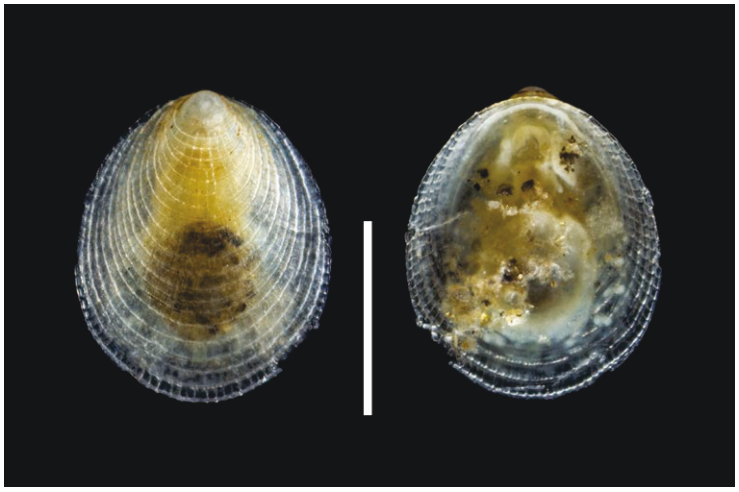


Examples of living Foraminifera (Protista). M = 0.6 mm). (c) Franck Lejzerowicz.

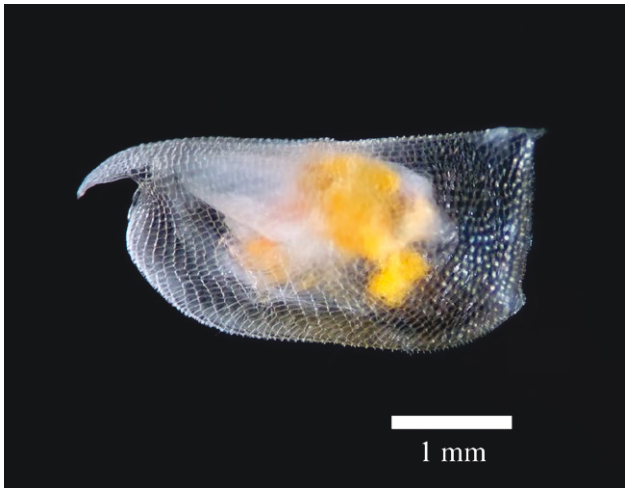
The Agassiz trawl collects the largest size group of organisms, the megabenthos. It comprises organisms ranging from several centimeters to the size of big fish. With this device, as with the EBS, we bring a lot of animals on the deck, and sometimes it is very difficult to wash and sieve about a ton of deep-sea mud. When the work on deck is finally done, Saskia Brix-Elsig and Karen Jeskulke are already waiting for the station protocols. In addition to their extensive work, ranging from sorting and photography to preparation of selected animals for genetic studies, they enter every station plan and the number of samples in an Access database for sample management. Each jar gets its own number. If a sample is sorted, then each vial receives a number as well that can be traced back to the original container number. This database (about which we will report in a later weekly report) helps - back in our home laboratories - to keep track of each of our many (thousands) of samples while distributed to expert scientists all around the worls, for example in Hamburg, Wilhelmshaven, Vladivostok, Tokyo, Lodz or anywhere else.


Sea Butterfly (Pteropoda) of the genus *Gymnosome*. (c) Nastya Maiorova)

This week, pteropods (also called sea angels) caught by means of the multinet held several surprises. Besides the common species *Clione limacina* and *Limacina helicina* which are known to frequently occur in these regions, we were able to obtain two individuals of gymnosome pteropods from the mesopelagial from a depth between 200-2000 m. The specimens belong to different species, one of them



A monoplacophoran - a „living fossil". Scale = 1 mm. (c) Torben Riehl



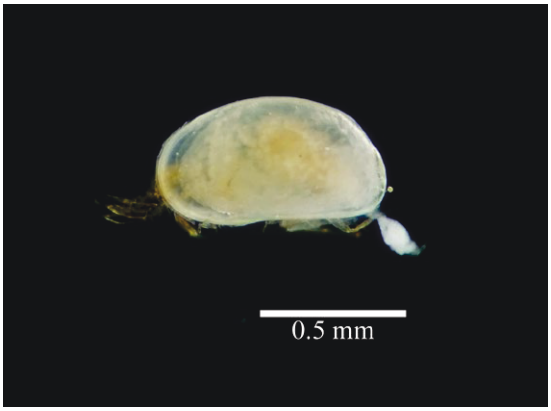

A planktonic Seed Shrimp (Ostracoda) *Conchoecissa* cf. *plinthina*. (c) Hayato Tanaka

being new to science. For this reason DNA vouchers of this species have been taken and their analysis will be complemented by a detailed microanatomical species description.
Furthermore, a mystery concerning an additional species was revealed and knowledge of its distribution was remarkably extended. Specimens of the species *Peracle* spec. have already been obtained during last year's SokhoBio expedition to the Sea of Ochotsk, but could (due to the severely damaged condition) only be identified through DNA-barcoding. Now we were able to obtain few undamaged specimens that could clearly be assigned to the genus Peracle, based on the more or less intact shells. Genetic analyses in the home laboratory will reveal whether these specimens belong to the known species *Peracle apicifulva* whether they are a new species.

A very interesting and rare find worth mentioning is a Monoplacophoran mollusk, a "living fossil", sampled with the epibenthic sledge which pleased not only us on board, but also our colleagues back at home in Germany. The deep station revealed - as was to be expected - new records and interesting discoveries. We have sampled fish of the macrourid group (benthic deep-sea fish) again, this time in more than 8000 m depth with the Agassiz Trawl. Prity exciting when considering that this species had been known from a maximum of 3700 m depth previously. We have brought the deepest evidence of benthic ostracod crustaceans from 8250 m depth and found that many of the species are huge at these great depths. We thus support the theory of gigantism of species with increasing depth. Particularly noteworthy for the stations in the third region (Area 6) is that (in the extension of Bussol Strait), we sampled species which were already collected in the Sea of Okhotsk during SokhoBio, while they were not known from KuramBio I abyssal stations. Thus, already the first three stations deliver answers to our scientific questions that we presented to you in last week's report after meticulous washing, sorting, the first analyses and determination of the species. It remains exciting because with each station and haul we gain new knowledge.

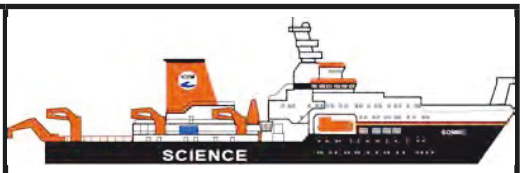
All participants are well and greet you and their families! Please send us the sun and a few centigrade air temperature to the Kuril-Kamchatka trench so that the fog here can be slightly dissolved.

