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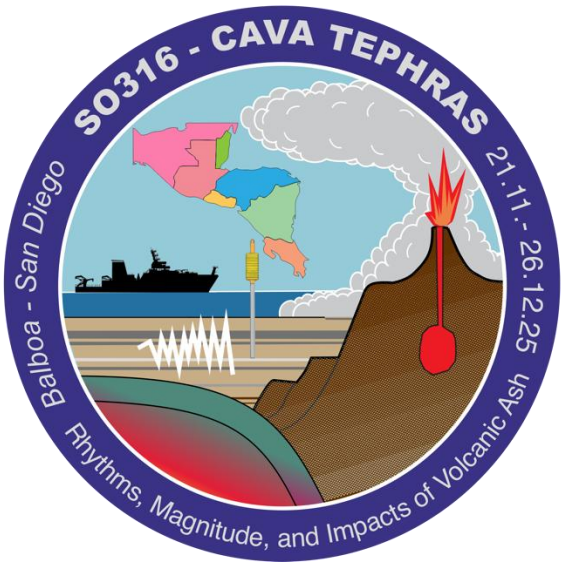
Short Cruise Report
RV SONNE Cruise SO316

Balboa – San Diego
21.11.2025 – 26.12.2025
Chief Scientist: PD. Dr. Steffen Kutterolf
Captain: Tilo Birnbaum



