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HELMHOLTZ-ZENTRUM FÜR POLAR- UND MEERESFORSCHUNG

HELMHOLTZ GEMEINSCHAFT

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About wihches, wires and worms

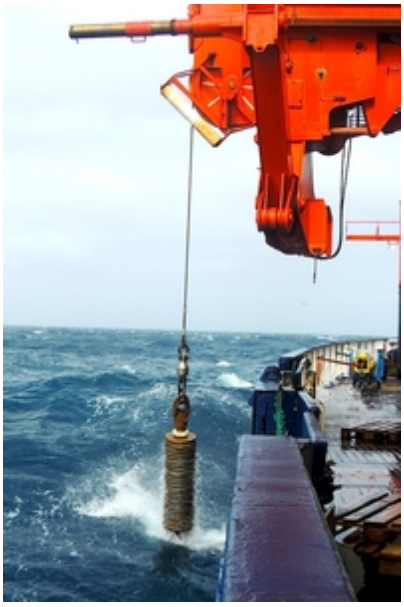
Fig. 1: The gravity corer on starboard.
Photo: V. Schlindwein

Last week, we changed the focus of our activities from the search for hydrothermal plumes towards the sampling of the seafloor at selected target sites where we previously had done heat flow measurements and obtained extensive video coverage. Sampling brought along the use of different tools, a welcome change for everybody. During a period of calm weather the deck's crew dismantled the airgun launch-way and lifted all necessary instruments with the large crane to easily accessible places.
At the moment, we use 7 different instruments that are operated on 4 different wires using 3 different winches. The CTD has its own winch and cable. The heat flow probe is launched on the starboard side using the so-called coax cable. If the video-instruments TV-MUC, OFOS or TV-grab are to be used, the glass fibre cable has to be mounted at the same location. Gravity corer and Agassiz Trawl are connected to a wire without power supply. The gravity corer goes over the starboard side, but the Agassiz Trawl is towed behind the ship requiring a shifting of the wire between measurements. For efficient cruise planning and realization it is therefore not only necessary to think about a good science plan, but a good share of logistical knowledge is as least as important. We effectively combined measurements and used transit times to avoid interruptions of the survey programme as much as possible for logistics. Since we entered the survey area on November 15th, we have employed almost 60% of the ship time exclusively for research stations. 14% of the time we sacrificed to poor weather and only some 26% of the time fell into the category ship positioning, transits, logistic demands and bathymetry surveys - a very satisfactory balance in the stormy "Furious Fifties".
On Monday, we pulled two 6m long sediment cores out of the depths at our "Hot Spot" site and could confirm elevated temperatures. During the following night for the first time, the Agassiz Trawl brought us organisms from the deep sea on deck – sea cucumbers, sea stars and worms that were admired by everyone and that are introduced more in detail in today's report of the biology team.

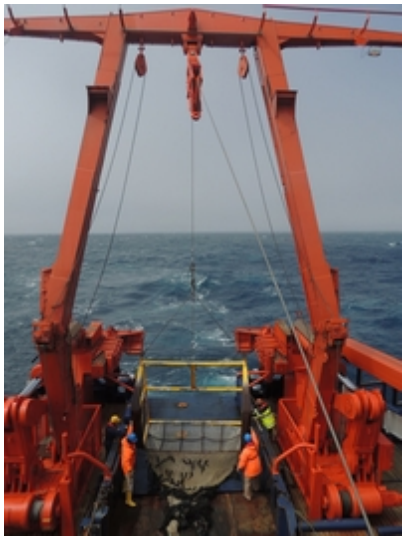
Fig. 2: Launching the Agassiz Trawl.
Photo: V. Schlindwein

Tuesday was a really black day – at first the heat flow probe got entangled in its wire and, when lifted out of the water, it freed itself in a jerk and got deformed. Later on, the CTD had a technical problem. We spend the night slightly restless on a rolling ship as we had decided on a bathymetry survey pattern to wait for better weather and for the repair of all our equipment. On Wednesday and Thursday we continued our sampling programme in the main survey area. On each location we probed the uppermost sedimentary layer with the TV MUC, gravity cores revealed the deeper sediment layers, the Agassiz Trawl brought us specimen of the fauna on deck. Environmental parameters of the water column and the seafloor had already been measured with the CTD and the heat flow probe. 1 o'clock a.m. on Thursday we waited - unfortunately in vain - for the surfacing of the last OBS, which should have detached itself automatically from its anchor. We speculate that it might have sunken so deeply into the very soft mud at the seafloor that it couldn't free itself. We therefore had to give up the OBS and continue our journey westwards where we wanted to search for hydrothermal plumes in the vicinity of known sulphide deposits. However, the CTD didn't show any anomalies and the OFOS

