

Technical Report for Raw 2D MCS Reflection Data, R/V Sonne Cruise 299, Leg 2, Singapore (Singapore) – Port Louis (Mauritius), 15/08/23 – 02/09/23

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Keywords: 2 D multichannel seismic (MCS) reflection data – raw data – GI Gun – Krakatau – Sunda Strait – tsunami – flow depositions – volcanism

Coordinates: *Median Latitude:* -6.142701 * *Median Longitude:* 105.398409 * *South-bound Latitude:* -6.370822 * *West-bound Longitude:* 105.182177 * *North-bound Latitude:* -5.901452 * *East-bound Longitude:* 105.612103

Abstract

The raw 2D multichannel seismic reflection data in this project were acquired during expedition SO299-2 offshore Krakatau using a single GI Gun. The data were recorded with a 48-channel streamer. The Krakatau survey aimed to shed light on the erupted volumes of the disastrous 1883 eruption and decipher the processes leading to a damaging tsunami. The data comprise 381-line kilometers and are provided in raw format (SEG-D) and associated standardized metadata. Detailed information on the acquisition can be found in the SO299-2 cruise report (https://doi.org/10.48433/cr_so299_2). This technical report provides further information on the acquisition of the 2D multichannel seismic reflection data set.

1 Introduction

The central objective of expedition SO299-2 was to gain a better understanding of the geological processes controlling volcanogenic tsunami genesis and to investigate post-collapse material redeposition and erosion processes. Focusing on Krakatau, we sought to shed light on the erupted volumes of the disastrous 1883 eruption and to decipher the processes leading to a damaging tsunami. Seismic imaging reveals three mass transport deposits, possibly originating from the 1883 events given their proximity to the modern seafloor. They vary in thickness reaching up to 100 m in some places. One of the deposits is topped by large blocks with diameters up to 400 m that stick out up to 30 m from the surrounding seafloor. The size and density of blocks decrease with increasing distance to the volcano, suggesting a debris flow deposit rather than a pyroclastic flow. Normal faults spread around the surveyed area show

recent activity until the presumed 1883 deposits. Several buried and thus older deposits of similar thickness are imaged, sandwiched between what is inferred to be hemipelagic sedimentation. Additional information from cores indicates that the uppermost sediments are dominated by hemipelagic green muds with little organic matter and high ash content. Intercalated turbidite and volcanic ash layers are frequent. Modern sedimentation is controlled by strong currents with evidence for both strong erosion in the west and areas of focused deposition in the east of the archipelago. The seismic data show widespread occurrence of gas and water column imaging reveals active venting from the seafloor in numerous locations.

2 Seismic Acquisition

During SO299-2, we used a high-resolution 2D seismic system to image the shallow subsurface at high resolution. The seismic source consisted of a single GI Gun with a 75/75 cubic inch generator and injector volumes. This array was towed 20 m behind the vessel at 2 m depth (Figure 1). The air pressure was 140-145 bar. The shot interval was 5 s and the record length for each shot was 4.5 s.

The seismic receiver consisted of a 40 m-long tow cable, a 25 m-long stretch section, a 75 m-long active cable, and a 20 m-long line to the tail buoy. A weight was attached to this line 2 m before the tail buoy to keep the streamer at depth. The active cable comprised six sections of oil-filled Geometrics GeoEel streamers with 48 channels in total. The hydrophone group spacing was 1.5625 m. The streamer was towed without birds but visual inspection suggested that the streamer was towed between 0.5 and 1.5 m depth. The seismic data were A/D converted within digitizing bottles within each streamer segment and transferred to the ship using an ethernet network. The data were recorded with an SPSU and Geometrics software in SEG-D format.

For navigation, we mounted a GPS antenna on the ship's superstructure close to the stern of the vessel. The position of this GPS antenna was measured with a tape measure and related to the towing points of the airgun source and the streamer. The navigation data were logged in parallel to the seismic data.

Seismic operations included two stations (SO299/2-2 and SO299/2-10) that covered 200- and 181-line kilometers, respectively (Figure 2). Seismic operations were continuous and without any downtime.

A detailed description of the streamer and source setup can be found in 7 Appendix.

