Micropaleontology – Invasion of the Forams

By Saku (Jeroen Groeneveld)

After many stories of what is happening on the *Greatship Manisha*, from drill pipes to smelly black stuff, from scientists and drillers to microbes, this is another episode of Expedition 347. Together with Nadine Quintana Krupinski, we are the micropaleontologists aboard. It's micropaleontology, but actually what we're looking for is pretty gigantic in comparison with the microbiology! I would refrain from changing it to macro-paleontology, because then we would end up with dinosaurs, for example, and make everything confusing!

Sometimes we also find strange remains like Indian dessert balls (a common dessert on the Manisha! (left)), giant forams (carniverous ones, centre), and core liner (right) (images ©ECORD_IODP).

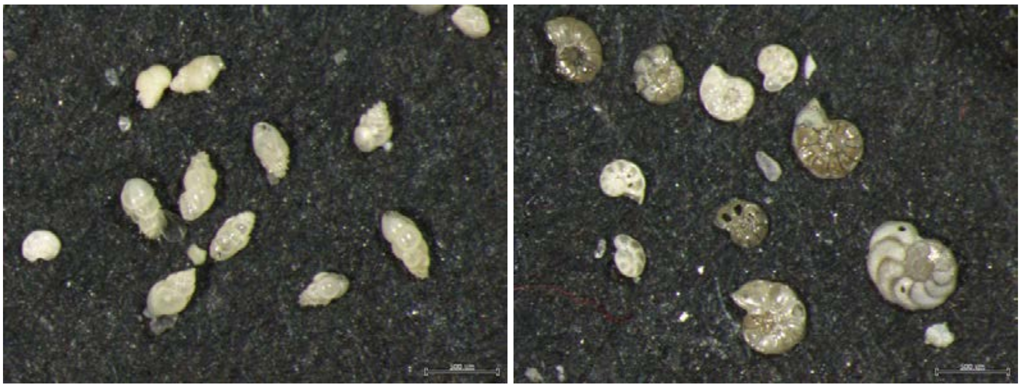
When new cores arrive on the deck and have made a pit stop with the curators, there is usually some leftover (the core catcher sample) which is then delivered into the science container where we are stationed, together with the sedimentologists, the stratigraphicolorists, and the occasional lost microbiologist. While the sedimentologist investigates the sediment, we take a spoonful of sediment and carefully place it into a sieve to wash it. Everything which is smaller than 63 µm is washed away, leaving us sometimes with hardly anything at all (the clays) or sometimes a lot of stuff (the sands). That's when the excitement reaches its climax (or often also anti-climax) as we're going to have a look at the residue under the microscope. And, although our main interest is on foraminifera (more on that in a bit), we check the residue for any remaining fossils and/or specific minerals. These fossils include foraminifera, ostracods, plant remains (and general organic matter), pollen, diatoms, charcoal and bivalves, as the most well-known fossil groups, but also more exotic creatures like Cladocerans (water fleas!).

Ostracods (left) and diatoms (right, the tiny, milky petri-dishes). (images ©ECORD_IODP).

All their respective abundances relate to specific settings in which the sediment was formed, i.e. for forams you cannot have fresh water, for diatoms you need to have some nutrients in the water column, for charcoal….right, something needs to be burning, and the pollen (mostly Pinus) indicate a relatively near-by forest setting instead of just tundra. On the other hand, a complete lack of fossil remains has its own meaning; the water (i.e. Baltic Ice Lake) had such a lack of nutrients in it that simply nothing lived there. Therefore, the clays can be completely barren. The alternative are mass deposits, i.e. the tills, dropped at the location by the ice, with nothing living in them. What we often find in these so-called re-worked sediments are fossils from older time periods including foraminifera from much warmer periods like the Cretaceous. These older sediments/rocks have been eroded by the ice and re-deposited in our tills.

After we have done a first check of the washed sample, we put them in a paper filter and store them in an oven to dry. After drying we have another look to see if we missed anything, the sample is put into a tube for storage and of course entered into DIS (Drilling Information System). Based on these data, and as long as they kind of fit with the sedimentology and the IW geochemistry, we get an idea which intervals are going to be sampled for later analyses.

Back to the forams for a bit, (which you'll usually hear us call them), or to be correct, benthic foraminifera. In the Baltic Sea Basin we only find benthic forams, i.e. they are living on top or within the first 1-2 cm of the sediment (opposite to planktonic forams which are living in the water column). They are one-cellular organisms, and what makes them so interesting for paleo-reconstructions is that they build a kind of shell made out of calcium carbonate.



Two commonly occurring species (*Bulimina marginata* on the left and *Hyalinea balthica* on the right) in the Anholt holes, indicating fully marine conditions. (images ©ECORD_IODP).

Apart from identifying different species of forams which can tell us something on the bottom water conditions like salinity or oxygen concentrations, we also use these calcium carbonate shells to do geochemical analyses. Why would we do that? Because when these shells are formed they record the conditions of the water they are formed in such as; temperature, salinity, nutrient availability, oxygen concentrations and a bunch of other things. So as long as we are sure that the forams we find are really representative for the level/age in the core they come from (be it re-worked Cretaceous specimens or freshly washed into the hole ones ;)), we can reconstruct variations of past water mass conditions and relate them to past climate. I could write another 10 pages on them, but I'm pretty sure we'll start losing people then, so enjoy the pictures, and if there is interest in foram tales (search for it on youtube) just come over!