Angelika Brandt, Center for Natural History (CeNak), (chief scientist SO250) and the cruise participants




The deepest record of a Seed Shrimp (Ostracoda) *Krithe* sp. (c) Hayato Tanaka & Hyunsu Yoo

# SO-250 KuramBio II
# 3. Weekly Report
# (29.08. – 04.09.2016)




FS. SONNE
45°31´N / 153°29´E

In the last week we finished our work in areas A6 and A5 and have started to work in area A4 in 8700 m depth. In the late evening of the 31. of August we had to interrupt our station work and return to Tomakomai due to a case of illness of a crew member who had to be brought to hospital. However, since Sunday morning 4 a.m. we are back in our study area and already map the seafloor of the Kuril-Kamchatka Trench on our way to area A4, in order to obtain more precise bathymetric information of the topography of our next research area A7 in roughly 9500 m depth. Due to our d-tour to Tomakomai (about 3.5 days) and additionally due to winch problems which caused and will continue to cause some loss of time during heaving of each gear deployment, we have to think

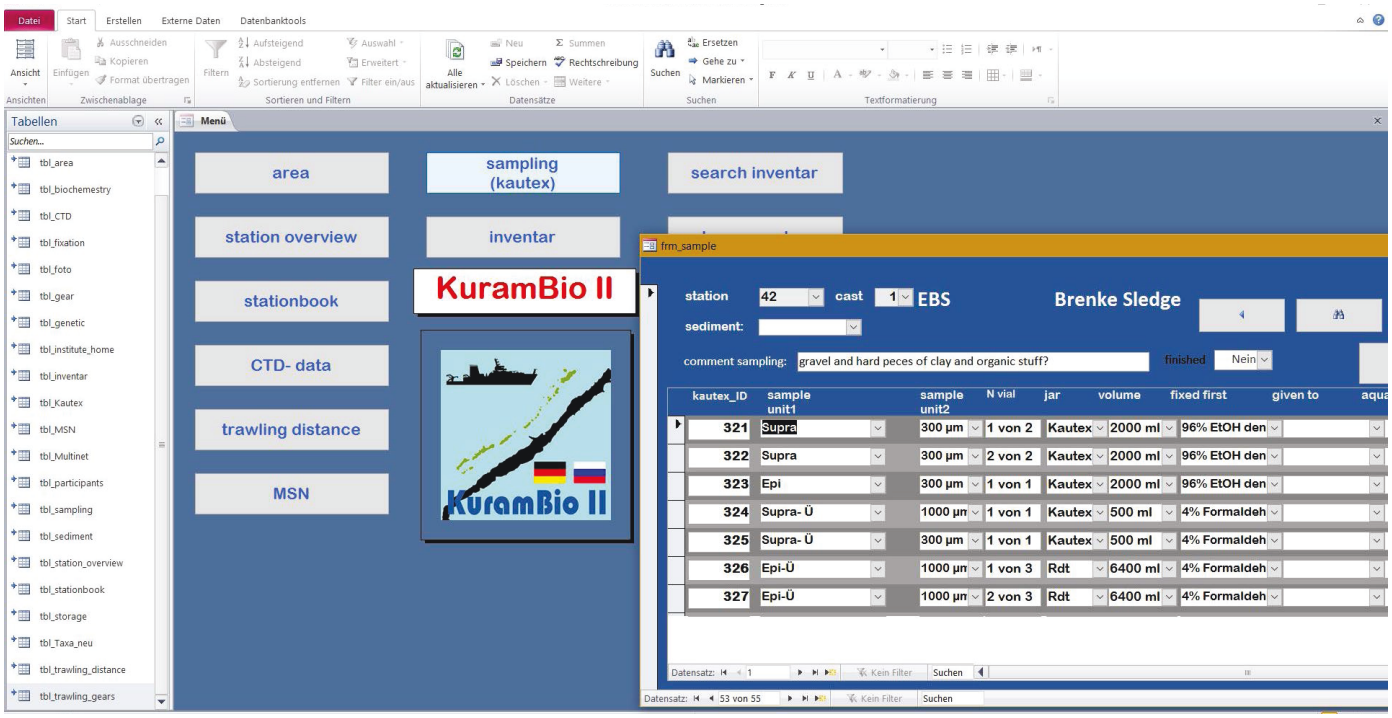



Fig.1: User interface of the on-board database when entering sample data for a sample of the epibenthic sledge (EBS) during the KuramBio II campaign..

Table 1: Summary of EBS catches sorted to higher taxon levels so far during the expedition KuramBio II.

| Taxa \ Area | Area A8 ca. 5100m | A6 ca. 6000m | A5 ca. 7200m | A1 ca. 8200m |
|---|---|---|---|---|
| Cnidaria | 14 | 11 | 1 | 7 |
| Mysida | 11 | | 15 | 27 |
| Cumacea | 40 | 16 | 11 | 27 |
| Tanaidacea | 105 | 3 | 11 | 6 |
| Ostracoda | 128 | 1 | | 25 |
| Copepoda Harpacticoida | 232 | 43 | | 86 |
| Nematoda | 180 | 89 | 1 | 211 |
| Amphipoda | 273 | 34 | 85 | 150 |
| Echinodermata | 138 | 59 | 14 | 356 |
| Copepoda Calanoida | 564 | 38 | 2 | 281 |
| Isopoda | 703 | 63 | 37 | 192 |
| Mollusca | 653 | 154 | 17 | 397 |
| Polychaeta | 1083 | 1261 | 224 | 978 |
| **Gesamtergebnis** | 4124 | 1772 | 418 | 2743 |

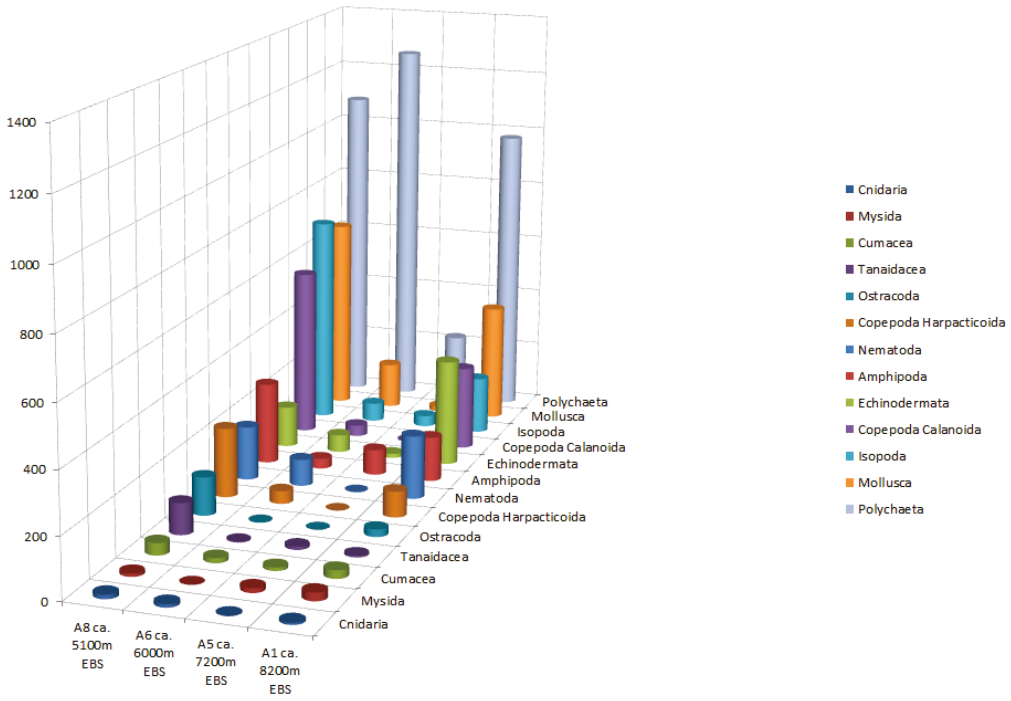



Fig. 2: Taxa composition of the epibenthic sledge catches made and sorted so far during the KuramBio II cruise.

of where and how to save on station time during the second half of the campaign. Until now we have decided to sacrifice the complete station work in area A2 in about 5000 m depth because this area is situated at the southeastern slope of the Kuril-Kamchatka Trench, where we already sampled a few stations during KuramBio I in 2012. This has already saved us about 2.5 days, but we will continue as planned with the other stations for now. In about 1.5 weeks we will have to decide again where and how we will have to save on time again.

