FS Sonne

Cruise SO310 (S-555)

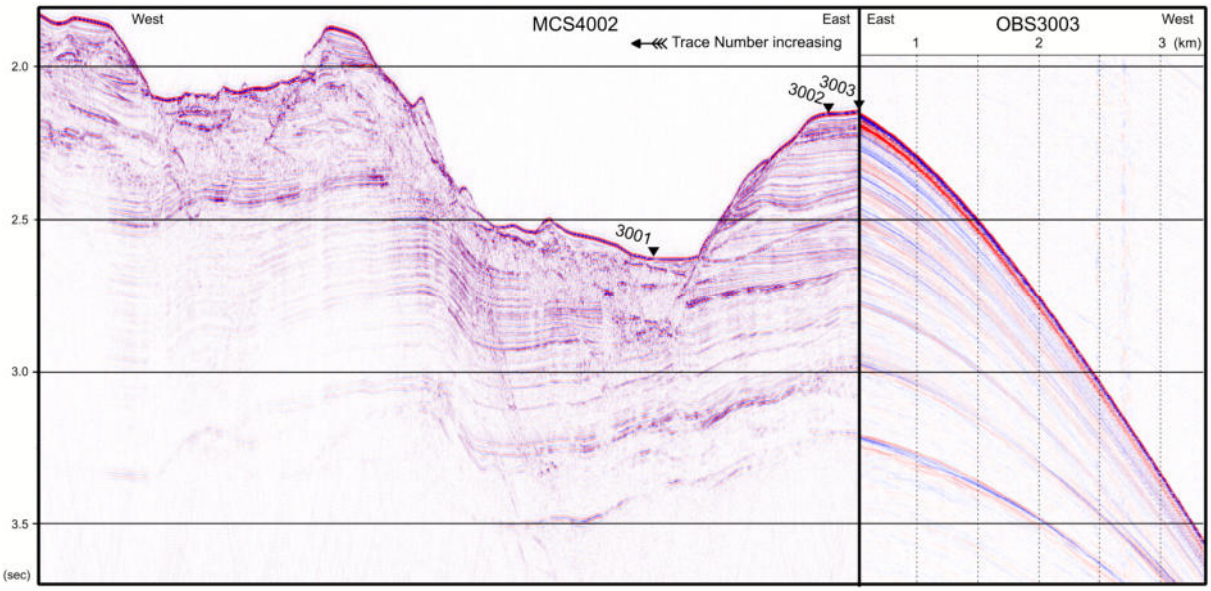
20.02.25 – 22.03.25, Wellington – Wellington

Weekly Report No. 3, 03.03. – 09.03.2025

Quantifying the role of mass wasting in submarine canyons on active and passive margins (MAWACAAP)

3. Weekly Report

2D-seismic data collection in Pegasus Canyon region started on 2 March and continued into the beginning of this week. The data show a deeply incised canyon with abundant landslides at its flanks. The thickness of undisturbed drape on top of the individual landslide masses varies significantly, suggesting a long history of landsliding. The data also show a BSR (Bottom Simulating Reflector), faults in close vicinity to the canyon and contouritic deposits. A data example from the northernmost multi-channel seismic (MCS) profile across the Pegasus Canyon is shown below on the left panel. Along the profile three ocean bottom seismometers (OBS) were deployed and a data example of OBS3003 is show on the right figure panel. Due to a strong current in the water column, the OBS drifted ~500 m northwards from its dropping position before it settled down at the seafloor. Both data examples show the same energy points and image the subsurface from the OBS position westwards. Several strong reflectors fit well in both seismic data examples. The geophone components of the OBS show converted S-waves. The OBS data will be used to estimate the seismic velocity distribution in the subsurface and contribute to the processing of the MCS data.



