Weekly pictorial – WEEK 3: Boring coring

For the last three weeks we have spent our time using various cameras and sleds to catch glimpses of every-day life in the Deep. Certainly, the photos and the biological specimens give us an appreciation of what the world is like in the cold, dark bottom waters of the Chatham Rise. From photographs, however, the sea-floor in soft-sediment environments can appear pretty monotonous and boring (Figure 1). In fact, we have to agree that it is a little difficult to get really, really excited about burrows, non-descript mounds and the tracks of usually anonymous animals criss-crossing the sediment surface. But if you dig a little deeper, the busy and fascinating micro-world of the smaller animals and microbes that live in and on the seafloor can be revealed. As part of the Oceans Survey 20/20 Chatham-Challenger Hydrographic, Biodiversity and Seabed Habitat project, we are trying to obtain information on this dynamic, unseen world by collecting sediment from the sea-floor using equipment called corers. In essence these are really just fancy (and expensive) scoopers of sea-floor sediment, but what they do is bring back to the ship an intact core of seabed material that we can then photograph, describe, preserve, manipulate and also sieve for the microscopic animals we are interested in.

Figure 1: Burrows and trails on the deep ocean sea-floor nearly a kilometer below the sea surface.

Our main coring tool is the multi-corer which has several large diameter, polycarbonate tubes that are pressed slowly into the sediment by overlying weights (Figure 2). The multi-corer is hauled in and out of the ship using a wire attached to one of the ship’s trawl winches. The beauty of the multi-corer is that the fragile interface between deep ocean soft sediment and the overlying water is usually recovered intact, so what you see in the cores is an actual small part of the sea-floor real estate.