Meanwhile we have used the steaming time to process and sort our samples further. In the last weekly report we explained which gear we used to answer our scientific questions. Today we want to focus on our samples and a few first results, because we have had three out of six working weeks so far and it is important to make an inventory now showing what we have managed to sample so far and whether we can be satisfied with our material obtained. For this purpose we want to shed some more light on our KuramBio II Access database. After the third week of sampling our database contains 1180 entries, which is reflected by the number of vials filled with organisms. We think this is quite a good number, as this number is based on only four completed working areas until now and considering that by far not all samples could be sorted on board.

Abb. 4: *Mesocletodes* is a genus of typical deep-sea harpacticoid copepods. This crustacean group is an abundant and diverse representative of the marine interstitial fauna. (c) P. Martínez Arbizu

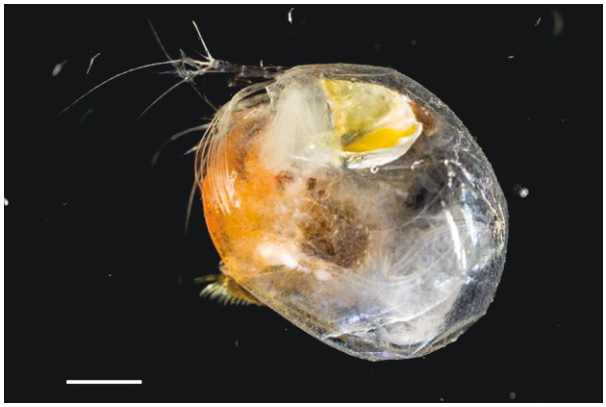


Fig. 3: One of the highlights of this week: *Gigantocypris* is by far the largest genus of Ostracoda. It belongs to the family Cypridinidae. This specimen was cought with a multi-closing plankton net from the mesopelagial. Scale: 2 mm. (c) T. Riehl

The main purpose of this database is cataloguing all collected animals. Our inventory will then allow us to keep track of the samples, where they are stored on board and which scientist will take care of them. We can also use the database for an extraction of some first results.

By the end of our expedition this database will be furthermore very valuable when writing the final cruise report, as we can use it to document and visualize the results obtained on

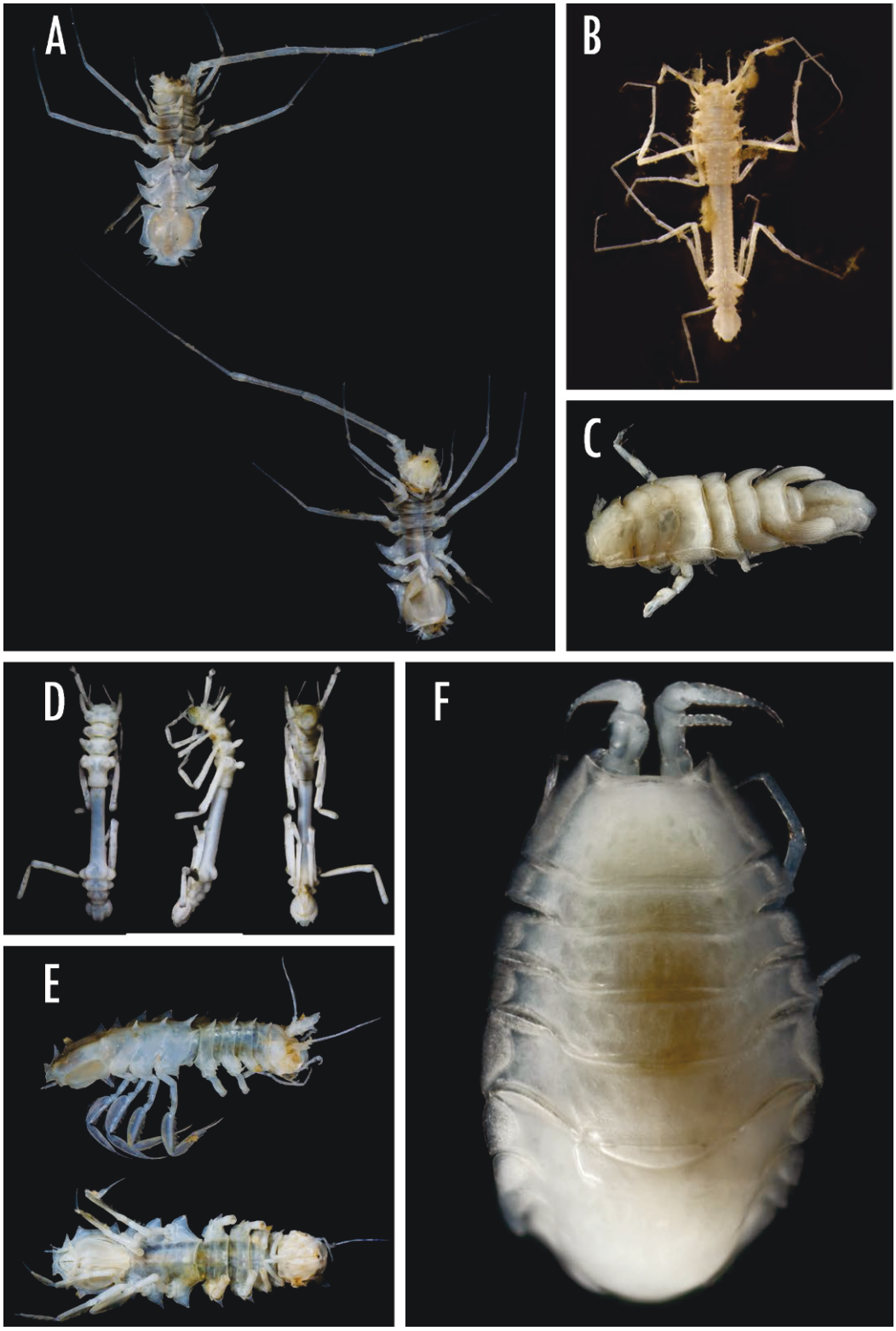


Fig. 5: Isopod crustaceans of abyssal and hadal depths of the Kuril- Kamchatka Trench. A, E: Munnopsidae; B, D: Ischnomesidae; C: Macrostylidae; F: Haploniscidae. Specimens are not shown to scale. (c) A.V. Lavrenteva (A, D, E), S. Brix (B), T. Riehl (C, F).

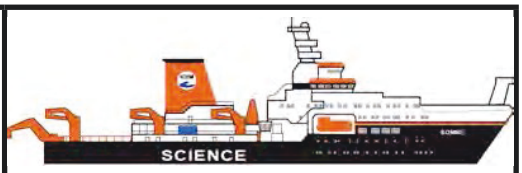
board during KuramBio II.