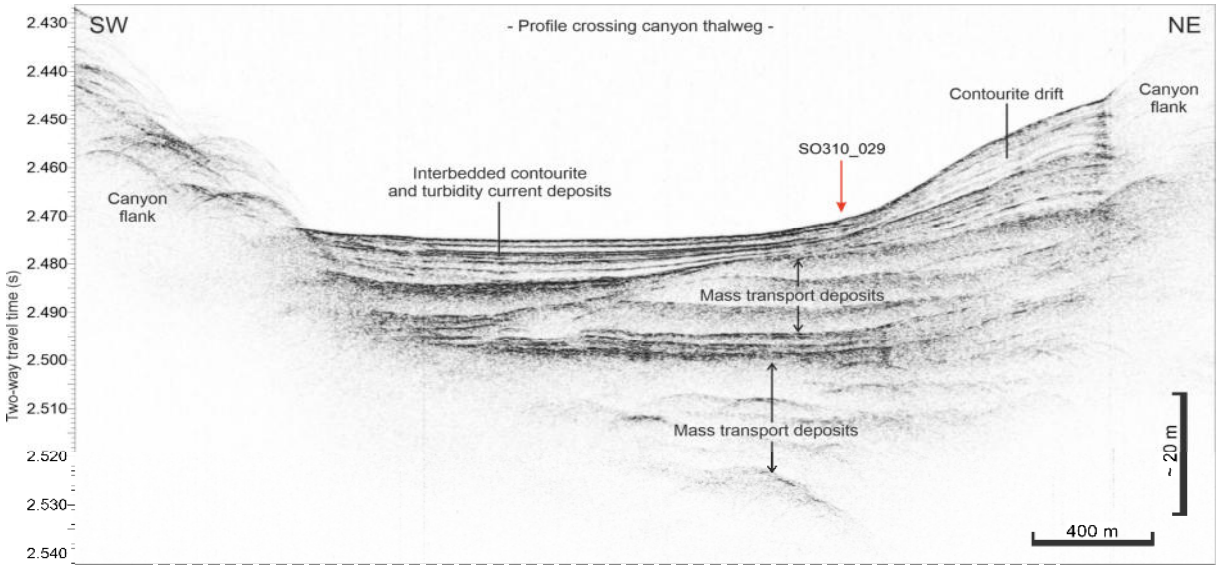
Data example of the northernmost profile crossing the Pegasus Canyon. Left: 2D-reflection seismic profile. Right: OBS record of the hydrophone channel.