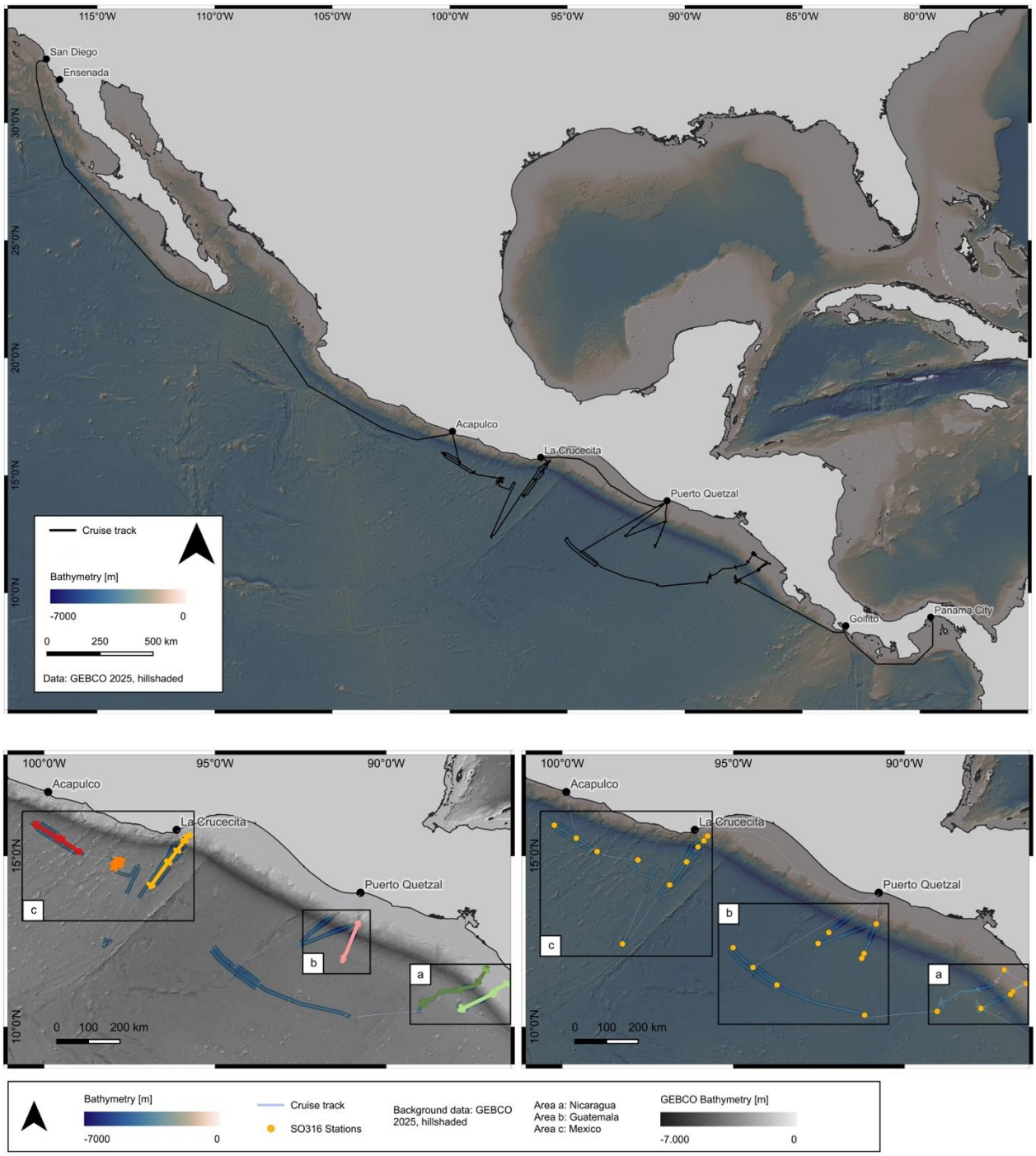


Fig 1: Upper panel: Track chart of Cruise SO316 (Balboa – San Diego). Lower left panel: hydroacoustic surveys as well as seismic profiles in color. Lower right panel: Yellow dots show geological sampling locations (GC, GC+MUC) during SO316. Insets a) to c) indicate the three focus research areas off Nicaragua, Guatemala, and Mexico.

Objectives

Volcanic activity is controlled by a complex combination of external (earthquakes, tides, sea level changes, tectonic rearrangements) and internal processes (melting rates, magma storage and replenishment, degassing). Based on volcanic activity records, stable periodicities similar to those of the global climate have been identified (e.g., 23,000-year periodicity; 41,000-year periodicity; 100,000-year periodicity), but the underlying physical processes remain controversial. It is also unclear whether and how volcanic material is recycled in subduction zones. Following this an important question is how alteration of volcanic matter, and its interactions with the deep biosphere, can influence the recycling and diagenesis in convergent margins and if those are even relevant for modern society. These questions lead to a successful pre-proposal for the International Ocean Discovery Program (IODP) and it was recommended to submit a full proposal after acquiring proper site characterisation data.

The need of this pre-site survey data (hydroacoustic and sampling) as well as complementary data for the upper most part of the seafloor lead to the SO316 cruise which addresses the following objectives: 1) Acquisition of the requested hydroacoustic pre-site data for an IODP full proposal as well as imaging the related research area in space and depth, 2) Establishment of ash frequencies of the Upper Pleistocene and their decrease in thickness in relation to their source (volcano) between sites, and 3) Understanding the transformation of silica phases from their earliest deposition to diagenesis in deeper sediments as part of ash alteration.

Therefore, the SO316 cruise aimed to provide important new scientific insights into ash alteration and diagenesis, the explosive volcanism in Central America and S-Mexico as well as the structure of the continental margin. It should also complement the future IODP^3 project, in order to ultimately provide a complete picture of how fluctuations in eruption frequencies are controlled by external triggers and how the transformation of silica phases works from their earliest deposition to diagenesis in deeper sediments.

Narrative

The scientific crew of the SONNE-Cruise SO316 embarked the vessel in Balboa on November 20 at 11:00h after passing the immigration in the harbor. The scientific crew consisted of 11 scientists from Kiel University, 8 scientists from GEOMAR, and 1 scientist each from the University of South Carolina (USA), the University of California in Riverside (USA), Oregon State University (USA), Woods Hole Oceanographic Institution (USA), Université Clermont Auvergne (France), the Universidad Nacional Autónoma de México (Mexico), the University of Costa Rica (Costa Rica), and the Shanghai Ocean University (China).

We left port on Friday, 21. November 2025, at 08:00 local time to anchor off the port for bunkering, which was completed at 16:00. Afterwards, the ship set course for Golfito (Costa Rica) in order to carry out the crew change there, which was not possible in Panama due to official regulations. After the successful crew change, we continued to transit into our first working area in Nicaragua's Exclusive Economic Zone. During the transit, the containers were unloaded and the laboratories were prepared for the upcoming work. In parallel the chief scientist and scientist Liseth Pérez continued tirelessly to retrieve the necessary research permits that have been submitted in May 2025, but still where under consideration due to various reasons.

24 November, at approximately 21:00h shiptime, the SONNE arrived in the working area and conducted the first bathymetric and Parasound survey at Station SO316-01. This survey served to precisely define the locations for the subsequent stations. On 25 November, at around 06:00h shiptime, the research vessel arrived at Station SO316-02 (10°30.617'N, 087°40.135'W) in a water depth of approximately 2900 m. The final station position was determined on the basis of the

previously collected Parasound data. We then deployed first a multicorer (MUC), which is generally run in combination with an SVP, followed by a first 10-m gravity corer. Due to the relatively low core recovery, a second attempt at the same position was necessary. During recovery of the device, a winch failure occurred, requiring immediate and complex retrieval operations to rescue the instrument. These were successfully completed on 26 November in the early afternoon. The scientific party extends its sincere gratitude to the crew for their highly professional and dedicated efforts.