Until now we have sorted 15.988 invertebrates from the various samples and gears (GKG, EBS, AGT), most of these are polychaetes (4551 individuals). Bivalvia, however, also occur in the samples frequently (1290 ind.), as well as isopods (1241 ind.) and other taxa of crustaceans. Moreover, we already extracted DNA (COI gene) of 61 copepods, 60 ophiuroids, 40 tanaids, 40 amphipods as well as 20 isopods.

All participants are well and we greet you and our families!

Angelika Brandt, Center for Natural History (CeNak), (chief scientist SO250) and the cruise participants

# SO-250 KuramBio II
# 4. Weekly Report
# (05.09. – 11.09.2016)




FS. SONNE
45°12.9´N / 152°42.8´E

After our return from Tomakomai to the working area A4 at a depth of about 8700 m we could continue our work in the late afternoon of last Sunday. We first used the steaming time in our area permitted by the Russian authorities to map the seabed more precisely with the multi-beam echo sounder (but at full speed, which does not allow very high resolution). Then, back at station, we had to start with the multinet again, because the first trial had been interrupted last week in order to leave the station for Tomakomai due to the emergency. After this deployment we got the first sediment from depth 8700 m on deck by means of the large box corer (GKG), but it was full to the brim, and thus the surface of the sediment had been disturbed. For that reason we gave the GKG a second trial, however, with the same result and sediment up to the top of the gear. The first Multicorer (MUC) deployment did not release in the soft sediment and returned on deck empty, however, with muddy smears on the cores.

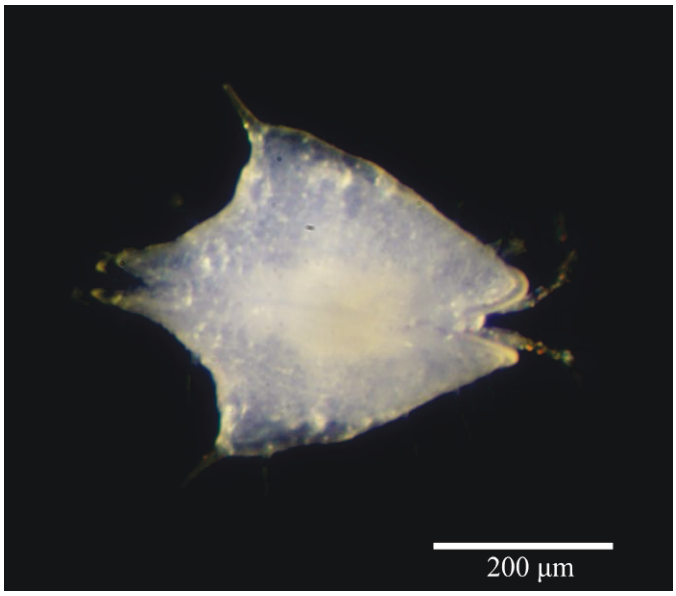



Figure 1: Seed shrimp (Ostracoda) of the genus Cytheropteron in dorsal view. This is the deepest record of an ostracod ever obtained. © Hayato Tanaka

We now know that the sediment in the central Kuril Kamchatka Trench has the consistency of soft serve ice cream, what makes sampling with coring devices difficult. That is because the devices require relatively resistant sediment in order to trigger the closing mechanism. We therefore changed our deployment strategy for the MUC and retrieved it at higher speed right after bottom contact without granting the otherwise often used few seconds for sediment penetration, in order to trigger the closing and avoid too deep sinking of the twelve cores. This strategy then brought us excellent material for sedimentology and meiofaunal research from depth 8700 m, and therefore we repeated this deployment once more. After additional three hours of veering and heaving, the MUC came on deck with a wonderful sample.

Figure 2: An EBS sample from 8700 m depth collected in the Kuril Kamchatka Trench during the KuramBio II campaign (working area A4). The benthos at this station was dominated by clams (Bivavia; white objects on the picture) and Foraminifera (Protista; brown stick-like creatures). © Marina Malyutina

All twelve cores were filled with sediment and there were still some 10 cm of overlaying bottom water, so that the sample was perfect and with an undisturbed sediment. Soon after a quick look into the cores, we recognized some small holothurians and worms on the sediment. In the laboratories we discovered a rich sample of copepods, nematodes and kinorhynchs, as well as, again another record, the deepest record of a benthic ostracod ever obtained (Fig. 1). This was very surprising, as it was previously assumed that ostracods cannot live at these depths, due to the enormous pressure (800 atmospheres) that requires enormous energy by the organisms to build up and maintain a calcareous shell. That is because free calcium carbonate would dissolve under such conditions. This sample was a great success. The following analyses of these samples in the labs back home will most certainly break additional records and bring us many more surprises.

The deployments of the epibenthic sledge (EBS) and the Agassiz trawl at 8700 m were also excellent

Figure 3: This ctenophore (*Beroe* sp.) was collected with a multi-closing plankton net in the working area A4 during KuramBio II. © Anastassia Maiorova

and brought - immediately visible to the eye - very large quantities of organisms, as depicted by the large quantity of small, white dots on the sieve that are shown in the picture. These are the shells of hundreds of minute bivalve molluscs that were sieved out from the muddy sample (Fig. 2).

On September 8th we reached the A3 region and after the deployment of CTD and the EM122 (echo sounder) we determined the position for the corers and towed equipment before we started deployment of the multinet. Besides collecting numerous interesting planktonic organisms, such as a comb jelly (Fig. 3), with this haul we were able to catch a large parasitic female isopod from the family Dajidae with her miniature dwarf male that was attached underneath her pleotelson (Fig. 5). These parasites usually infest decapod crustaceans. It is a rarity to sample these ectoparasitic organisms.

Until Saturday morning (September 10), we were able to work at this station, but then we had to weather a storm and stop the collection work. As we have no time to spare after the long journey back to Japan, we decided not to conduct the second AGT and EBS deployments in this area. Instead we mapped the hadal of the Kuril-Kamchatka trench in the region around the deepest of the planned sampling areas (A7) with the multi-beam echo sounder to retrieve even better topographic information (Fig. 6) in order to possibly shift this 9500 m station further to the southwest for saving

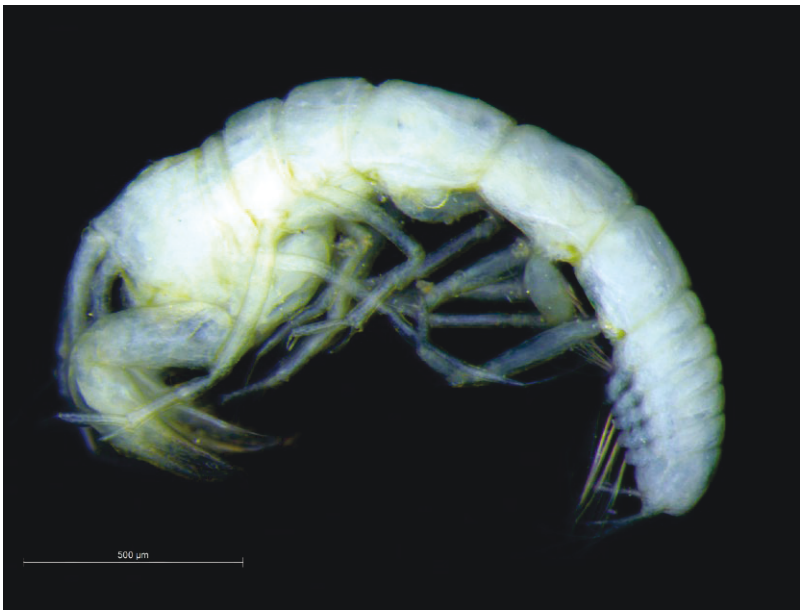



Figure 4: The tanaid crustaceans of the genus *Pseudotanais* was already collected frequently during the first KuramBio campaign and was also in the samples during this cruise, KuramBio II. © Magdalena Blazewicz