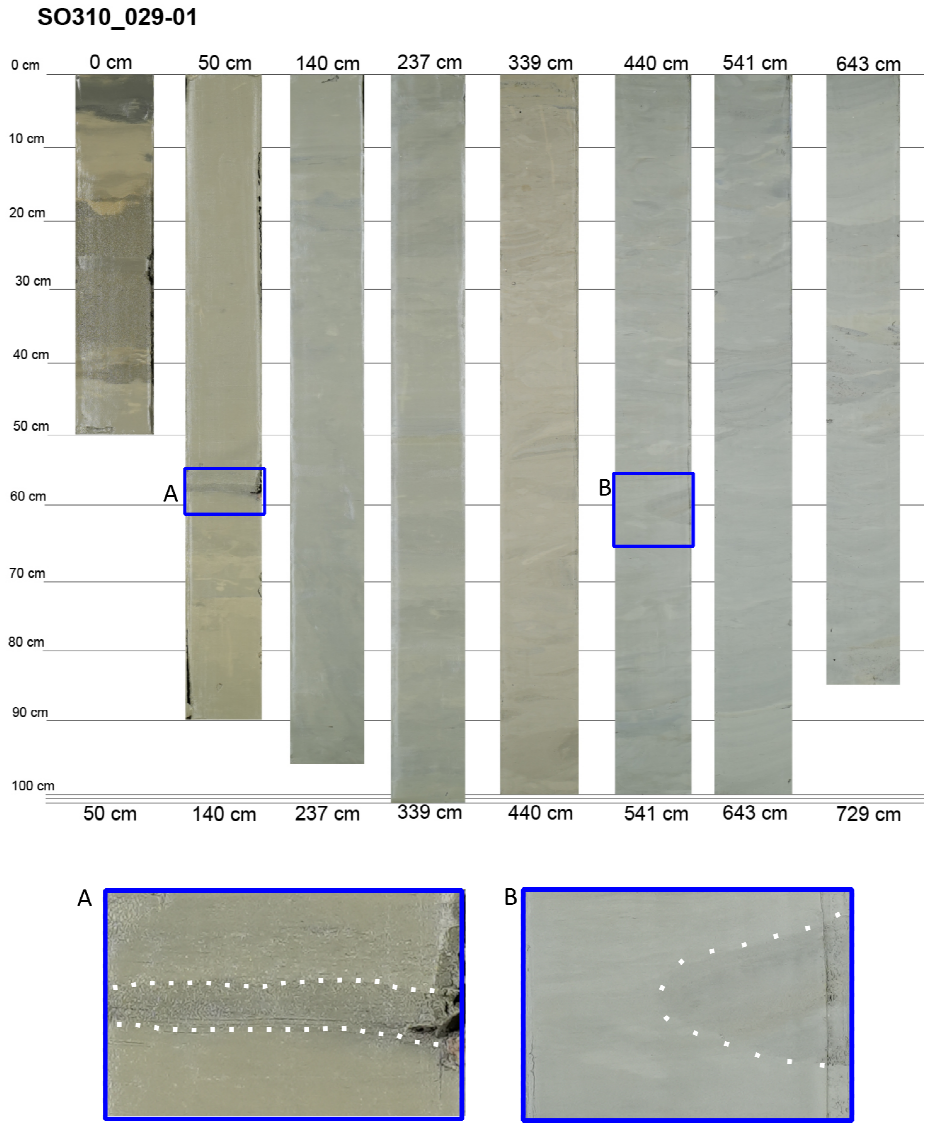
2D seismic data collection was continued until 23:30 on 4 March when we decided to retrieve the streamer due to predicted high winds in the second half of the night. During the night, we collected Parasound profiles along the upper part of the thalweg of Pegasus and Pukakai Canyons. The profiles show a very interesting pattern of repeated mass wasting and contourite deposition along the canyon axes. 5 March was a windy day but coring was still

possible. We collected 4 cores along the thalweg of Pegasus Canyon, targeting different sedimentary units. Core lengths ranged from 572 to 802 cm. Most cores showed significant gas expansion and it was necessary to drill some holes in the liner to allow the gas to escape. The night was used to continue hydroacoustic mapping around Pegasus Canyon. The morning of 6 March welcomed us with nice weather conditions though it was cold. Fresh snow on the mountains at the coast reminded us that it is autumn in New Zealand.

View from RV Sonne with snow covered mountains at the coast. Photo: S. Krastel

We collected the three OBS deployed along the northernmost 2D profile in the morning. This was followed by another long day of coring. A transect of 5 cores sampled different landslide deposits. Coring was very successful with core recoveries varying between 205 and 909 cm. The figure below shows core SO310_29, which was collected in the thalweg of the canyon. We selected the location based on the series of mass transport deposits evident in the Parasound data. Sediment recovery was 729 cm, and the core contains layered sequences consisting mainly of silt and clay components indicative of canyon floor deposits. These layers are interrupted by thin sand layers that are likely turbidite deposits (see image below, close-up A). Two (deci-)metre-scale units towards the base of the core, which include sandy clasts, shell fragments and show bended and folded sediment structures (see image below, close-up B), correlate with acoustically transparent mass transport deposits observed within the Parasound data.