Following the completion of the retrieval, the seismic equipment was deployed for the first time on 27 November at 14:30h shiptime. The first 2D seismic profile (approx. 180 nautical miles; Station SO316-3) was acquired using a 200-m streamer and a seismic source. All deployments were done following a strict protocol to minimize the effect on marine mammals. The protocol includes mammal watching for 1h and start of the survey only if no mammals have been around closer then 500 m (mitigation radius) as well as a soft start with smoothly increasing power of the seismic source.

On 28 November, during the seismic work, a live video broadcast with several German-Danish schools took place. The students showed great interest in the scientific work and asked numerous questions regarding the research programme and life on board.

In the early morning of the 28th of November, the seismic gear was retrieved on board and additional multicorer and gravity cores (stations SO316-4-1 to 4-3; SO316-5-1/5-2) were successfully collected off the coast of Nicaragua on previously defined crossing points of the seismic and parasound profiles to fulfill the obligations of IODP[3] pre-site survey data. After the multicorer SO316-4-1 we experienced overshooting of the 5-m long gravity core SO316-4-2, which made it necessary to repeat the coring attempt with a 10-meter core device. After another MUC station Station (SO316-5-1) two more 10-m cores have been very successfully deployed (SO316-5-2; SO316-6-1) with nearly full recovery. Description, sampling and first geochemical analyses have been started. The night of the 28th to the 29th of November was covered by parasound and multibeam work (station SO316-7) to get a parallel hydroacoustic profile on the Nicaraguan shelf and to select the coring position of the next day. Subsequently a successful MUC and a 10-m corer was deployed on the 29th of November (Station SO316-8-1/8-2) on the shelf followed by the final seismic profile (Station SO316-9) in Nicaraguan waters. In parallel, intensive efforts continued to secure the required research permits for Guatemala and Mexico in order to ensure the planned progress of the cruise program.

On 01 December 2025, the final 2D seismic profile in the Nicaraguan Exclusiv Economic Zone was successfully completed, an XSV probe (SO316-10) was deployed to get a better sound velocity profile of the water column, and an additional distal gravity core (Station SO316-11-1) was taken to finalize the profile and station work off Nicaragua.

Afterwards, as we were still waiting for the necessary research permits from Guatemala and Mexico, a transit brought us to international waters outside of El Salvador’s Exclusive Economic Zone (EEZ), where another 10-m gravity core (Station SO316-12-1) was successfully collected on the 2nd of December.

The original plan to begin work in Guatemalan territorial waters on 02 December 2025 had to be changed due to missing permits. Therefore from 03 to 04 December 2025, following several transits, additional 15-m long gravity cores (Stations SO316-13-1; 14-2; 15-1) and a MUC (SO316-14-1) were taken outside Guatemala’s and Mexico´s EEZ. These cores provide valuable information about the sediments on the incoming plate as well as the distribution of several very large volcanic eruptions, whose ash layers we were able to identify in the marine sediments.

On 03 December, another live video broadcast with a German primary school took place. This time, the participating pupils were able to actively ask questions, showing great interest both in life on board and in the explosively active volcanoes of Central America.

In the late afternoon of 04 December 2025, we began a transit to Puerto Quetzal (Guatemala) to

receive the required research permit on 05 December 2025 and to embark a Guatemalan observer. Afterwards we were able to continue our research off the coast of Guatemala.

In the evening of the 05th December we started again our station work after a small Parasound survey with a MUC (Station SO316-16-1) at the Guatemalan slope, which was followed by a gravity core profile (Stations SO316-16-2; 17-1; 18-1) from the slope across the trench onto the incoming plate until midday of the 6th December. Core recovery was generally very good with 8.7 to 10.5 meters. Subsequently, seismic operations were resumed and a 2D profile (SO316-19) was acquired for 24 hours across the core locations. Thereafter we transited to two gravity core locations (Stations SO316-20-1; 21-1) that have been selected and cored on December 8th. The goal of the two sampling stations has been to track and connect ash layers found in the eastern coring sites of Guatemala to and with the eastern Mexican working area by cores between.