Figure 5: Parasitic isopods (Crustacea) of the family Dajidae collected at the Kuril Kamchatka Trench. Top: Female with male attached to the pleotelson (left); below: dwarf male. © Alexandra Petrunina

additional time. When we realized that the more western areas were shallower than hoped for we decided to stick to the originally planned 9500 m station. Once the weather was favorable enough again, we deployed the box corer at this depth. However, the signal from the contact of the gear with the ocean floor that we saw on our instruments on board casted doubt on the success of this deployment, as it looked like the box corer did not release and would return on deck empty. The contrary turned out to be the case. The gear brought a phantastic sample from the seafloor in 9500 m depth with a rich fauna, for example pogonophorans, derived polychaetes which feed chemosynthetically via symbiontic bacteria.

Meanwhile, we continued working in the laboratories on the first results for the cruise report. For example, of the tanaidacean crustaceans (Peracarida; Fig. 4) 212 specimens were sorted from EBS, AGT, and GKG samples collected at

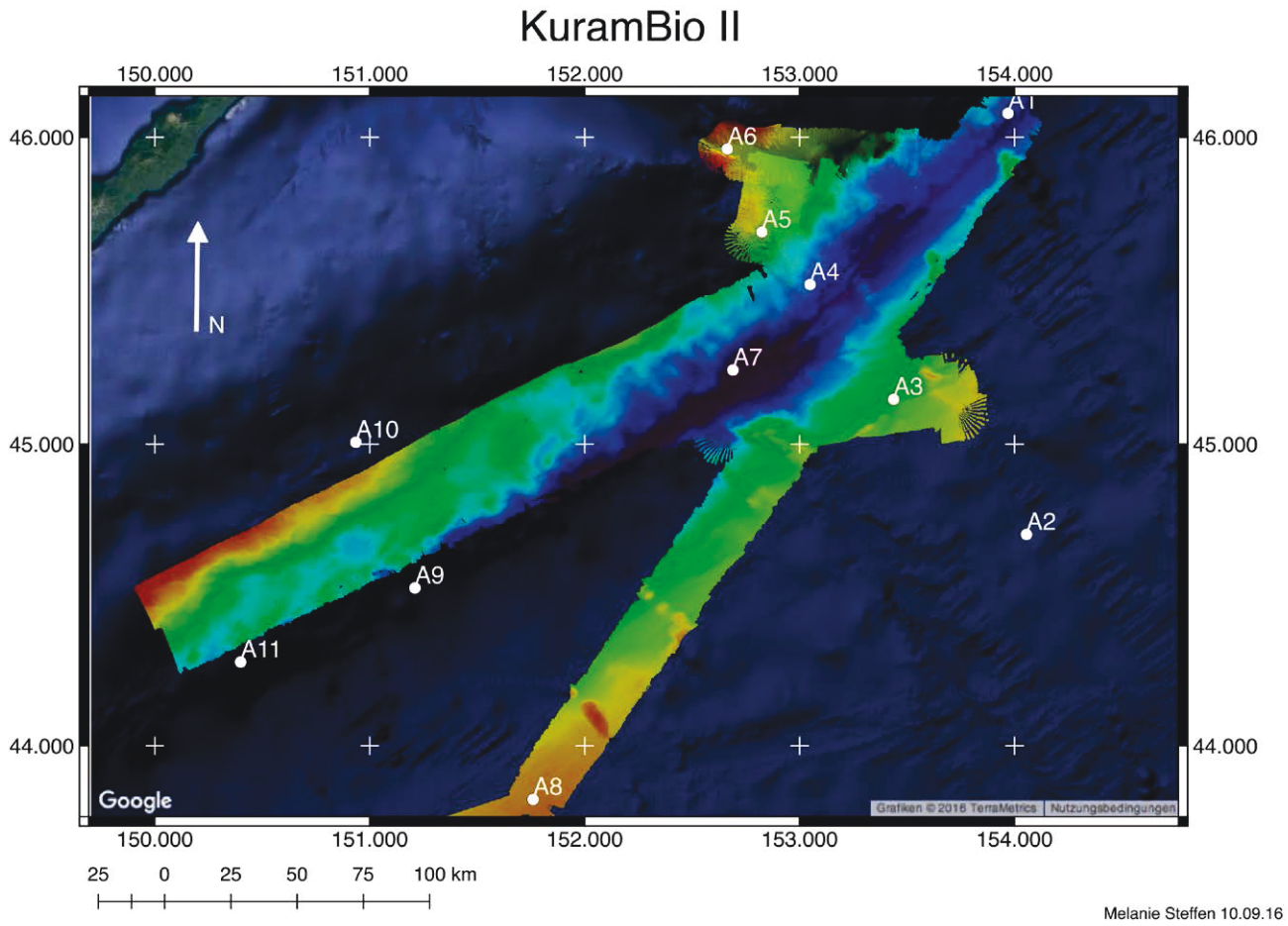


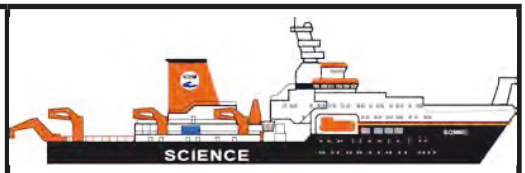

Figure 6: The new bathymetric data obtained during KuramBio II allows a more detailed view on the sea floor as compared to previous maps. © Melanie Steffen, Harbor City University Hamburg

the four areas sampled so far (A1, A5, A6, and A8). All of them were identified to family level. They represent all three known suborders, with clear dominance of Tanaidomorpha (90%). The most abundant family was the Pseudotanaidae (Photo) representing 35% of all tanaidaceans in our samples, followed by Akanthophoreidae (19%), Typhlotanaidae (10%), and Agathotanaidae (8%). Apparenty, at the abyssal area (A8: 5100-5200 m) Tanaidacea were much more abundant and diverse than at the deeper ones. Only at this area (A8) 65% of all sorted tanaidacans were found. Areas A1 (8191-8250 m) and A6 (6050-6228 m) were clearly less diverse, however, at each of these, a few specimens of the families Pseudotanaidae and Akanthophoreidae were also identified. Until now, DNA extractions were done from 96 specimens and the first PCR reaction using the COI marker is tested.

Everybody on board is well, though we all miss the German summer. With best wishes home, please keep some warmths for us upon return!

