RV SONNE - SO297 "PISAGUA"

24.02.2023 – 11.04.2023
Talcahuano (Chile) – Guayaquil (Ecuador)

4th Weekly Report

13. - 19.03.2023

At sea, 24°58’S/71°11“W, 19 March 2023

The first three days of the week we continued acquiring refraction data while towing the air pulsers and MCS streamer behind the ship and measuring some more refraction seismic profiles (Figure 1). At 11 am on Wednesday, 15/03, the air pulsers and streamers were retrieved to perform maintenance on the equipment. Then, after a short transit of 14 nautical miles, the southernmost station in the network (OBS 3B13) was recovered. At 2 pm, FS SONNE headed west to survey previously unmapped seafloor (Figure 2) on the oceanic plate. At 4 pm, we mapped parts of a seamount that rises well above the surrounding seabed (Figure 2). The multibeam survey ended at 04:45 on 17/03 with the arrival at the set-down position of the first drift-free pressure sensor.

During SO297, five newly developed drift-free pressure sensors will be deployed to measure vertical seabed movements with cm accuracy. Since the stress build-up of strong earthquakes mainly occurs near the trench, this drift-free measurement allows for the first time to resolve long-term vertical deformation, contributing to knowledge on stress build-up in the marine forearc. At the same time, the pressure readings also reflect sea level changes, which the system also records. During the SO297 cruise, three absolute pressure sensors from IMO (Instituto Milenio de Ocenografía, Chile) and two pressure sensors from GEOMAR will be installed.

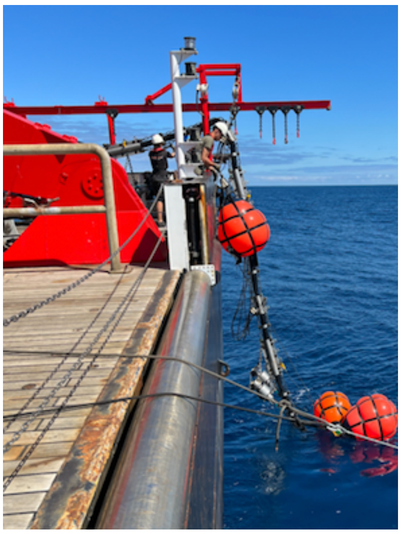

Figure 1: Retrieving the air pulsers and floats on the starboard side. Photo: B. Bauer.

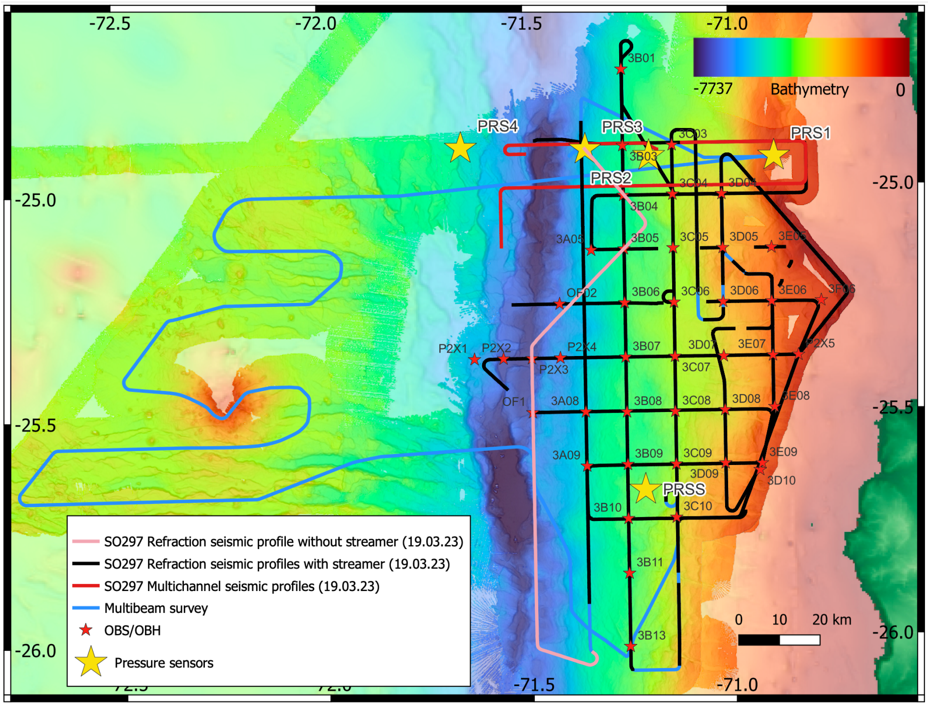

Figure 2: Map of the three-dimensional refraction experiment superimposed to the newly acquired multibeam mapping in the area of the 3D experiment. From 19 March 12 am. Illustration by M. Kühn.