In the beginning of the fourth week of SO316 the Guatemalan observer left the SONNE on the 9th December 2025 close to Puerto Quetzal (Guatemala) and afterwards, the transit of approximately 350 nautical miles to Bahia Santa Cruz (Mexico) began, where two technicians embarked on the 10th of December in the morning for the repair of the broken winch.

Immediately thereafter, the scientific work off the coast of Mexico, the final working area of cruise SO316, began. After an additional transit of roughly 16 nautical miles, the starting point of the planned seismic profile (Station SO316-22) was reached, and at around 13:00 on the same day, the 2D seismic profile, approximately 280 nautical miles in length, using a 200-m streamer and a seismic source, was started.

Following the seismic work, and two XSV probe stations (Stations SO316-23, 24), the planned geological operations began on the evening of the 12th of December 2025 and lasted for two days. Both the MUC (Stations SO316-26-1, 28-2, 29-2) and the gravity corer (Stations SO316-25-1, 26-2, 27-1, 28-1, 29-1, 30-1) were deployed several times. The objective was to obtain a geological profile from the continental shelf, across the continental slope, and the incoming oceanic plate off the coast of Mexico. The profile also included a core directly from the deep-sea trench at a water depth of ~5500 m (Station SO316-27-1) and ended with a core location (Station SO316-30-1) outside the EEZ of Mexico on Sunday the 14th of December to cover the most distal traces of Guatemalan explosive volcanism. Core recovery in general was successful between ~5.7 and 9.4 meters and will yield important samples for subsequent sedimentological, geochemical, and micropaleontological analyses in this region.

During the night of the 14th to 15th of December we went back to the EEZ of Mexico and started a hydroacoustic survey (Station SO316-31) to better constrain the subsequent seismic profiles (Station SO316-32) that started on midday on the 15th of December.

During the early morning on the 16th of December a live video broadcast took place from the Sonne to 68 schools all over Germany to give insights into the scientific work and life on board. This was very well received and the students asked numerous questions after a 30 minutes tour through the labs.

The 2D-seismic surveying ended on the 16th of December and soon after a gravity core with 9.0 meter of recovery (SO316-33-1) was taken to connect the two working areas off Mexico. Subsequently we transited roughly 140 nautical miles to the western most point of the working plan where the starting point of the planned seismic profile (Station SO316-34) was located, and at around 13:00 on the 17th of December, the 2D seismic profile, approximately 140 nautical miles in length was started.

With the end of the last 2D seismic profile on midday the 18th of December we started to take geological samples in the last and westernmost part of the working area. We took three cores with recovery up to ~8 meters (SO316-35-1, 36-2, 37-1) and one multi corer (SO316-36-1) on an east west profile where positions were selected from the hydroacoustic surveys. On Friday 19th of

December at ~18:00 ship time we ended the scientific program of SO316and started to transit to Acapulco where some participants and the technicians disembarked the vessel. Subsequently the transit to San Diego started where we arrived in the early morning of the 26th of December.
Despite all the problems with the research permits and some technical issues of the vessel, the RV SONNE Cruise SO316 was a great success. We collected about 5000 kilometers of hydroacoustic data in the working area. We acquired about 1700 km of high-resolution seismic profiles of excellent quality and we collected geological samples at 25 stations (27 gravity cores with ~200 meters of total recovery and 10 multi cores). With the hydroacoustic/seismic profiles and the geological samples we will be able to establish time series for the explosive volcanism of Central America and S-Mexico of the uppermost Pleistocene as well as to investigate of structure of the continental margin in relation to volcanism (e.g. distribution of thicker ash layers) and tectonics (e.g. bent faults, slope-trench-incoming plate profiles). The new data will allow us also to submit an IODP^3 full proposal to have deep coring in the working area and to extend the detailed analysis of the role of ash alteration on diagenesis and microbiology as well if and how explosive volcanism may be controlled by external processes like climate and tectonics.

Acknowledgements

The scientific party of RV SONNE Cruise SO316 gratefully acknowledges the very friendly and most effective cooperation with Captain Birnbaum and his crew. Their great flexibility and their perfect technical assistance substantially contributed to make this cruise a scientific success, especially during the recovery and repair of the friction of the winch. We would also like to thank the German embassies in Guatemala and Mexico as well as Guatemalan embassy in Germany for their help during the last-minute research permits and the issuing of the Mexican working VISA. We also appreciate the valuable support by the Leitstelle Deutsche Forschungsschiffe (German Research Fleet Coordination Centre) at the University of Hamburg. The expedition was funded by the BMBF (Bundesministerium für Bildung und Forschung).