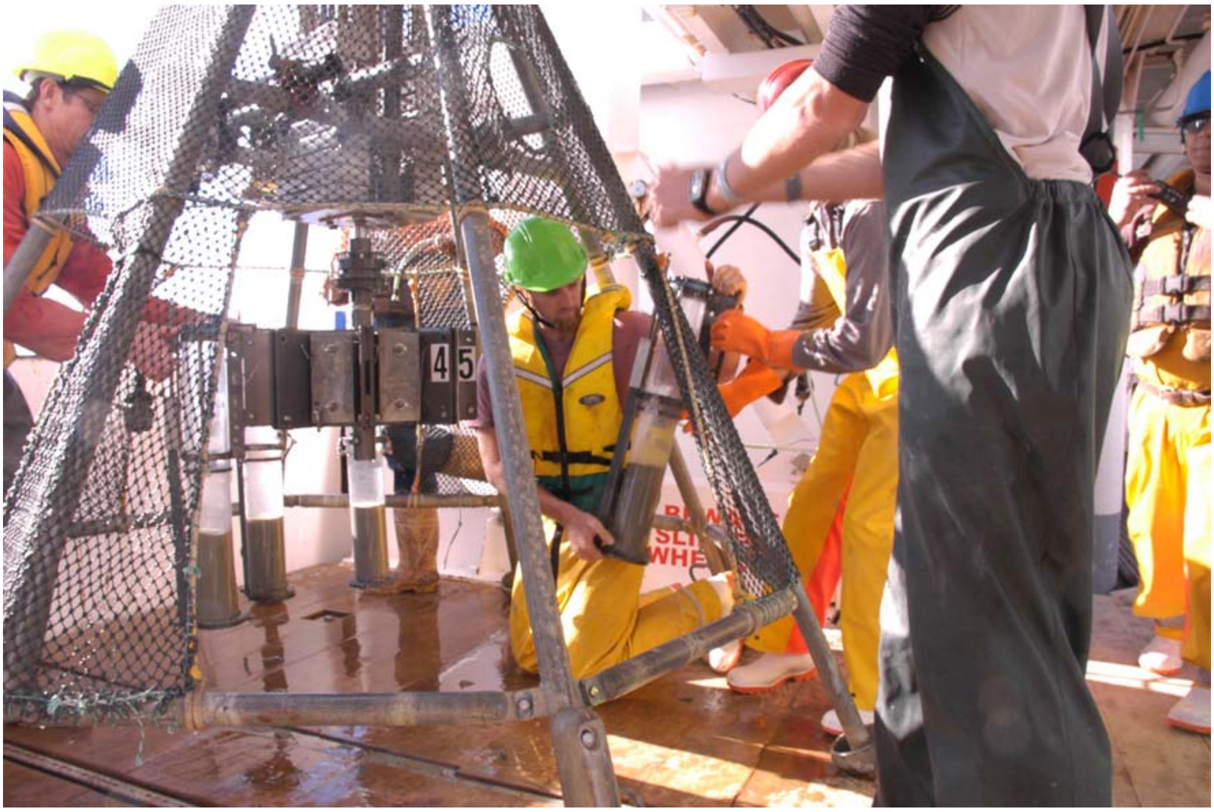

Figure 2: A flurry of activity as scientists unload sediment cores from the multi-corer.

The other device we use for sampling the seabed is the box corer (Figure 3), which operates in a similar manner to the multi-corer, but generally delivers a significantly greater volume of sediment that can then be used for a variety of analyses.

Figure 3: Oktopus box corer being recovered onboard RV *Tangaroa*.

Once onboard the sediments are treated in number of ways (Figure 4). From some cores we extract smaller cores that will be analysed for the weird and wonderful small animals that live in the pore spaces between sediment grains (called meiofauna). We take surface scrapes of sediment to analyse for bacteria, which make up to 90% of the total carbon biomass in many deep ocean sediments. Other cores are sliced and diced for sediment physical and chemical properties (such as grain-size and organic content) since organic matter that accumulates in the sediments is a principal food source for the animals in the deep-sea. We also sieve whole cores for the larger animals that live in the sediment including small worms, molluscs and crustaceans. In one case on this trip, the multi-corer also acted as a fish trap, catching some of the small fish, known as myctophids that migrate daily from 400 m water depth to feed in near-surface waters at night. Another interesting application is collecting sediment cores and then incubating them onboard the ship to find out how much oxygen the animals in the sediments are taking up. Like us, benthic invertebrates use oxygen and exhale carbon dioxide (Figure 5). This gives us an idea about how the whole benthic community functions and how energy is cycled around since food that is consumed by the animals is converted into tissue and reproductive products or is lost via respiration and burial in the sediments.

Figure 4: Processing cores. Seb Holmes (MFish), Matt Knox (kneeling, University of Waikato) and Kareen Schnabel (NIWA) begin the slicing and dicing of deep-sea cores

Figure 5: Matt Knox and Phil Ross (both University of Waikato) looking far too happy in their work as they prepare sediment cores for incubations.

Despite what you see in the seabed photographs, however, sea-floor sediments are far from boring and monotonous. On this voyage, the DTIS camera has shown that even at water depths of over 1 kilometre there are swift currents sweeping across the sea-floor, creating a rippled surface of fine sands, just like on a beach or in a tidal inlet (Figure 6). The multitude of burrows and trails tell us something about how animals live in the deep-sea. Sea urchins move over extensive areas of sea-floor, chowing down on organic matter deposited in the sediments, and carnivorous gastropods “charge” after their prey (since speed is very relative in the deep-sea) (Figure 7). Some asteroids (sea stars) half-bury themselves in the sediment and ophiuroids (brittle stars) hang out in large burrows (Figure 8). Perhaps they are grabbing a meal together or just enjoying the pleasure of each others company. Where ever there are even small pebbles of rock to cling to, sponges, corals and anemones happily live in soft-sediment environments, sometimes on the backs of other more moveable beasties (Figures 9 and 10).

Figure 6: A sandy “beach” at 1 kilometre below the ocean surface. The ripples are caused by strong currents running along the sea-floor

Figure 7: The hustle and bustle of busy daily life at 1000 m, Chatham Rise (Left) The urchin shuffle – a pitter-patter of tiny tube feet; (Right) Snail on a mission.