Photo: V. Schlindwein

experienced a technical delay such that we decided to give up our search on this location. On the newly acquired bathymetry map we had meanwhile discovered fields of peculiar crater-like structures on the seafloor. Circular basins of roughly kilometre size that are surrounded by an about 200 m high rim reminded us of a landscape on Moon. We geoscientists hoped that these craters might be the expression of unusual off-axis volcanism and we were deeply disappointed that even the steepest slopes of these craters didn't expose beautiful rocks but the OFOS again showed wonderful deep-sea fauna on sedimented seafloor. The TV-grab, however, returned with a full load of sticky mud that contained numerous little chunks of rock, a large portion obviously of volcanic origin. With loads of water, shovels, sieves and even more patience we freed the rocks from their muddy cover.
This was just the proper occasion for the geologists on board to honour St. Barbara, patron of geologists and miners, with the traditional party held at many geoscience universities around December 4th, St. Barbara's day.

We send our kind regards back home

Vera Schlindwein
On behalf of all cruise participants

52° 10' S 14°9'E, +1,7°C, Wind 6 Bft.

Sea cucumbers, brittle stars and acorn worms: Life at 4000 m water depth

(Antje Boetius, Dirk de Beer, Sebastian Albrecht, Sergey Galkin, Yann Marcon, Massimiliano Molari, Axel Nordhausen, Amandine Nunes-Jorge, Norbert Rieper, Fabian Schramm, Rafael Stiens, Wiebke Stiens)

The geo-biologists on board cannot get enough seafloor time to watch their favorite animals. This stretch of the Southwest Indian Ridge is under influence of the Antarctic bottom water, the Atlantic Deep Water and the Indian Ocean, and the bio-geography of its seafloor communities so far remained a mystery. Where do the creatures come from that inhabit the sea floor at over 4000m water depth? What do they eat, and are they using chemical energy provided by hydrothermal vents, with the help of microorganisms? This region is biologically largely unexplored because wind and waves of the "Furious Fifties" have so far prevented research vessels, submarines and underwater robots to study seafloor life.

The icebreaker RV Polarstern, however, can deploy our relatively storm proof video-guided devices despite the 4-6 m waves and a stiff breeze. We use the fiber optic cable of RV Polarstern to tow integrated camera and sensor systems over the ground and to transmit images of the seabed residents. This is called "Sea cucumber-Television" on board. The sediment-eating sea cucumbers are actually the most common life found between the steep valleys of the Southwest Indian Ridge. We have counted over 15 species, some of which are more than half a meter long. But there is more to see: sea urchins, starfish, feather stars, sea anemones, sea lilies, deep-sea jellyfish and acorn worms impress us with incredible colors and shapes.

Why does this chilly deep area host so much life? Are the animal assemblages showing us the way to hydrothermal vents? When we start our dives to the seafloor, we note at first that also the surface waters are teeming with life: We are at the polar front, where at this time of the year diatoms have bloomed and now sink in the form of large flakes ("marine snow") to the seafloor to be eaten by the hungry benthic residents. Indeed, we find that the sediments are covered by greenish particles. In fact, the sediment cores are almost exclusively composed of the glassy shells of diatoms, because this region belongs to the famous silica belt of the Southern Ocean. But is there a specific influence of the Southwest Indian Ridge system on the distribution of life at the seafloor? Even though we still have not found hot vents or black smokers, the rugged rocky ridge system apparently plays an important role as sediment trap. Large amount of sediment accumulates on the slopes between the ridges, and the composition and density of the benthic communities increases significantly from the abyssal plain to the ridge system. Also, the mere presence of rocks and stones changes the diversity of life. Many animals like to sit on solid ground - and the mixture of rocky and soft bottom, that we find here, apparently creates particularly colorful communities.

Of these, we would like to give you a little taste here:

Fig. 3: The figure shows clockwise from top left: A sea anemone, three different species of seacucumbers, a coral, sea anemone, an acorn worm, which decorates the sea floor with spiral excretions, another sea cucumber, sea anemone, and in the middle of the image a transparent sea cucumber. The organisms are between 10 and 50 cm tall. And really, most bottom dwellers here come in those pretty pastel colors