List of Participants

Name	Discipline	Institution
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Krastel, Sebastian, Prof.	Marine Geophysics/Co-chief scientist	CAU
Belo, Julie, Dr.	Volcanology/Co-chief scientist	GEOMAR
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Hooton, Georga-Marie	Seismics	CAU
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Theden, Christian	Seismics	CAU
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Scheffler, Janne	Volcanology	GEOMAR
Sourisseau, Delphine, Dr.	Volcanology	UNAM

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Luo, Min, Dr.	Geochemistry	SOU
Squires, Katie	Geochemistry	WHOI
Holzmann, Ben	Micropalaeontology	GEOMAR
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Sandoval, Maria, Dr.	Micropalaeontology	UCR
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Cisneros, Alejandro, Prof.	Petrology	USC
Heinrich, Sven	Technician	CAU
Huvgen, Fynn	Technician	GEOMAR
Jähmlich, Heiko	Technician	CAU

GEOMAR	Helmholtz-Zentrum für Ozeanforschung Kiel
CAU	Christian-Albrechts-Universität zu Kiel
UCA	Université Clermont Auvergne (France)
UNAM	Universidad Nacional Autónoma de México (Mexico)
UCIR	University of California in Riverside (USA)
SOU	Shanghai Ocean University (China)
WHOI	Woods Hole Oceanographic Institution (USA)
OSU	Oregon State University (USA)
USC	University of South Carolina (USA)
UCR	University of Costa Rica (Costa Rica)

Stationlist

Station	Date/Time UTC	Device	Latitude	Longitude	Depth (m)	Comment
SO316_1-1	25.11.25 03:14	Multibeam with Parasound	10° 30,606' N	087° 40,087' W	2918	start survey
SO316_1-1	25.11.25 11:25	Multibeam with Parasound	10° 32,145' N	087° 45,849' W	2955	end survey
SO316_2-1	25.11.25 13:03	Multi-Corer	10° 32,199' N	087° 45,885' W	2929	with SVP
SO316_2-2	25.11.25 16:33	Gravity Corer	10° 32,199' N	087° 45,885' W	2923	GC 5m
SO316_2-3	25.11.25 19:41	Gravity Corer	10° 32,200' N	087° 45,884' W	2922	GC 10m
SO316_3-1	27.11.25 00:02	2D-Seismik	10° 36,349' N	087° 48,227' W	2903	start survey
SO316_3-1	28.11.25 13:27	2D-Seismik	11° 18,869' N	086° 31,284' W	120	end survey
SO316_4-1	28.11.25 15:27	Multi-Corer	11° 15,591' N	086° 26,406' W	121	with SVP
SO316_4-2	28.11.25 15:55	Gravity Corer	11° 15,594' N	086° 26,404' W	119	GC 5m
SO316_4-3	28.11.25 16:39	Gravity Corer	11° 15,596' N	086° 26,400' W	121	GC 10m
SO316_5-1	28.11.25 19:49	Multi-Corer	11° 01,883' N	086° 49,939' W	568	with SVP
SO316_5-2	28.11.25 20:38	Gravity Corer	11° 01,883' N	086° 49,941' W	566	GC 10m
SO316_6-1	28.11.25 22:26	Gravity Corer	10° 56,834' N	086° 53,733' W	1381	GC 15m with SVP
SO316_7-1	28.11.25 23:25	Multibeam with Parasound	10° 58,356' N	086° 54,693' W	1371	start survey
SO316_7-1	29.11.25 14:26	Multibeam with Parasound	11° 35,351' N	087° 05,119' W	101	end survey
SO316_8-1	29.11.25 15:20	Multi-Corer	11° 40,091' N	087° 05,003' W	122	
SO316_8-2	29.11.25 15:40	Gravity Corer	11° 40,089' N	087° 05,004' W	120	GC 10m
SO316_9-1	29.11.25 18:01	2D-Seismik	11° 37,877' N	087° 00,886' W	118	start survey
SO316_9-1	01.12.25 18:14	2D-Seismik	10° 48,926' N	088° 55,693' W	3346	end survey
SO316_10-1	30.11.25 14:52	XSV	11° 07,236' N	087° 44,709' W	4355	
SO316_11-1	01.12.25 23:01	Gravity Corer	10° 27,057' N	089° 02,606' W	3315	GC 10m with SVP
SO316_12-1	02.12.25 14:02	Gravity Corer	10° 20,596' N	091° 09,839' W	3742	GC 10m with SVP
SO316_13-1	03.12.25 17:36	Gravity Corer	12∞ 19,087' N	095∞ 00,517' W	4143	GC 15m
SO316_14-1	04.12.25 09:28	Multi-Corer	11∞ 13,572' N	093∞ 43,713' W	3951	with SVP
SO316_14-2	04.12.25 13:03	Gravity Corer	11∞ 13,575' N	093∞ 43,709' W	3953	GC 15m
SO316_15-1	04.12.25 21:43	Gravity Corer	11∞ 44,515' N	094∞ 25,731' W	4016	GC 10m
SO316_16-1	06.12.25 01:52	Multi-Corer	13∞ 00,773' N	090∞ 49,569' W	2284	with SVP
SO316_16-2	06.12.25 04:04	Gravity Corer	13∞ 00,775' N	090∞ 49,572' W	2286	GC 10m
SO316_17-1	06.12.25 13:02	Gravity Corer	12∞ 08,791' N	091∞ 10,845' W	3632	GC 10m
SO316_18-1	06.12.25 17:05	Gravity Corer	12∞ 00,542' N	091∞ 14,876' W	3842	GC 10m
SO316_19-1	06.12.25 20:37	2D-Seismik	12∞ 02,702' N	091∞ 16,170' W	3778	start survey
SO316_19-1	07.12.25 18:20	2D-Seismik	13∞ 02,334' N	090∞ 51,639' W	2179	end survey
SO316_20-1	08.12.25 06:22	Gravity Corer	12∞ 26,456' N	092∞ 31,384' W	3920	GC 15m
SO316_21-1	08.12.25 12:44	Gravity Corer	12∞ 45,657' N	092∞ 12,620' W	3956	GC 15m
SO316_22-1	10.12.25 20:37	2D-Seismik	15∞ 34,584' N	095∞ 52,066' W	1405	start survey
SO316_22-1	12.12.25 17:53	2D-Seismik	14∞ 11,585' N	096∞ 57,029' W	3431	end survey
SO316_23-1	11.12.25 01:58	XSV	15∞ 30,066' N	095∞ 51,412' W	2289	
SO316_24-1	11.12.25 14:27	XSV	15∞ 09,175' N	096∞ 04,562' W	4438	
SO316_25-1	12.12.25 20:25	Gravity Corer	14∞ 09,171' N	096∞ 51,725' W	3626	GC 10m with SVP
SO316_26-1	13.12.25 03:53	Multi-Corer	14∞ 49,685' N	096∞ 22,089' W	3305	with SVP
SO316_26-2	13.12.25 07:01	Gravity Corer	14∞ 49,682' N	096∞ 22,088' W	3302	GC 10m
SO316_27-1	13.12.25 13:44	Gravity Corer	15∞ 15,963' N	096∞ 01,995' W	5492	GC 10m