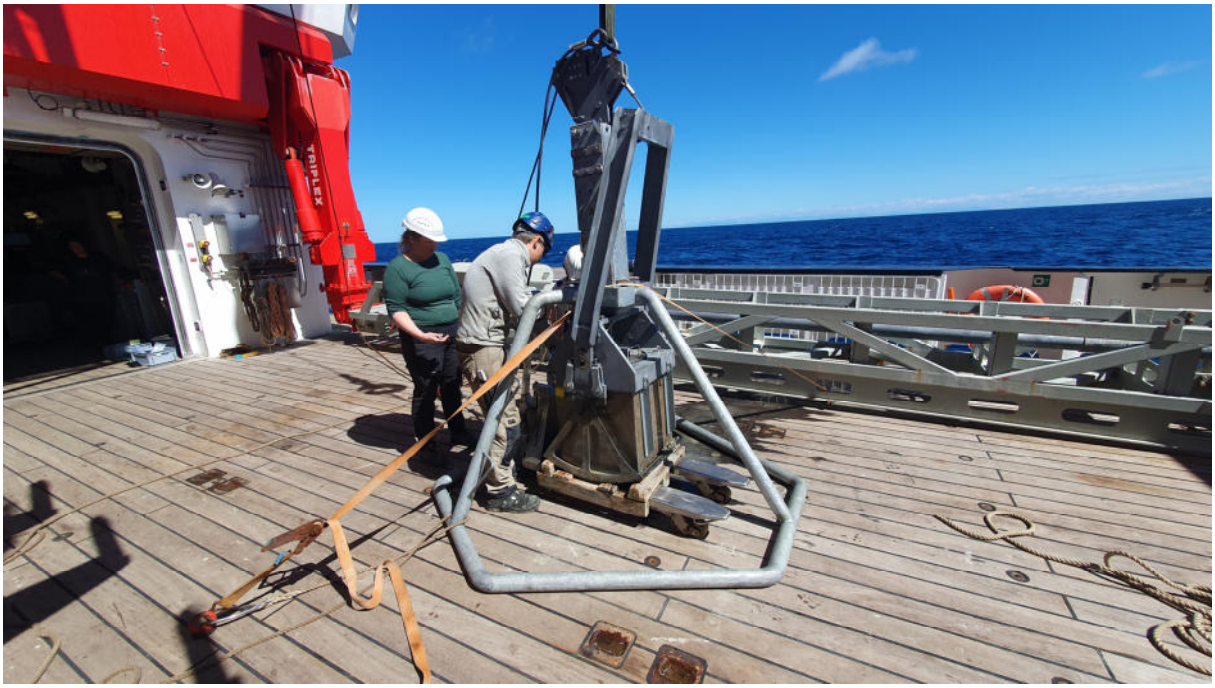


Top: Parasound profile crossing Pegasus Canyon near its confluence with Pukaki canyon. The location of SO310_029 is indicated by the red arrow. Bottom: Photographs of core SO310_029-01 displaying the different sedimentary units. Close-up A shows a sandy layer (turbidite deposition) and close-up B displays a folded structure (mass transport deposit).

We then left the Pagasus Canyon area as the weather forecast for the Palliser region predicted a few calm days with favorable conditions for the continuation of the 3D cube. We arrived in the Palliser Canyon region early on 7 March and collected some additional hydroacoustic data. P-Cable deployment started at 08:00. The deployment went smoothly, but tests before the start of the profile indicated an electrical problem. So, the P-Cable was retrieved and tests quickly revealed that water had entered the junction box between the data cable and the cross cable. Repairs required the data cable to be replaced, which took until the evening. The afternoon and night were spent collecting hydroacoustic data across the Booboo Fault, which displaces the seafloor in the southern Cook Strait. The P-Cable was redeployed in the morning of 8 March. Data acquisition started as planned, but another failure forced us to retrieve the system in the evening. When recovering the cable, it became apparent that a large amount of kelp had collected on the data cable, which probably caused the problem. The night was again used for hydroacoustic imaging. The P-Cable was ready for deployment on the morning of 09 March, but testing on deck indicated another problem, most likely still a consequence of the failures of the previous days. We therefore decided not to deploy the system, but to collect giant box cores across the thalweg of the Palliser Canyon in order to investigate the main path of activity for this canyon. This activity is currently ongoing.

We are halfway through the expedition and have already collected a large amount of data. We are curious to see what the second half will bring.
Everyone on board continues to be well. With best wishes on behalf of all participants

Sebastian Krastel
(Christian-Albrechts-Universität zu Kiel)
Auf See, 41°42.9’S, 175°08.3’E



Giant Box Corer back on deck. Photo: S. Krastel