Survey: P1000

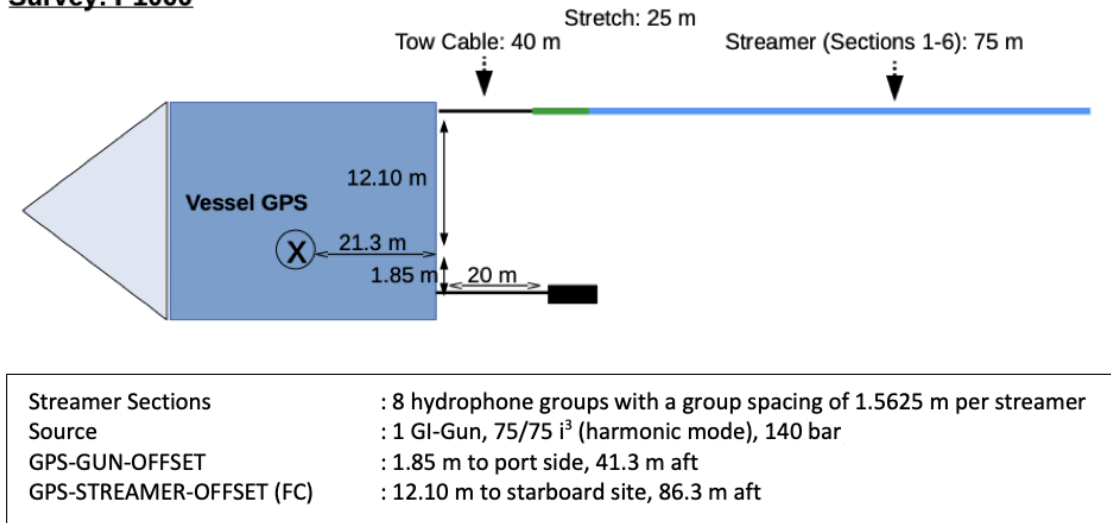


Figure 1: Survey geometry for 2D seismic acquisition during SO299-2.

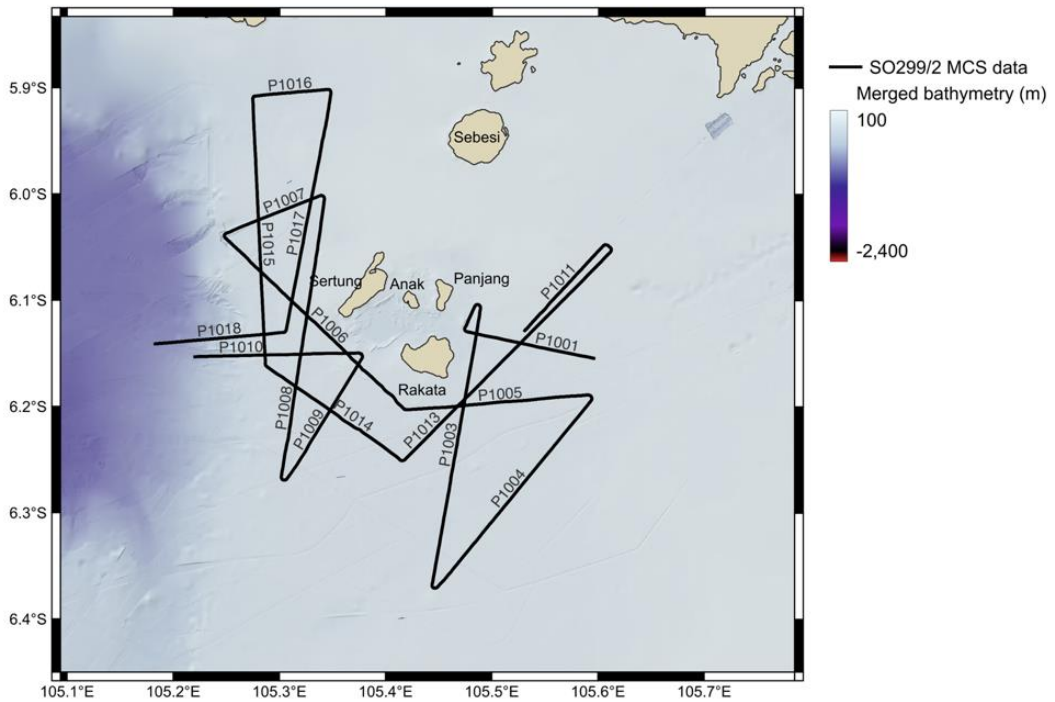


Figure 2: Overview of reflection seismic acquisition during SO299-2

3 Data Description

The complete raw 2D multichannel reflection seismic data have been archived at the German repository PANGAEA. The data have been quality controlled before archiving. However, for completeness, all recorded shots, whether qualified or not, have been included in the archiving process except SP (Shot Point) 1 up to SP 115 as they are not valid.

In addition, the seismic watchkeeping log called *SO299-2_2D_Seismic_watchkeeping_log.xls* documents any changes or problems during the acquisition and logging of the data. The navigation files listed in Table 1 have been attached and linked to the data set.

Please note that the line numbering in this technical report has been revised after the first quality control and might differ from the original final line numbering referred to in the original logs and final report linked to this data set.

