



Expedition SO251

Weekly Report No. 2



Research Vessel *Sonne* now is back at the Terminal of Yokohama harbor, where our first leg ended on Saturday October 15 around 8 o'clock in the morning. Our first scientific experiment at the beginning of the second and already last week of our short research voyage to the Japan Trench, was to acquire a 175km long East-West bathymetric profile perpendicular to the margin at 39.3°N. The track from the incoming oceanic plate across the trench and slope to the shelf followed the exactly same track of a bathymetric survey conducted by JAMSTEC in 2007 (i.e. 4 years before the Tohoku-oki earthquake). By analyzing the differences between the 2007 data set (pre-earthquake) and our newly acquired dataset (post-earthquake) we can test if the seafloor at the location around the northern extend of the Tohoku-oki rupture zone experienced co-seismic displacement during the earthquake. In the recently published literature some rupture and/or tsunami inversion models suggest seafloor displacement in this area, while other models predict no significant movement. With our dataset we will be able to test these models to better constrain the along-strike variation or earthquake rupture along the Japan Trench megathrust.

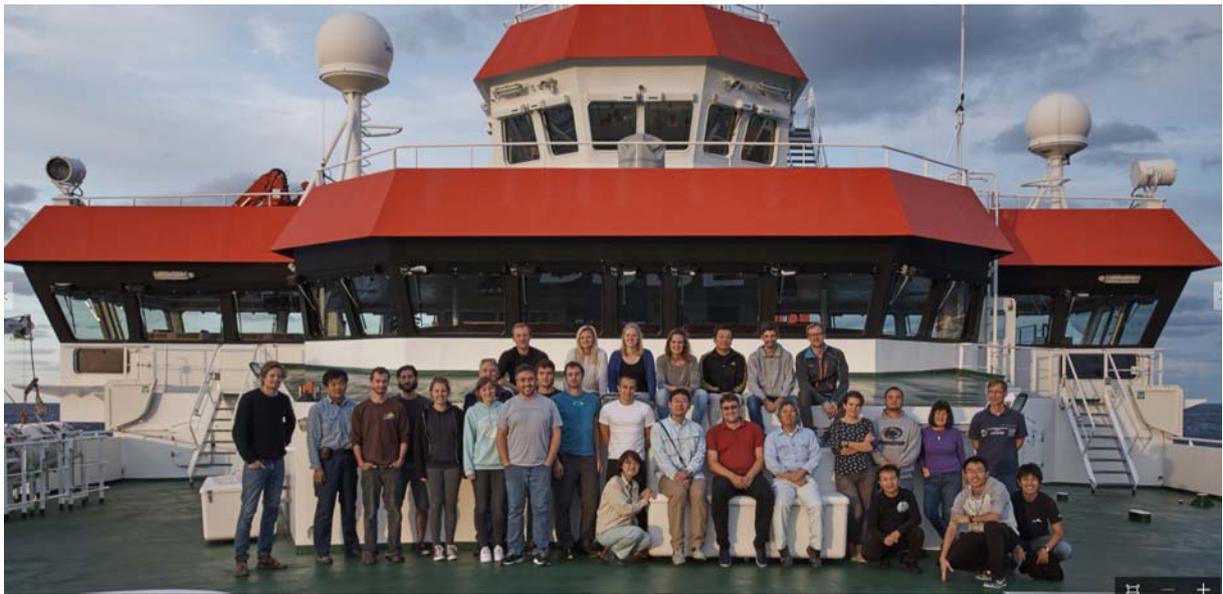
Followed by detailed multibeam and Parasound mapping along the trench axis to the North, we arrived at the northernmost station of our expedition on Tuesday October 11 to take a 10m long core from the trench basin infill, which allows to document sedimentary processes and extreme-event deposits along the northern part of the Japan Trench Subduction zone (Sanriku segment). At the same day, we also managed to obtain a double coring of the slope sediment in the northern part. For each of the three slope sites of representative location of the landward slope of the subduction system, we retrieved two cores, one of which is kept closed and will be analysed by the Marine Geotechnics research group at MARUM to study strength and deformation behavior upon dynamic stresses simulating different earthquake shaking scenarios. With such experiments, we aim at assessing critical earthquake intensities needed to trigger sediment remobilization, towards quantitatively calibrating the geological record of extreme event deposits for past earthquakes.

On Wednesday Oct 12, R/V *Sonne* navigated back southwards, there while filling small gaps in mapping to eventually succeed in acquiring a complete high-resolution bathymetric map of the trench axis and nearly 2000 km of subbottom Parasound profiles, covering the entire along-strike extent of the Japan Trench from 36° to 40.3° N. On our voyage back south there remained enough time to take two additional cores in the deep trench, including the successful recovery of a core from the very same location, where we cored the deep sea trench sediment during previous *Sonne* cruise SO219-A in 2012. At that time, the geochemists documented striking anomalies in porewater-geochemistry data, which are interpreted to be transient signals induced by remolding and resedimentation triggered by the Tohoku-earthquake. Now, 5 ½ year after the earthquake, we repeat the porewater and solid phase geochemistry analyses at this location to study the transient signal and assess

post-depositional processes and rates to learn how the event-deposit becomes archived in the geological record and what distinct chemical signals remain.

In summary, we can look back to a very successful leg, during which we achieved all priority objectives of the EAGER-Japan project in the Japan Trench working area. We are thankful to Captain Meyer and his crew for excellent hospitality and collaboration and acknowledge the BMWF for support of this fascinating research expedition.

Michael Strasser (chief scientist SO 251-A) representing onboard science party



SO251-A Science Party (from left to right: Gauvain Wiemer, Yukihiro Nakano, Dominik Jaeger, Timo Fleischmann, Katarina Bachmann, Marie Rex, Martin Kölling, Christian dos Santos Ferreira, Sebastian Trütner, Karl Lange, Jasper Moernaut, Neeske Lübben, Kazuko Usam, Alex Rösner, Mareike Höhne, Asuka Yamaguchi, Jana Molenaar, Toshiya Kanamatsu, Michael Strasser, Paul Töchterle, Ken Ikehara, Tobias Schwestermann, Jess Hillmann, Toshiya Fujiwara, Matt Ikari, Cecilia McHugh, Tian Sun, Witold Szczucinski, Arata Kioka)



Sampling pore water fluids for geochemical analyses

Complete bathymetric map along the entire Japan Trench trench axis acquired during SO251-A. Yellow dots locate coring sites (9 sites, nearly 90m core recovery)