Station	Date/Time UTC	Device	Latitude	Longitude	Depth (m)	Comment
SO316_28-1	13.12.25 18:18	Gravity Corer	15∞ 26,974' N	095∞ 51,689' W	2397	GC 10m
SO316_28-2	13.12.25 20:08	Multi-Corer	15∞ 26,974' N	095∞ 51,688' W	2396	with SVP
SO316_29-1	13.12.25 23:14	Gravity Corer	15∞ 35,236' N	095∞ 45,275' W	1349	GC 10m
SO316_29-2	14.12.25 00:20	Multi-Corer	15∞ 35,224' N	095∞ 45,277' W	1342	
SO316_30-1	14.12.25 22:21	Gravity Corer	12∞ 25,616' N	098∞ 14,422' W	3598	GC 10m with SVP
SO316_31-1	15.12.25 11:28	Multibeam with Parasound	14∞ 20,984' N	097∞ 22,574' W	3334	start survey
SO316_31-1	15.12.25 17:04	Multibeam with Parasound	14∞ 25,020' N	097∞ 31,570' W	3471	end survey
SO316_32-1	15.12.25 20:22	2D-Seismik	14∞ 36,167' N	097∞ 53,744' W	3412	start survey
SO316_32-1	16.12.25 17:09	2D-Seismik	14∞ 38,169' N	098∞ 01,246' W	3552	end survey
SO316_33-1	16.12.25 20:47	Gravity Corer	14∞ 53,229' N	097∞ 47,373' W	3570	GC 10m with SVP
SO316_34-1	17.12.25 17:40	2D-Seismik	15∞ 51,285' N	100∞ 15,636' W	3680	start survey
SO316_34-1	18.12.25 22:12	2D-Seismik	15∞ 10,239' N	098∞ 56,907' W	3489	end survey
SO316_35-1	19.12.25 01:03	Gravity Corer	15∞ 07,830' N	098∞ 58,940' W	3529	GC 10m
SO316_36-1	19.12.25 13:24	Multi-Corer	15∞ 54,093' N	100∞ 14,012' W	3651	with SVP
SO316_36-2	19.12.25 16:45	Gravity Corer	15∞ 54,089' N	100∞ 14,009' W	3651	GC 10m
SO316_37-1	19.12.25 23:24	Gravity Corer	15∞ 31,345' N	099∞ 35,304' W	3586	GC 10m