Table 1: Supplement

Item	Description
SO292-2_ship.txt	Navigation text file – Start 19.08.2023 at 05:29:45 End 21.08.2023 at 18:13:22
SO299-2_P1000.0001.Nav.txt	Navigation text file for SP 200-30898
SO299-2_trigger.txt	Navigation text file – Start 19.08.2023 at 05:30:40 End 21.08.2023 at 18:13:15
SO299-2_2D_Seismic_watchkeeping_log.xls	Watchkeeping log for 2D MCS reflection RAW data
	Technical report for 2D MCS reflection RAW data
https://doi.org/10.48433/cr_so299_2	Cruise Report SO299-2

4 Data Quality/ Accuracy

The seismic data are of high quality and do not show significant noise apart from a bubble pulse and the seafloor multiple. Due to the relatively soft seafloor both these noise sources do not affect the imaging in a significant way, but it will be useful to suppress the seafloor multiple with more sophisticated processing as the data show clear evidence of primary reflections below the onset of the first seafloor multiple. The penetration of the seismic data is generally good reaching more than 1 s two-way travel time in some parts of the survey area.

5 Data Availability/ Access

The raw seismic files and all corresponding logs and spreadsheets or files have been archived at PANGAEA <https://doi.pangaea.de/10.1594/PANGAEA.972725>

The data will be freely available after the end of the moratorium period of four years ending 2nd September 2027, unless the author has applied for an extension. When using the data, please cite this data publication. Recommended citation is:

Urlaub, M., Husrin, S., Kühn, M., Berndt, J., 2024. 2D multichannel seismic reflection raw data (entire dataset) of RV SONNE during cruise SO299/2. PANGAEA, <https://doi.pangaea.de/10.1594/PANGAEA.972725>

6 Acknowledgments

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7 Appendix

7.1 Details for P1000

(Please refer also to Figure 2: Overview of reflection seismic acquisition during SO299-2)

Table 2: Seismic profiles for **P1000**
(**FGSP** stands for **F**irst **G**ood **S**hot **P**oint and **LGSP** stands for **L**ast **G**ood **S**hot **P**oint)

Event	Profile	FGSP	LGSP	LAT Start	LONG Start	LAT End	LONG End
SO299-2_2-1	P1001	200	1320	6.154343°S	105.595266°E	6.126808°S	105.473973°E
SO299-2_2-1	P1002	1321	1630	6.126720°S	105.473980°E	6.103851°S	105.486586°E
SO299-2_2-1	P1003	1631	4120	6.103868°S	105.486669°E	6.370812°S	105.446081°E
SO299-2_2-1	P1004	4121	7835	6.370816°S	105.446171°E	6.190029°S	105.592938°E
SO299-2_2-1	P1005	7836	9410	6.189962°S	105.592869°E	6.202252°S	105.417150°E
SO299-2_2-1	P1006	9411	11665	6.202188°S	105.417080°E	6.038340°S	105.248021°E
SO299-2_2-1	P1007	11666	12730	6.038264°S	105.248057°E	6.001245°S	105.339222°E
SO299-2_2-1	P1008	12731	15350	6.001255°S	105.339306°E	6.269202°S	105.304057°E
SO299-2_2-1	P1009	15351	17000	6.269211°S	105.304121°E	6.150428°S	105.376640°E
SO299-2_2-1	P1010	17001	18566	6.150358°S	105.376549°E	6.153291°S	105.219869°E
SO299-2_10-1	P1011	18629	20200	6.128043°S	105.530836°E	6.047396°S	105.606364°E
SO299-2_10-1	P1012	20201	20285	6.047387°S	105.606446°E	6.051892°S	105.612110°E
SO299-2_10-1	P1013	20286	22390	6.052002°S	105.612125°E	6.250973°S	105.414655°E
SO299-2_10-1	P1014	22391	24030	6.250951°S	105.414581°E	6.160443°S	105.286498°E
SO299-2_10-1	P1015	24031	26660	6.160364°S	105.286482°E	5.907900°S	105.275896°E
SO299-2_10-1	P1016	26661	27555	5.907874°S	105.275964°E	5.902407°S	105.347497°E
SO299-2_10-1	P1017	27556	29725	5.902471°S	105.347553°E	6.129859°S	105.304995°E
SO299-2_10-1	P1018	29726	30898	6.129915°S	105.304902°E	6.141178°S	105.182547°E

Table 3: Data acquisition parameters for **P1000**

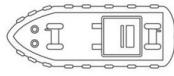
* Includes bird sections (none); + measured relative to GPS antenna

