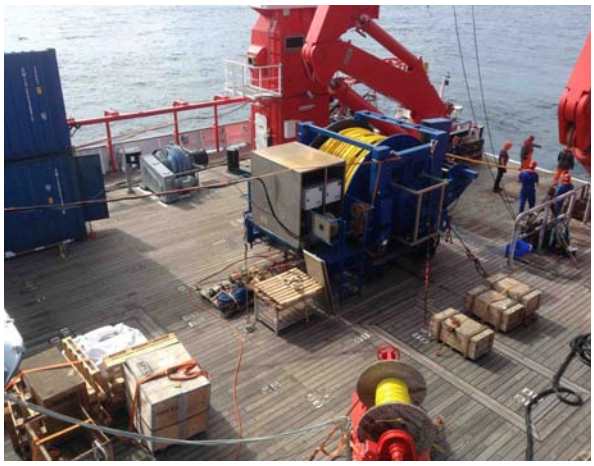
Research Vessel SONNE Voyage SO246 Project CHATHAM RISE

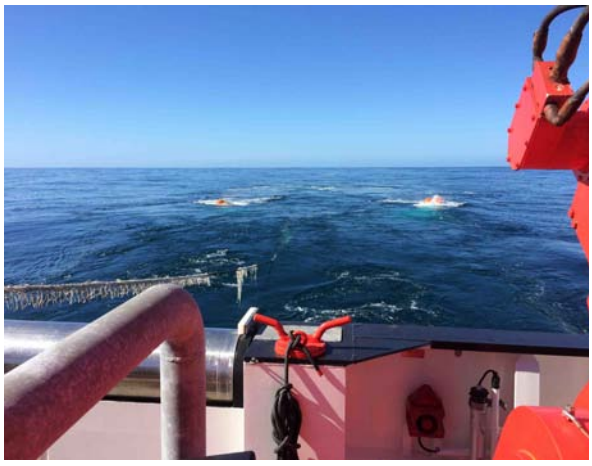
Weekly Letter No. 2 from 14th Feb 2016

This second week of our SONNE cruise has been focussing on geophysical surveying along an almost 450 km long profile that extends from the only 100-200 m deep central Chatham Rise across its southern slope into the 5000 m deep deep-sea. Two seismic survey methods were applied to investigate the deep structure and the tectonic evolution of the Earth's crust of this rise.

For the seismic refraction method, we deployed 40 ocean-bottom seismometers (OBS) in a spacing of 11 km to each other along the seafloor. These instruments sink to the seafloor by their anchor weight and remain there, until we send an acoustic signal to release a hook from their anchor so that they float back to the sea surface to be collected. While the built-in seismometers and hydrophones at the seafloor are permanently recording, the ship moves across the profile and is sending a seismic pulse every 60 seconds from our airguns towed behind the stern. These seismic waves travel into the sub-seafloor through the crust and into the Earth's uppermost mantle, being reflected and refracted at geological layer boundaries, and are recorded by the OBS systems even in large distances along the profile.



Plenty of space on the working deck for the large seismic winch with its 3000 m long streamer, that is being pulled back in, the magnetometer winch and workshop container (Photo: K. Gohl).

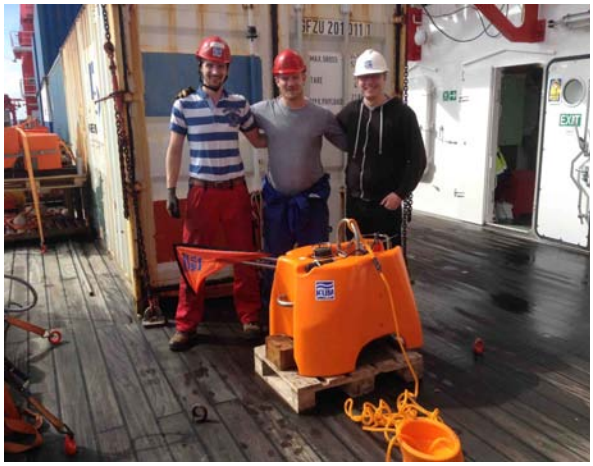


SONNE is towing the hydrophone-streamer and airguns for seismic surveying (Photo: B. Davy).

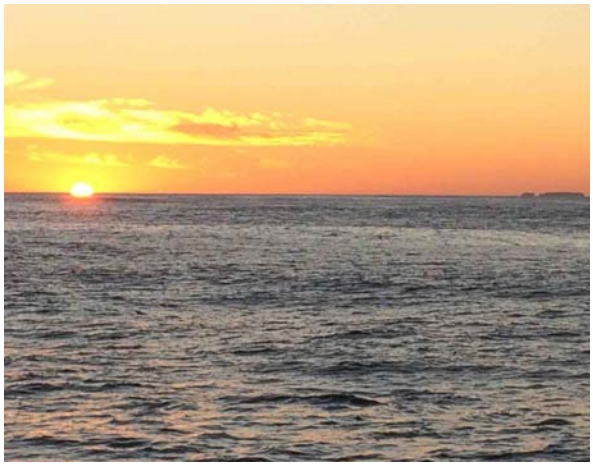
We also need to record data from the sediments and upper zones of the Earth's crust and, therefore, tracked the profile a second time. This time, we shot the airguns every 15 seconds. A towed 3 km long cable (streamer), filled with hundreds of hydrophones, records the seismic waves that are reflected from these sedimentary and crustal layer boundaries. This seismic reflection method, in combination with the long-distance records of the OBS systems, gives us a pretty good image from the architecture of the various layers and zones in the Earth's crust even down to the uppermost mantle. First play-backs of the seismic streamer records show that the seismic reflection method generates high-quality data. Currently, we are collecting the 40 OBS systems.

Our seismic profiling activity is accompanied by a 4-person team of whale observers. In alternating watches, they keep a permanent lookout with high-quality binoculars and notify us immediately when they see whales, dolphins and protected seals. Their visual observation is supplemented by a passive acoustic monitoring system,

consisting of a towed cable with specific hydrophones, to record and range any sound by marine mammals. As soon as marine mammals are observed within a 1-2 km large safety distance from the ship, the airguns are shut down immediately. Only if no marine mammals are observed in the ship's safety perimeter, the seismic sources are slowly powered up again. This is a sensible, precautionary measure, even though there has not been any proof that seismic profiling, as done for scientific purposes, causes serious harm to marine mammals.



The new prototype of a KUM ocean-bottom seismometer just returned from the seafloor. Test was successful ☺ (Photo: K. Gohl)



Scientist-friendly weather! The *Forty Fours*, a small group of islands belonging to the Chatham Islands, are visible in 25 km distance (Photo: B. Davy).

Two weeks so far with absolutely fine weather – this was not to be expected between 43° and 47° southern latitude. This weather makes work on the beautiful wooden deck of SONNE so much more pleasant and contributes to the great mood and atmosphere among the crew and science groups.

Collection of the OBS systems will continue until Monday; Reinhard's geologists are ready to begin their next rock sampling activity at the seamounts we have partly mapped so far by multi-beam echosounding. More of the story next week ….

With best wishes from all

Karsten Gohl
(Chief Scientist)