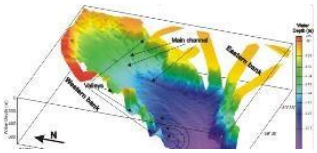
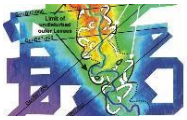
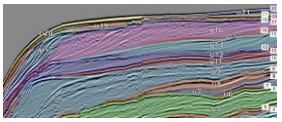


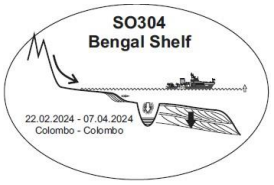
FS Sonne Cruise
Weekly Report No. **4**
Bengal Schelf & Fan
Colombo - Colombo



SO304

11.3. - 17.3.2024





After having finished our alternative program at an active depositional lobe between 15°N and 16°N last week, FS Sonne made its way northwards towards the EEZ of Bangladesh. The massive restrictions imposed by the Bangladesh permit do not allow us to carry out the research program of cruise SO304 as planned. In the end, we only have nine positions approved for sampling, but with no scientific rationale for their location and no freedom to adjust them based on survey data and sampling success. Also, surveying was only allowed on lines connecting those points, thus orientation and length of such lines could not be defined based on good scientific practice.

On March 13, we arrived in the Swatch of No Ground shelf canyon, a main target of our research campaign.

According to multibeam bathymetry from previous FS Sonne visits in 1994, 1997 and 2006, the area around this first station should present a channel, which serves as the main pathway for sediment transport toward the deep sea. Our new multibeam bathymetry revealed, however, that the previous channel has been completely infilled with up to ~15 m thick sediment units.

Station work at the thalweg was comprising investigation of water properties, surface and core sampling plus the deployment of a mooring, monitoring flow and tides over a period of several weeks, targeting currents with ADCP, water masses with CTD and sediment transport with turbidity sensor and a particle trap.

The cores reveal very recent turbidite deposits, which indicate modern land-sea material transport and canyon head stability.

Afterwards, we went to the second approved location at 300 m water depth within the same canyon. Only one Parasound profile was allowed, although a net of survey lines should originally reveal the canyon dynamics on decadal scales, documenting loss and growth of the sediment fill.

At the second station, a similar program with CTD, multicorer and finally a gravity corer was carried out. In these samples, recent turbidite activity was documented and a mass-transport deposit got preserved at the bottom of the gravity core. To better understand the nature of the canyon fill, we ran two video-camera dives with the shipboard OFOS system at both stations (300 and 600 m water depth), with the objective of assessing the presence of macroplastics and identifying flowrelated sedimentary structures.

The two dives provided interesting and surprising insight. The amount of marine litter was fortunately limited (plastic bags, a bottle, fragments of packages). During both dives, we found aggregated, organic mud flocs drifting in the water and at the bottom with the strong tidal current. We also found abundant plant debris and leaves, both in the surface waters and at the seafloor, partially buried (Fig. 1). Sandy bedforms and erosional features indicted stronger impact of flow, likely associated with recent events. And fresh small-scale fractures and fallendown blocks of sediment mark the instability and potential for the collapse of the channel flanks.

Fig. 1. OFOS image at the 600 m water depth station showing a patch of partially buried plastics and plant debris covered by mud aggregates and surrounded by bacterial mats.

Multibeam mapping completely covered the canyon floor below 300 m, and recent submarine landslide scarps could be imaged along the canyon flanks, different from the status in 2006 (SO188).

Further sediment sampling in the vicinity of both stations then also allowed to sample distinctly stratified deposits, this time with a high core recovery >7 m, and comparisons with previous Parasound records clearly confirmed high sedimentation rates of decimetres per year.

Due to the limitations in further canyon sampling we commenced a survey program passing over some possible sampling points with multichannel seismic and Parasound to evaluate their coring potential. The target area was now the submarine delta, which transfers material from land to ocean, and planned studies should reveal human impact that might be traceable offshore. Particularly, we are interested in reconstructing how damming, embankment and various other landuse practices have started to change the overall sediment budget within the submarine part of the delta. Also, the discharge of industrial and residential contaminants to the ocean can be reconstructed, given the enormous sedimentation rates offshore that allow for sub-annual to sub-seasonal time resolution. This budget and contamination approach, together with the mobilization effect of the frequent cyclones crossing this region, has not only a high scientific value but one would think that also the country of Bangladesh should be interested in such, given its dense population facing a changing climate.

From the remaining enforced 7 sampling stations, two were in too shallow water not suitable and safe for sampling and too sandy either. Two more are at the upper continental slope, too steep for coring and too risky without Parasound and multibeam mapping, and they don’t match our research focus. Two points on the outer shelf or the foot of the delta are sediment-starved and cannot provide fresh sediment material at all. One of these stations failed with a very short core in a damaged core barrel.

Afterwards, we continued surveying in the eastern part of the Bengal Shelf between the given points. There we anticipated to image anticlines resulting from the ongoing sedimentary accretion within the Indo-Burman Range and thus to map the westernmost extent of the deformation offshore. The surveying turned out to be quite challenging due to the enormous number of fishing boats in the area.

Therefore, we had to soon leave the pre-defined profiles, but managed to run seismic lines, which well imaged anticlines, folds and faults in the subsurface at very high quality.

At the last of the 7 points to the very East we then interrupted seismic on March 17 and cored in a region which had looked promising from previous echosounder lines some 10's of km away. We could collect a >4 m long sediment core near the Myanmar border, which is outside of the direct influence of the GangesBrahmaputra Delta, comprising proximal shelf facies, but from a mud-belt type of environment with high clay content. Subsequently we continued seismic profiling to further investigate the tectonic setting.

Regarding our work program in the next week, we seem to be very limited in our sampling options. But an appx. 1 week seismic survey program is yet to be carried out, as proposed originally, to study the subsidence history of the area in response to compaction and tectonics using sea level influence on seismic sequences preserved.

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