List of seismic profiles

Profile -Nr.	Date Start	Time Start UTC	Time End UTC	Latitude Start (South)	Longitude Start (East)	Latitude End (South)	Longitude End (East)	FFN Start	FFN End
P101	26.11.25	27.11.25	23:56	01:59	10°36.31	087°48.210	10°28.605	087°43.876	399
P102	27.11.25	27.11.25	02:08	03:26	10°28.240	087°44.442	10°28.385	087°50.432	1486
P103	27.11.25	27.11.25	03:50	18:10	10°29.728	087°50.950	10°57.946	086°52.675	2352
P104	27.11.25	27.11.25	18:13	19:08	10°58.21	086°52.48	11°01.77	086°50.40	9412
P105	27.11.25	27.11.25	19:42	21:05	11°00.43	086°48.83	10°54.78	086°51.53	10468
P106	27.11.25	27.11.25	21:19	22:34	10°52.61	086°52.36	10°59.407	086°55.308	11638
P107	27.11.25	27.11.25	22:40	23:41	10°59.838	086°55.198	11°03.077	086°52.029	12615
P108	27.11.25	28.11.25	23:49	00:52	11°03.040	086°51.470	11°00.11	086°47.690	13433
P109	28.11.25	28.11.25	01:25	02:03	10°58.376	086°48.892	10°59.921	086°51.531	14580
P110	28.11.25	28.11.25	02:12	09:45	11°00.466	086°51.457	11°16.93	086°23.64	15148
P110_transit	28.11.25	28.11.25	09:45	11:04	11°16.93	086°23.64	11°12.936	086°22.380	20579
P111	28.11.25	28.11.25	11:04	13:26	11°12.936	086°22.380	11°18.845	086°31.244	21533
P201	29.11.25	29.11.25	17:57	20:08	11°37.70	087°00.56	11°42.731	087°08.268	30157
P301	29.11.25	29.11.25	20:15	21:17	11°43.07	087°07.74	11°44.79	087°03.57	32000
P302	29.11.25	30.11.25	21:39	04:31	11°43.89	087°02.53	11°17.860	087°19.679	33004
P303	30.11.25	30.11.25	04:47	05:27	11°18.141	087°20.864	11°21.065	087°31.833	38128
P304	30.11.25	30.11.25	05:49	07:18	11°21.79	087°20.84	11°18.28	087°15.51	38883
P305	30.11.25	30.11.25	07:37	08:10	11°17.37	087°16.11	11°18.93	087.18.29	40175
P306	30.11.25	30.11.25	08:22	09:53	11°18.85	087°19.01	11°12.904	087°22.933	40706
P307	30.11.25	30.11.25	09:57	16:23	11°12.712	087°23.200	11°05.525	087°51.463	41757
P308	30.11.25	30.11.25	16:30	17:12	11°05.755	087°51.860	11°08.888	087°51.957	44640
P309	30.11.25	30.11.25	17:36	19:15	11°09.046	087°50.640	11°01.94	087°47.96	45210
P310	30.11.25	30.11.25	19:37	20:30	11°01.65	087°49.13	11°05.39	087°50.60	46249
P311	30.11.25	01.12.25	20:39	13:15	11°05.59	087°51.09	10°40.820	089°00.146	46780
P312	01.12.25	01.12.25	13:36	15:14	10°39.519	089°00.169	10°36.230	088°54.479	55501
P313	01.12.25	01.12.25	15:37	18:14	10°37.106	088°52.375	10°48.938	088°55.698	56528
P401	06.12.25	06.12.25	20:40	21:37	12°02.615	091°16.056	11°58.892	091°13.524	60178
P402	06.12.25	06.12.25	21:45	22:36	11°58.33	091°13.66	11°55.280	091°16.471	60673
P403	06.12.25	07.12.25	22:49	16:12	11°55.642	091°17.189	13°03.401	090°48.505	61157
P404	07.12.25	07.12.25	16:23	16:56	13°03.312	090°47.631	13°00.713	090°47.231	68899
P405	07.12.25	07.12.25	17:13	18:20	13°00.030	090°47.880	13°02.361	090°51.687	69325
P501	10.12.25	10.12.25	20:40	22:45	15°34.644	095°51.932	15°35.365	095°43.102	70132
P502	10.12.25	10.12.25	22:54	23:39	15°35.797	095°42.752	15°38.858	095°43.739	71288
P503	10.12.25	11.12.25	23:54	03:06	15°38.705	095°44.891	15°25.672	095°54.825	71796
P504	11.12.25	11.12.25	03:12	03:36	15°25.909	095°55.514	15°27.093	095°57.775	73530
P505	11.12.25	11.12.25	04:21	06:11	15°28.532	095°57.453	15°26.450	095°49.719	74086
P506	11.12.25	11.12.25	06:35	07:19	15°25.424	095°50.274	15°26.50	095°53.95	75231
P507	11.12.25	11.12.25	07:23	12:08	15°26.39	095°54.17	15°08.445	096°07.671	75645
P508	11.12.25	11.12.25	12:15	12:53	15°08.653	096°08.214	15°10.971	096°10.173	77780
P509	11.12.25	11.12.25	13:08	14:50	15°11.568	096°09.554	15°08.404	096°02.979	78137
P510	11.12.25	11.12.25	15:06	15:48	15°07.640	096°03.355	15°09.308	096°06579	78951
P511	11.12.25	11.12.25	15:55	21:58	15°09.251	096°07.059	14°48.008	096°23.396	79319
P512	11.12.25	11.12.25	22:08	23:02	14°48.080	096°23.986	14°51.436	096°26.332	82392
P513	11.12.25	12.12.25	23:22	01:13	14°52.228	096°25.490	14°47.572	096°18.746	82979