Angelika Brandt, Center of Natural History (CeNak), (expedition leader SO250) and all participants

# SO-250 KuramBio II
# 5. Weekly Report
# (12.09. – 18.09.2016)




FS. SONNE
44°39.05´N / 151°27.34´E

World record with full nets

Last Sunday we had to weather a storm and made use of the time for bathymetric scanning of the seafloor. On Monday we first started sampling in working area A9, that we passed by during mapping. Also, the sea was more favourable at this locality with lower wave hights than at A7, which was originally planned to be the next site. At A9, we spent one day mapping the sea floor and deploying CTD, plankton net, box corer as well as multiple corer. But then we couldn't wait any longer. We returned to the deepest of our proposed working areas (A7) at 9581 m depth, where the hadal seafloor

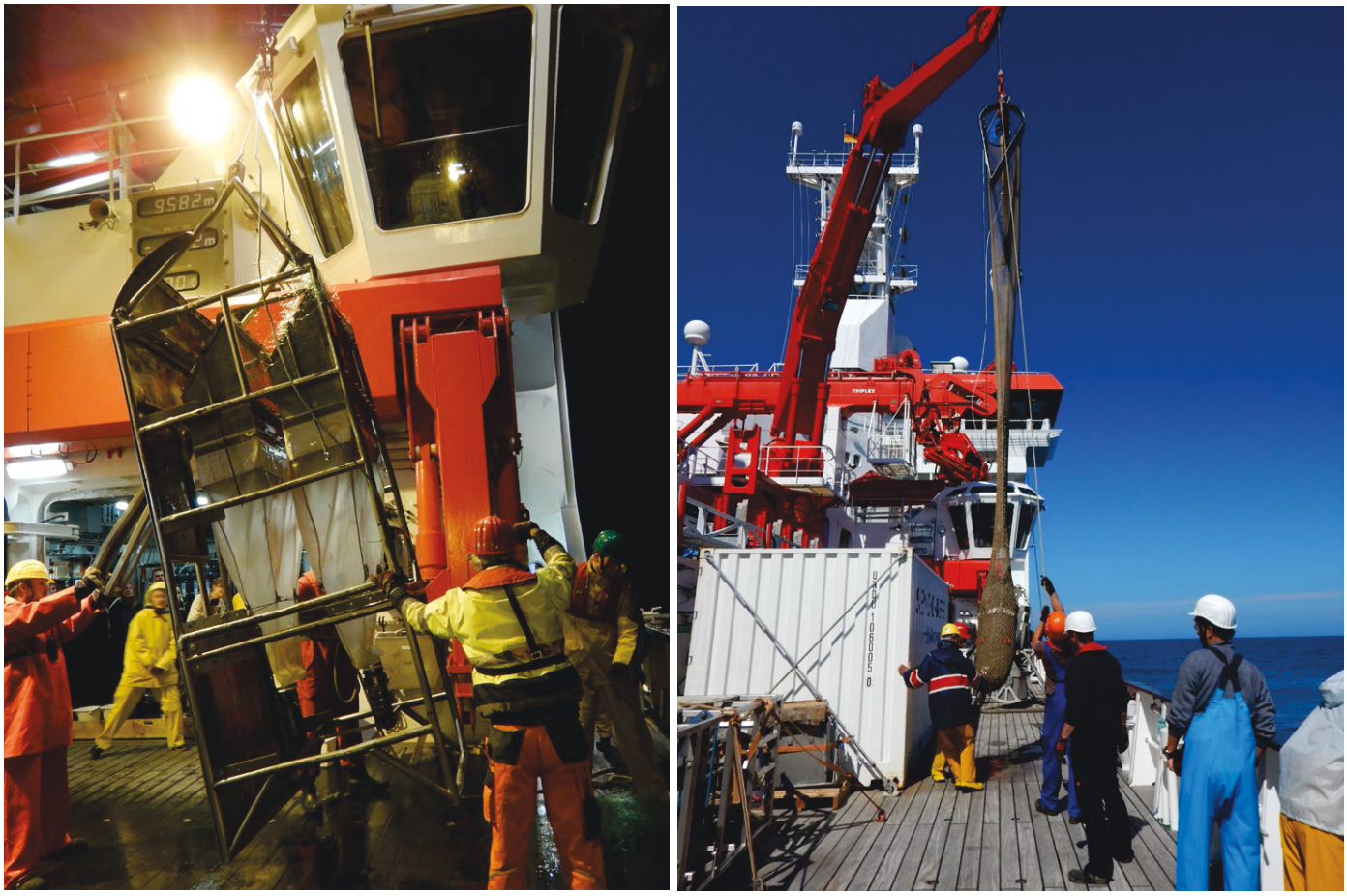


Figure1: The epibenthic sledge (EBS) „META" (left) and the Agassiz Trawl (AGT, right) are heaved onto the working deck of RV Sonne after the record-breaking deployments. The fine-meshed nets of the EBS and the wider AGT net held sediment and organisms from 9581 m depth. This was the deepest deployment ever conducted with an EBS. (c) Angelika Brandt

lies deeper below the surface than the altitude of the Himalaya. Sampling in such depth reqires lots of patience from both scientists and crew because each deployment takes a lot of time. Each trawl with the epibenthic sledge, for instance, or the Agassiz Trawl took more than twelve hours. During the first box-corer deployment the rope tension at bottom contact was inconclusive. It appeared as if the closing mechanism had not been triggered. In this case, the gear would have come back to the ship empty. However, the opposite was the case. After more than seven hours deployment the sediment surface was still undisturbed when the box was pulled out from the corer, the water crystal clear. It was a fascinating moment! Deep-sea floor from more than 9500 m depth! Although it had been our plan to conduct these deployments all the time: it was hard to believe that this relatively small device just had successfully collected the sea floor at almost 10 km beneath RV Sonne and put it right in front of us.

Figure 2: The proud EBS team after the successful deployment in 9581 m depth during the KuramBio II expedition on board RV Sonne. (C) Oliver Meyer

The immediate sieving and fixation of the samples revealed numerous bivalves and pogonophorans - chemosynthetically feeding relatives of the polychaetes. Afterwards, we tried to take meiofauna and sediment samples with the multiple corer (MUC). Despite trying to adjust the setup of the gear and the deployment protocol, we did not succeed and had to come up with an alternative plan. Instead, we deployed the box corer once more and took subsamples manually with the MUC cores.

Then, we ventured to deploy the epibenthic sledge (EBS). The head of EBS operations, Nils Brenke, had to make use of the full length of available cable, 11,000 m, that is available on the winch of RV Sonne. This was not the first time because already during the maiden voyage of RV Sonne (Vema-TRANSIT; SO 237) EBS samples were taken from the bottom of the Puerto Rico Trench. However, the key difference between these deployments was that here at the KKT the water depth exceeds that of the PRT by more than thousand meters. As a consequence the EBS could not be deployed in the usual way, using a cable length 1.5 times that of the water depth, simply because it is not available. It was hence not clear if the EBS would reach the ground. Despite its weight, currents may cause drifting and the bottom may not be reached. It was a challenge! We reduced the towing speed but trawled for longer time, about one hour. The expectations and anxiety were thus high when the EBS broke through the surface after many hours of deployment. Everyone cheered when we saw that indeed there were nice samples in the cod ends of the EBS (Fig. 2). Echiurids and elpidiid holothurians (sea cucumbers), amphipods, bivalves (clams, mussels) and many other taxa were comprising this sample.