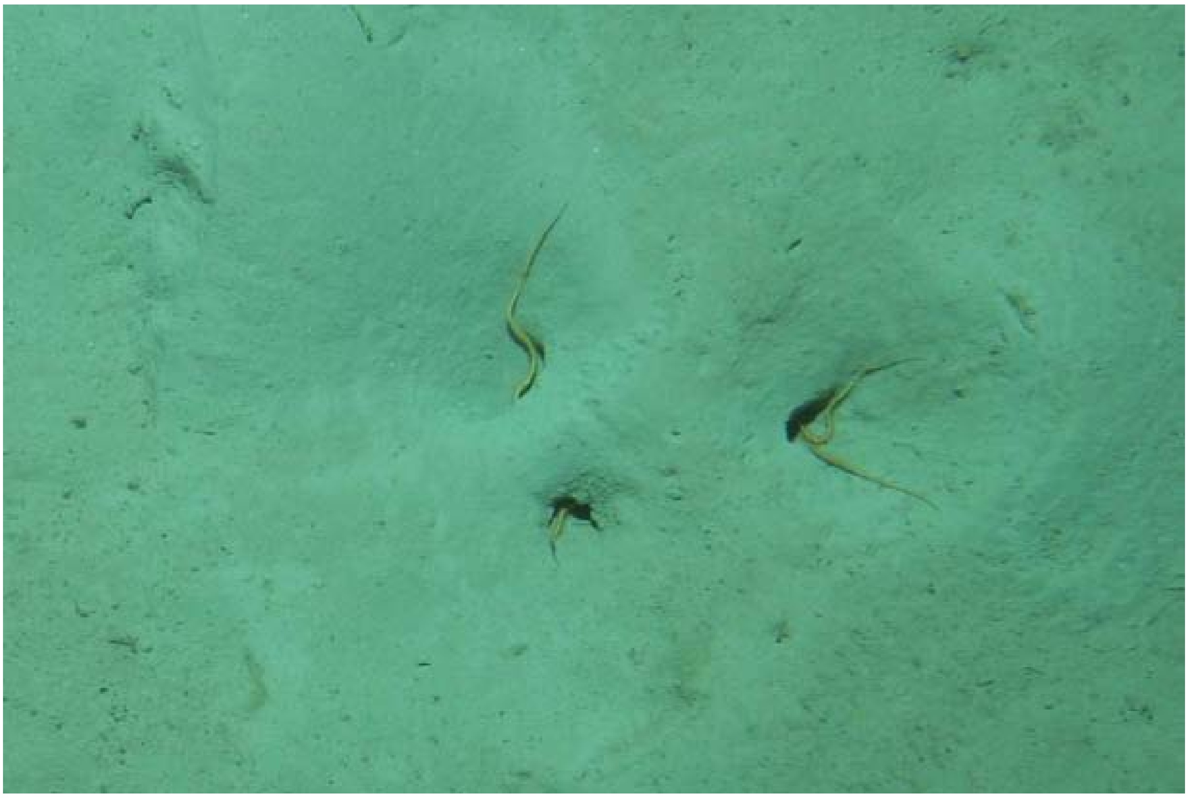

Figure 8: (Top) An orgy of ophiuroids?, 1200 m water depth, north Chatham Rise. Compare this to the images of ophiuroids in the first weekly report which were moving openly about on the sea-floor at the same depths on south Chatham Rise; (Bottom) Mud pack beauty treatment for an asteroid, 1400 m, north Chatham Rise.