The installation of the drift-free of pressure sensor PRS1 from IMO in 1774 m water depth started after a CTD (17/03, 04:45) to obtain a water sound profile. This sound profile was then used to set the instrument down on the seabed at the deep-water wire (Figure 3) to obtain similar water depths for the acoustic measurements compared to the deep-sea wire length. First, an acoustic modem (Figure 4) was lowered to 50 m water depth. Then, the pressure sensor was lowered on the deep-sea wire until the seafloor. The instrument reached the seafloor at 10:51. Details on the installation procedure are shown in Figure 5. After releasing the instrument, it turned out that the instrument was still hanging on the cable, as the depth of the instrument decreased when the cable was uplifted. We hoisted the pressure sensor with its frame to the sea surface to inspect the device's condition. When we reached the sea surface (12:39), we saw that the lines were jammed in the device, but the releaser had been triggered. As it was hoisted above the water surface, the weight of the pressure sensor was enough to release the lines. The device returned to the seabed with a fall speed of 1 m/s. During the whole time, we were connected to the device and could measure the distance and check the status of the device via an acoustic connection at any time. By

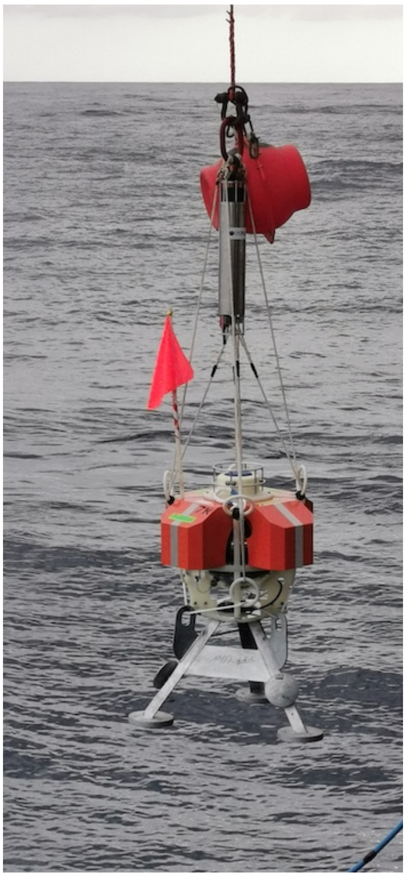
Figure 3: Photo of the drift-free pressure sensor during installation on the deep-sea wire. Photo: A. Dannowski.

13:07 am, it had arrived at 1785 m water depth, standing horizontally as planned with an angle of incidence of two degrees. An upload of the data from the device on the seabed showed that the pressure sensor was working as desired.

After a short transit, the air pulsers and streamer were launched at 17:00, and a refraction profile was run through the network to the southernmost point and then back north until the morning after next (19/03, 07:00). The streamer was retrieved at 09:00 on 18/03 as it was not working correctly. The air pulsers remained in the water until the next day.

On the morning of 19/03, we installed the second pressure sensor at ~25°S and a planned water depth of 5943 m. Below 5600 m, we suddenly lost the acoustic connection to the device, which was re-established soon after. Furthermore, the position determination with the Posidonia system of the ship and the acoustic communication with the pressure sensor did not work simultaneously, probably due to the considerable water depth. The device reached the seafloor at 14:00. We controlled the inclination, lifted it again 30 m and released it. During the hoisting of the deep-sea wire, two working measurement cycles were run, and then the data was uploaded with the acoustic modem.

After retrieving the heel devices and acoustic modem, the air pulsers were installed again (19/03, 16:00). A complete north-south refraction profile will be taken the following night, after which recovery of 33 of the experiment's OBS instruments will begin.


Figure 4: Photo of acoustic modem for acoustically connecting to the pressure sensors. Photo: D. Lange

As in the weeks before, the Pacific showed its good side with relatively calm seas and warm temperatures. Everyone on board is in good health.

With best regards on behalf of all participants on board of the RV SONNE,

Dietrich Lange

(GEOMAR Helmholtz-Centre for Ocean Research Kiel)

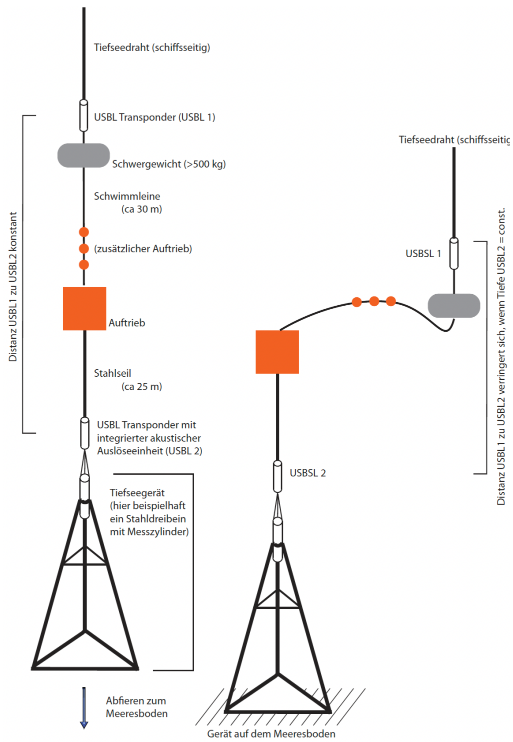

Figure 5: Deployment method for the absolute pressure sensor using the deep-sea cable of FS SONNE. The three Chilean instruments are installed on a tripod from Sonardyne. The two instruments from GEOMAR use an OBS rack as instrument carrier. Illustration: H. Kopp.