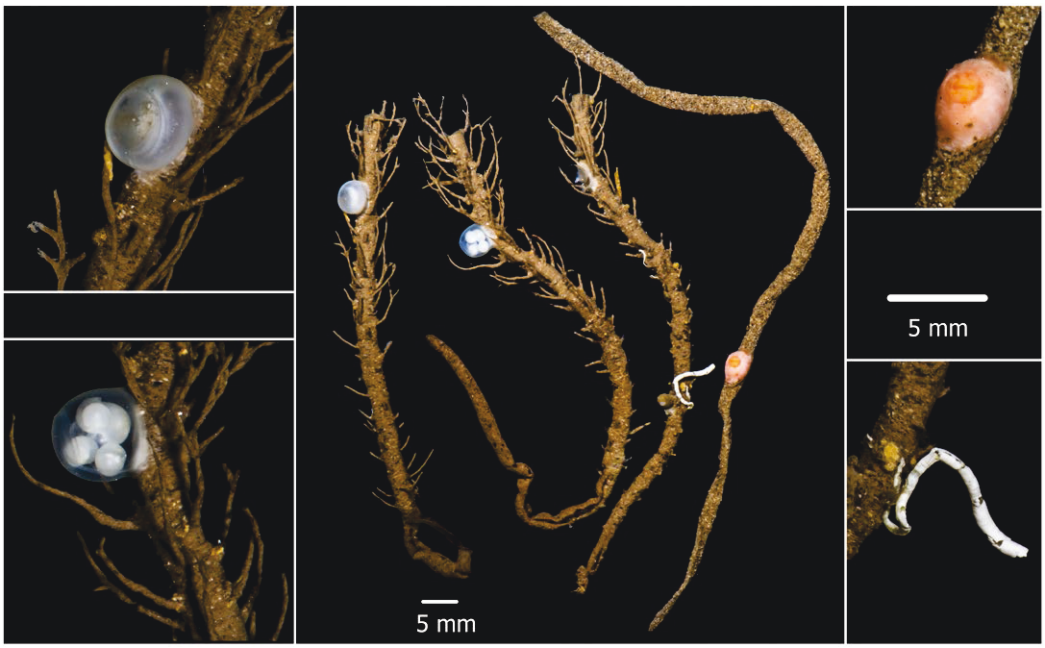



Figure 3: Hard structures are rare in the sediment plains of the hadal and abyssal. Accordingly, sessile organisms make use also of „artificial" hard substrates, such as these tubes built by polychaetes. In this case they are inhabited by other polychaetes, cnidarian polypes, and have been used for egg deposition. (c) A.V. Lavrenteva

Subsequently we were as excited while awaiting the AGT. Just as the EBS, the deployment was successful and we collected loads of megafauna organisms from the hadal – more than 1100 holothurians for example (Fig. 4). Like at all sampling sites before we also encountered a high diversity and richness at this deepest station. This also includes organisms that make use of calcium carbonate for skellettal hard structures. Accordingly we are able to reject the hypothesis that such organisms cannot thrive below the calcite compensation depth (depending on the region between 3000–5000 m) due to problems with building up calcareous structures.

After we finished the deepest hadal station successfully we mapped our way towards area A10 during the night and star-ted collecting more samples in the early morning of September 17. First we deployed the plankton net. After the


Figure 4: The small sea cucumber or „sea pig“ *Elpidia* cf. *hanseni* was caught in large numbers by the trawl in 9581 m depth. (c) A. V. Lavrenteva

deployments of a box corer and two multiple corers the EBS presented a totally different sediment as compared to the closeby hadal stations. It contained sand and gravel with small stones. This site is located at the upper slope of the KKT towards the Sea of Okotsk and is apparently affected by strong currents eroding the smaller sediment particles. Nevertheless we already got a glimpse at the many small critters that the sample contained during washing and sieving it. It was clearly shown that the hadal organisms of many taxa are really larger at abyssal depths than here in the abyss (gigantism, we briefly mentioned that in an earlier report).

Finally the AGT apparently got entangled at the seafloor, possibly amongst large boulders. The head of operations, Kirill Minin, got quite nervous while awaiting his gear back on board. The AGT net indeet arrived in a desastrous state of destruction, however, the net still contained the sample. It was comprised of manifold megafauna organisms with many different species of sea cucumbers, as well as several big stones.

After finishing all stations at A10 we returned to A9, where we had already started sampling on Monday during bad weather. We completed our set of deployments with each one multiple corer, EBS, as well as AGT. Subsequently we continued mapping the seafloor around the final site A11 in order to understand the bottom topography better and make capable decisions as to where to deploy the benthos gear. However, about those stations we are going to report next week.

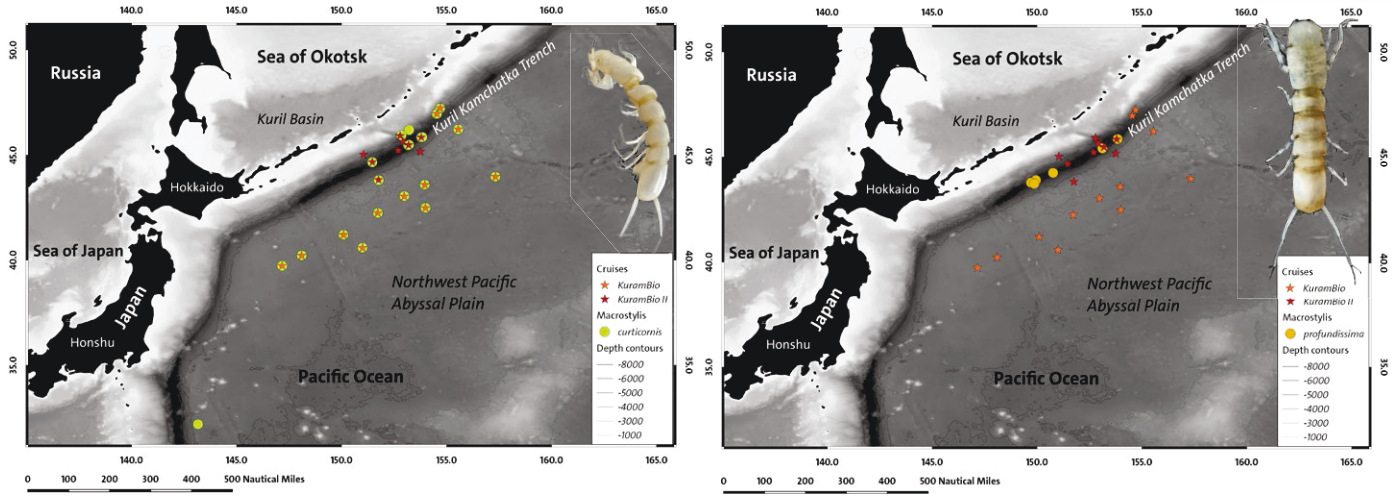



Figure 5. Distribution of the isopod species *Macrostylis curticornis* Birstein, 1963 and *M. profundissima* Birstein, 1970 (Macrostylidae) after preliminary sorting and taxonomic identification. Both species are currently only known from the North-west Pacific and show morphological similarities. The distribution patterns are however different: While *M. curticornis* (3-10 mm) occurs on both sidesof the KKT in abyssal as well as hadal depths the much smaller *M. profundissima* (1-3 mm) seems to be restricted to depths deeper than 7000 m. In the home laboratories molecular genetic analyses will help to test if there is differentiation across the trench and whether or not we are dealing with one or several cryptic species. (c) Torben Riehl, CeNak

Already now, after our on-board sorting and taxonomic identification, interesting distribution patterns become appa-rent. We found species for which the Kuril Kamchatka Trench seems to be no barrier. They were found on both sides as well as in both hadal and abyssal depths. Other species occur only within the trench; again others were collected only on one side. This was the case, for instance, in different species of the isopod family Macrostylidae of which selected preliminary results have been documented by Torben Riehl using distribution maps (Fig. 5).