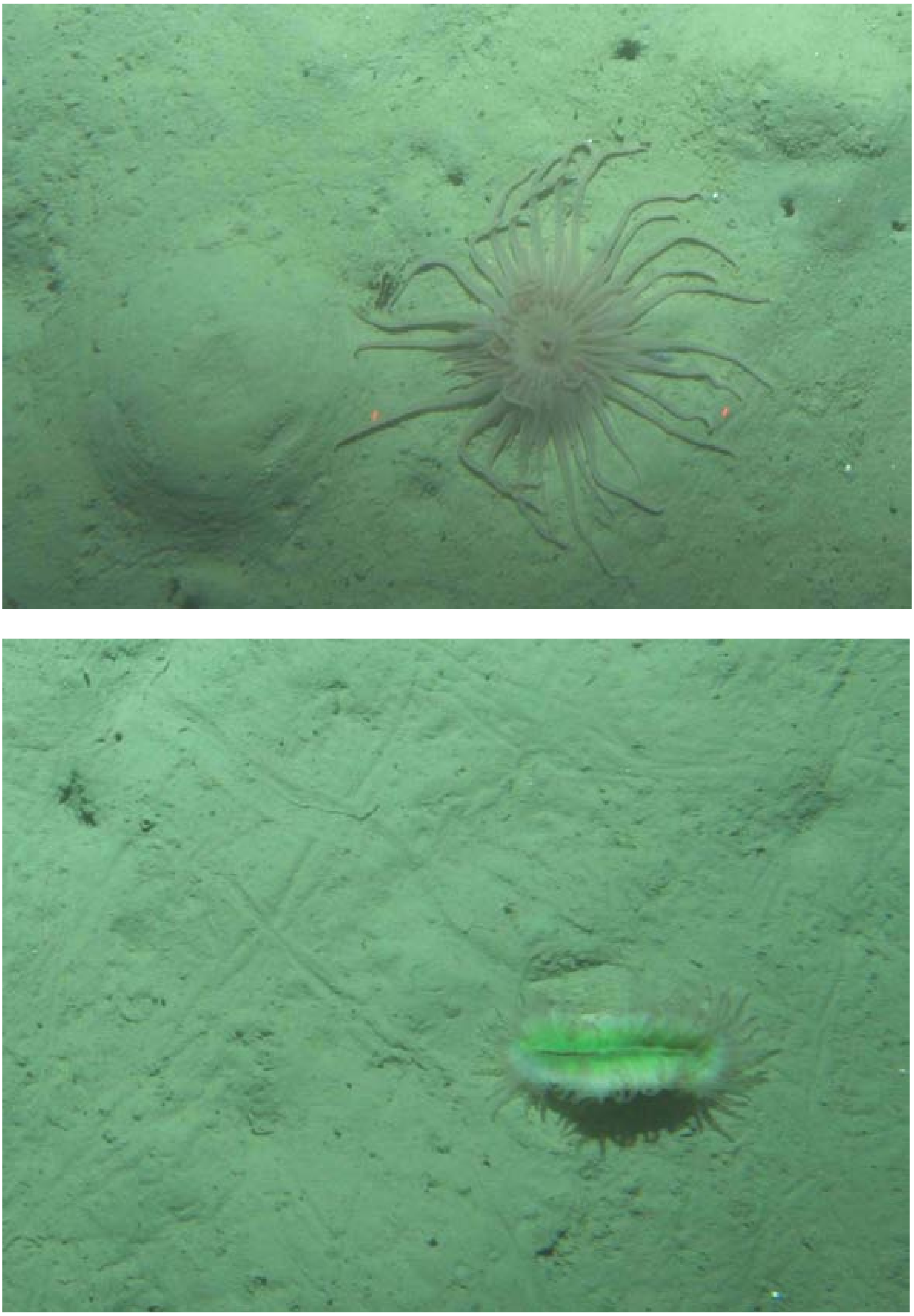

Figure 9: Show-offs of the Deep, 500 m, south Chatham Rise. (Top) Anemone; (Bottom): *Flabellum* coral.

Figure 10: Easy Rider –sea pen hitchhiking a ride on the back of an ophiuroid. The red dots are from two laser pointers mounted 20 cm apart on the DTIS camera frame. 1400 m water depth, north Chatham Rise

We have also obtained excellent shots of some of the fish that live at or near the bottom of the sea, and have been fortunate enough to have a number of fisheries biologists onboard (Alan Hart, Paul Grimes and Owen Anderson) who have been able to identify a lot of the species we have observed (Figure 11). Since the DTIS camera photographs the fish predominantly from above, these images are in contrast to the "normal" way in which fish are generally described and identified (i.e., from side views), making it a challenge for definitive IDs.

Figure 11: (Left) The Apple of Alan's Eye – a docile ribaldo and (Right) Flash Harry hoki at 900 m, north Chatham Rise.

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