	P1000
Shot rate (s)	5
Record length (s)	4.5
Sample rate (ms)	1
Shot mode	GI Gun (75/75 cubic inch)
Streamer depth (m)	0.5 – 1.5
Total Streamer Length (m)*	160
Delay (ms)	55
Gun-offset to port (m)⁺	1.85
Gun-offset aft (m)⁺	41.3
Streamer offset to starboard (m)⁺	12.1
Streamer offset aft (m)⁺	86.3

Cruise: SO299_2
 Line: P1000

Date: 19.08.2023

cable length 155,00 m



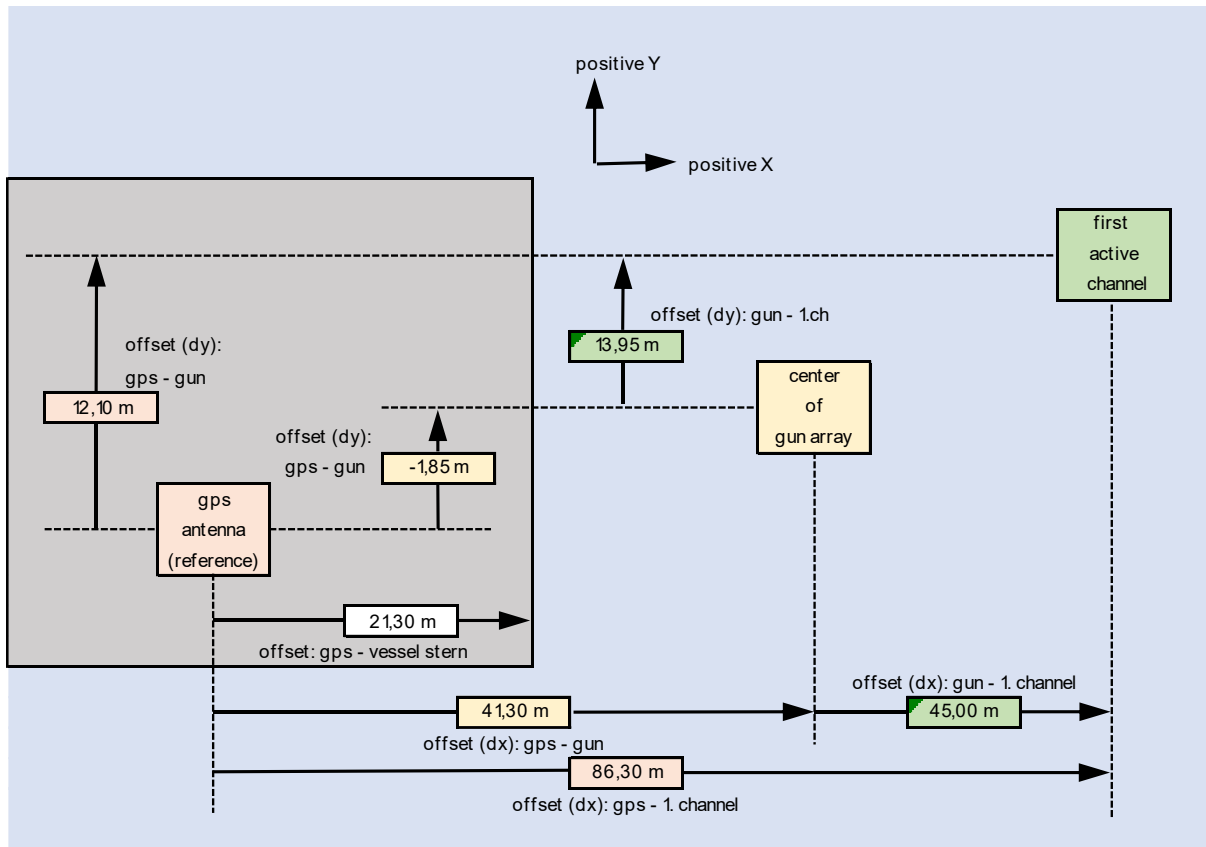
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
GeoEel TowCable	GeoEel Vibro	GeoEel Steamer	GeoEel Steamer	GeoEel Steamer	GeoEel Steamer	GeoEel Steamer	GeoEel Steamer	cable-to-buoy	tail-buoy
40,00 m	20,00 m	12,50 m	12,50 m	12,50 m	12,50 m	12,50 m	12,50 m	20,00 m	0,00 m
40,00 m	60,00 m	72,50 m	85,00 m	97,50 m	110,00 m	122,50 m	135,00 m	155,00 m	155,00 m

sample rate 1ms
 record length 4,5

Figure 3: Streamer setup for P1000

Cruise SO299-2
 Line: P1000

Date: 19.08.2023



shot mode: GI-Gun (75/75)
 shot rate: 5 sec
 delay: 55 ms
 pressure: 140-145 bar

Figure 4: Source setup for P1000

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