Everybody is well on board! Best wishes for you and our families!

Angelika Brandt, Center of Natural History (CeNak), (expedition leader SO250) on behalf of all participants

10,542 m water depth at 44 ° N 150 ° 07:00 18:00 O refuted!

Thank you and goodbye!

The last week ended as exciting as the new week began. “Between the weekly reports“ have been mapping the seafloor bathymetry using the EM122 overnight in search of the deepest area in the Kuril-Kamchatka Trench which was supposed to be located in the region covered by our Russian work permit. Melanie Steffen, who did this night shift for us, first saw it, but in the morning it became clear to all of us: there would be no hadal area deeper than 10,000 m water depth near the station region A 11 whatsoever. Accordingly, the bathymetric charts and data in the literature are incorrect and need to be revised (Jamieson, 2015).

Figure 1: Group picture of the scientists on board RV Sonne during the expedition KuramBio II.

Because we wanted to sample a fifth station at hadal depths in the middle of the trench we chose the deepest area in this region and thus could sample once more in > 9500 m depth. We again deployed our devices successfully and now have data for a very good comparison at this great depth.

Comparable to the last very deep station at 9581 m, one could immediately recognize that the diversity of organisms was significantly lower than at abyssal depths, but the abundances of species that occurred in the samples was immense. You had already a look into our full sieves (bivalve molluscs) in the last weekly report from the other very deep station and also already saw the large numbers of „Sea pigs“, elpidiid sea cucumbers. Now we had a déjà vu in this last station area and immediately saw these species again in high numbers. Our work in this last station area was completed on

Figure 2: The Agassiz trawl is heaved back on board. After the last, very deep (> 9500 m) station the net is extremely full. These metric tons of mud from the seafloor kept the scientsts busy for the rest of the night and half of the day sieving. (c) Angelika Brandt

Thursday, September 22, at about midnight with the deployment of a multinet. We are now on the way to Yokohama, where we will arrive on Monday morning. The laboratories are now empty again, everything has been packed back into the expedition boxes and these are now already in the containers thanks to Nils Brenke's professional logistic planning.

During the expedition SO250, KuramBio II, we have sampled 106 stations with a standardized deployment of our gear. In total, we have deployed 53.100 m of single-conductor cable and 619.841 m of deep-sea wire during the course of the last six weeks.

In addition to the compulsory weekly reports we also informed the public about our work by means of 42 daily logs in three languages (German, English, Russian) published via the Senckenberg Museum (http://www.senckenberg.de/root/index.php?page_id=5253&blogEntryID=450). Highlights have been posted as well on the website of the University of Hamburg as well as on social media.

Our Access database has recorded 869 numbers for Kautex jars as well as 3123 inventory numbers for sorted samples. We bring very extensive animal material and PCR products home besides wonderful memories.

Now it is time to say thank you, because we have to leave the ship tomorrow. We do this with mixed feelings: one laughing eye (we look forward to our families) and one crying eye (we love the sea, our work, and the team

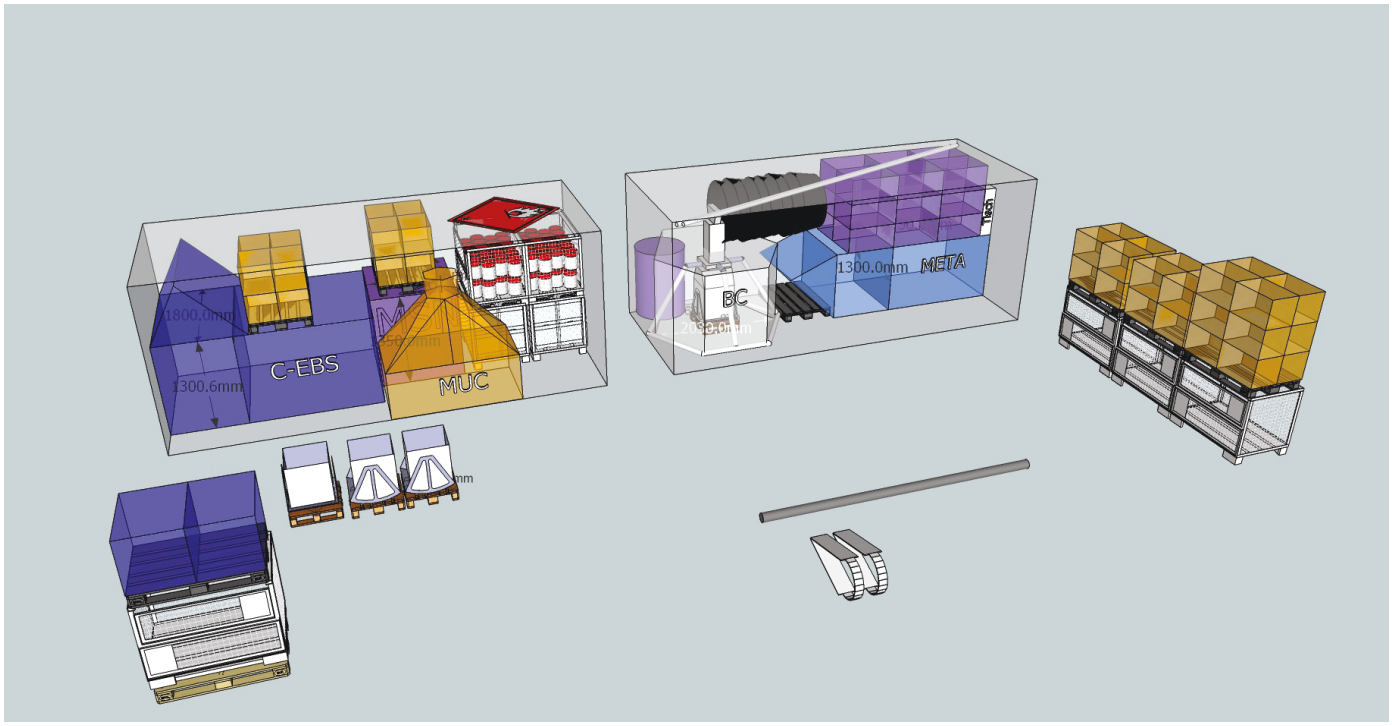



Figure 3: Packing the containers is a logistic enterprise that requires precision. (c) Nils Brenke.

Figure 4: Sunset on the northwestern Pacific Ocean. (c) Torben Riehl

on board). Many thanks to captain Oliver Meyer and the great team on the bridge, on deck, in the engine room, behind the technology and the cooking pot! Thanks also for the very friendly hospitality and helpfulness throughout the journey. Thank you all for your help, professional work, and your kindness.

Dear scientists, colleagues and friends here on board. Without you, your constant and tireless commitment at any time, day or night, your help and support of my work on the yellow deck and your indulgence with me have helped this expedition heaps! We can already look back on a very successful expedition. This was excellent teamwork – thanks a lot!

On behalf of all scientists I thank the Ministry of Education and Research for providing the FS Sonne for this expedition as well as the necessary consumables (03G0250A) and the shipping company Briese for logistics.

Best wishes to you and our family sends - for the last time during the expedition KuramBio II -

Angelika Brandt, Center of Natural History (CeNak), (chief scientist SO250) on behalf of all participants.

Citation: Jamieson, A. (2015): The Hadal Zone. Life in the Deepest Oceans. Oxford University Press, 1-382.