

Weekly report no. 4 (ANT XXI/2) RV "Polarstern" 08.12. - 14.12.2003

This week we have started with our main work. At the beginning we were in a field of pack ice further northeast near Atka Bay, the site we had chosen for our large-scale colonisation experiment. Unfortunately there was not much hope that the tricky ice conditions would change, and the benthic community did not agree with our expectations either. So we sent out a helicopter for ice exploration that detected a large, ice-free area of water on the way to Kapp Norvegia. As a result we gave up our initially chosen site, left the traps and one mooring under the ice and changed our position to the new site near the iceberg-resting place Austasen. Studying the site with photo sledge and underwater video (ROV) we found the right benthic community in an acceptable water depth (300m). Here was the rich, three-dimensional community of sponges, bryozoans, sea squirts, and cnidarians that we have studied for more than a decade, especially well developed. A disadvantage is the larger distance to Neumayer Station, a place annually visited and so the juxtaposition of an experimental site would allow us to closely control the colonisation of the bottom in the coming years. Off Austasen we have worked since Tuesday, calm and safe like in Abraham's lap, because of the extended pack ice fields that border our lagoon. We have worked in gorgeous South summer weather and in front of a great scenery of shelf ice edge and icebergs that pile up in the resting place and around it.

The "Benthos Disturbance Experiment" (BENDEX) is the heart of this expedition. We know that benthic communities on the Antarctic shelf are constantly disturbed by icebergs which scour the bottom of the sea while drifting around the continent or when running aground at certain sites because of the sites' special topography. We call these accumulations of icebergs now "resting places" and not "cemeteries" as before because they are set free after a while due to the influence of storms or tides. Where icebergs scour or run aground the entire bottom fauna is destroyed and a complicated process starts of re-colonisation and succession of different stages of succession, which - if no further disturbance happens - will once again attain the rich, well-structured community that we know from the area around Kapp Norvegia. And the "when" is the important point. Until now we know of a wide range of typical succession stages in icebergs scar marks. But because we have always encountered existing cycles we do not know which stages follow each other in what time scale, and how long the entire benthic community needs for a complete recovery. The ability to recover is a measurement for vulnerability and resilience of an ecosystem. For comparison, simple marine ecosystems like the bottom fauna communities of the North and Baltic Seas recover quickly after disturbances whereas complex systems like tropical coral reefs need much longer. It also depends on the ecosystems' familiarity to disturbances. Possibly the Antarctic ecosystem also needs a long time for an entire recovery from disturbances (this means it may be less resilient and therefore need special protection) but this hypothesis requires proof.

In the framework of BENDEX we try to simulate an iceberg scar. We will clear an area of 1000x100 m of its fauna, mark it with pinger buoys and trace the re-colonisation process from time zero during the next years. Before the disturbance Julian's group had to record the natural community with UW video and photosledge, then Dieter and colleagues took samples from undisturbed patches by multiboxcorer and giant boxcorer and took further photos. This took place more or less without any problems, although the multicorer for the meiofauna failed because of the dense sponge spicule mats. But the real problems started with the first bottom trawling to remove the living sea floor surface with a modified bottom trawl. After a few minutes the trawl was so heavy due to the caught sponge spicule mats that it did not leave the bottom at initial hauling but continued to collect material. When it hung free in the water column it ripped open at the upper and lower shield because of the enormous pressure. At times the trawling gear had to lift 36 tonnes. With freeing the net from the bottom the problems were not over because the intact tunnel and codend still brought more than 5 tonnes of tightened sponge material on deck that could neither be emptied nor sorted in an acceptable time. For the second trial a kind of valve was put into the net; the net was cut at the codend and closed with a thin piece of line to rip open under pressure. But this did not work either because the sponge spicules settled in the cod end like a block so that the first mate had to cut this "emergency exit" open with a knife in a not harmless looking action. Now Rainer is wondering how the cod end can be opened under water; an idea that is not popular to many cruisers who hoped for material. We still work on the solution of this problem whilst trying to be fair to all thoughts and interests.

Our planktologists Anna and Jan are especially active at night times when heavy gear cannot run. They are studying the summer "wake-up" of the pelagic zone, which is producing more and more planktonic algae (especially centric diatoms) every day. By now these algae have colonised the upper water layer down to over 100 m depth. This young bloom has called many large, herbivorous copepods into action that have started to produce faecal pellets and to begin reproduction. Eggs, larvae and juveniles of the ice krill were also found in the water column but not yet in large numbers, and predators are rare. The planktologists work in close collaboration with the different benthologists' groups to jointly account for the benthopelagic coupling during this time of the year.

A welcome by-product of the plankton catches have been some well developed larvae of the deep-sea shrimp *Nematocarcinus lanceopes*, that occurs down to 4000 m depth, - and these have been in the surface catches. We had searched for these larvae for years!!! Sven and the chief scientist, both celebrating their birthdays on the 10th of December, asked for a "fun trawl" with the AGT at 1500 m to catch egg-carrying females of this species. And it worked! Now our hope is that the numerous shrimp larvae develop through the different larval stages in the cooling container. Another joker in the deep AGT were yellow, stalked crinoids (sea lilies), also searched for by colleagues for years. Animals of this type were common

in Cretaceous seas but are nowadays limited to the deep sea and are not common. We have to come back to this site with Dieter's multiboxcorer to take in situ photos of this community.

As you can read, it is exciting in Antarctica! Luckily we still have some time to look out at the incredible landscape around us or to watch the tiny Wilson's storm petrels that seem to think that "Polarstern"'s front deck is a good rock for breeding. Using the beautiful Sunday weather Captain Domke called for an abandon ship manoeuvre, during which some lucky ones of the crew and science were able to cruise around icebergs. Those who preferred it cosy were able to go to the pre-Christmas decorated "Zillertal" bar and to sip Moni's Irish coffee listening to Christmas chorals. Some really switched on ones tried to combine the two, boat journey and Irish coffee... The nice thing about "Polarstern" is its variety; here everybody can enjoy himself/herself and therefore the mood on board is good.

Best wishes from Antarctica, Wolf Arntz