Profile -Nr.	Date Start	Time Start UTC	Time End UTC	Latitude Start (South)	Longitude Start (East)	Latitude End (South)	Longitude End (East)	FFN Start	FFN End
P514	12.12.25	12.12.25	01:28	02:12	14°46.964	096°19.567	14°.48.733	096°48.762	84063
P515	12.12.25	12.12.25	02:21	14:11	14°48.582	096°22.997	14°05.491	096°53.609	84508
P516	12.12.25	12.12.25	14:22	15:17	14°05.218	096°53.073	14°06.412	096°48.616	90698
P517	12.12.25	12.12.25	15:39	17:54	14°07.671	096°48.505	14°11.621	096°57.112	91352
P601	15.12.25	15.12.25	20:21	23:55	14°36.119	097°57.709	14°48.847	097°58.206	100100
P602	16.12.25	16.12.25	00:00	03:51	14°48.859	097°57.832	14°44.401	097°43.880	101762
P603	16.12.25	16.12.25	03:58	07:33	14°44.927	097°43.980	14°55.634	097°53.045	103542
P604	16.12.25	16.12.25	07:40	10:35	14°55.684	097°52.6027	14.52.378	097°41.113	105214
P605	16.12.25	16.12.25	10:42	11:40	14°52.829	097°41.255	14°54.870	097°45.356	106575
P606	16.12.25	16.12.25	11:49	14:03	14°54.634	097°45.824	14°44.987	097°48.962	107073
P607	16.12.25	16.12.25	14:08	17:09	14°44.684	097°49.213	14°38.166	098°01.250	108115
P701	17.12.25	17.12.25	17:43	19:15	15°51.570	100°15.483	15°57.624	100°11.942	110185
P702	17.12.25	17.12.25	19:40	20:40	15°58.557	100°12.908	15°57.18	100°16.96	111058
P703	17.12.25	18.12.25	20:47	06:16	15°47.543	100°01.882	15°30.014	099°33.101	111560
P704	18.12.25	18.12.25	06:34	07:17	15°28.930	099°33.379	15°27.278	099.36.148	115969
P705	18.12.25	18.12.25	07:46	09:39	15°28.106	099°37.075	15°34.660	099°33.013	116500
P706	18.12.25	18.12.25	09:51	10:33	15°34.101	099°32.223	15°31.000	099°33.936	117439
P707	18.12.25	18.12.25	10:40	19:53	15°30.451	099°33.848	15°06.180	098°56.439	117807