Description of dataset “Data of the controlled source seismic profile LISPWAL2: Lithospheric structure of the Namibian continental passive margin at the intersection with the Walvis Ridge”

T. Ryberg, C. Haberland
GFZ German Research Centre for Geosciences, Telegrafenberg, D-14473 Potsdam, Germany

Abstract
This dataset contains data of a reflection seismic profile in North-Western Namibia. The measurements were carried out in continuation of the LISPWAL project aiming to decipher the lithospheric structure of the Namibian passive margin at the intersection with the Walvis Ridge (Ryberg et al., 2014a, b; 2015). Scientific aims were a) to produce a high-resolution image of the reflectivity of the lower-crustal high-velocity body revealed by wide-angle observations; b) an improved understanding of how continental crust and plume head interact, c) to investigate what the extent and volumes of magmatic underplating are, and d) to understand how and which inherited (continental) structures might have been involved and utilized in the break up process. The dataset contains seismic data, including raw and SEG-Y files, of the controlled-source survey in North-Western Namibia (Kaokoveld) using near-vertical reflection seismic methods.

Coordinates: -18.722 S 12.646 E
Keywords: Geophysics, controlled-source seismic survey, onshore, offshore, continental margin, Namibia, Walvis Ridge

1. Introduction

Passive continental margins offer the unique opportunity to study the processes involved in continental extension and break up as well as the role of hot-spot related magmatism. We conducted combined on- and offshore seismic experiments in Northern Namibia designed to characterize the Southern African passive margin at the interaction with the Walvis Ridge, to assess the interaction of the presumed plume with the continental lithosphere and to determine the deep structure of the transition from the coastal fold belt to the stable craton, where the Walvis Ridge hits the African continent. The seismic LISPWAL2 dataset (follow-up of LISPWAL) consists of near-vertical seismic investigations of the previously discovered lower crustal high-velocity body (Ryberg et al, 2014a, b, 2015; LISPWAL project). The knowledge of the lithospheric structure of the margin together with results from other geoscientific studies (e.g., conducted within the SPP-SAMPLE “South Atlantic Margin Processes and Links with onshore Evolution” (DFG Priority Program SPP 1375, https://www.sample-spp.de/) will help to address fundamental questions such as how continental crust and plume head interact, what the extent and volumes of magmatic underplating is, and how and which inherited (continental) structures might have been involved and utilized in the break-up process.

2. Data Acquisition – Experiment, schedule, acquisition parameters

2.1 Experiment design and schedule

In January 2012 we conducted an extensive seismic experiment in Northern Namiba, in the Kaokoveld. Along a coast-parallel line with a total length of more than 200 km, we deployed 300 seismic sensors and CUBE data loggers (Fig. 1) at 2000 locations in a roll-along regime. The average spacing of the instruments was ~100 m along the coast-parallel line, the average shot spacing was 1400 m, 146 shots had been carried out. The data loggers had been equipped with short-period, one- and three-component seismic sensors.
Every shot location consisted of one borehole (~25m deep) which had been drilled directly along the existing tracks to minimize the environmental impact. The charge size was 25 kg of explosives. The holes were loaded, several meters of stemming added, then blasted. The exact blasting time was measured with special equipment (GPS based, high-accuracy).

Shots had been carried out from January 9th until January 26th 2012. We started our investigations at the southern end of the line (position #1). In total, the sensor spread, consisting of 300 stations, spaced ~100 m apart, was 30 km long. After blasting of ~8 shots in the morning of each day, 100 seismic sensors/recorders have been picked up, the data downloaded, and then re-deployed at the next 100 locations further north.

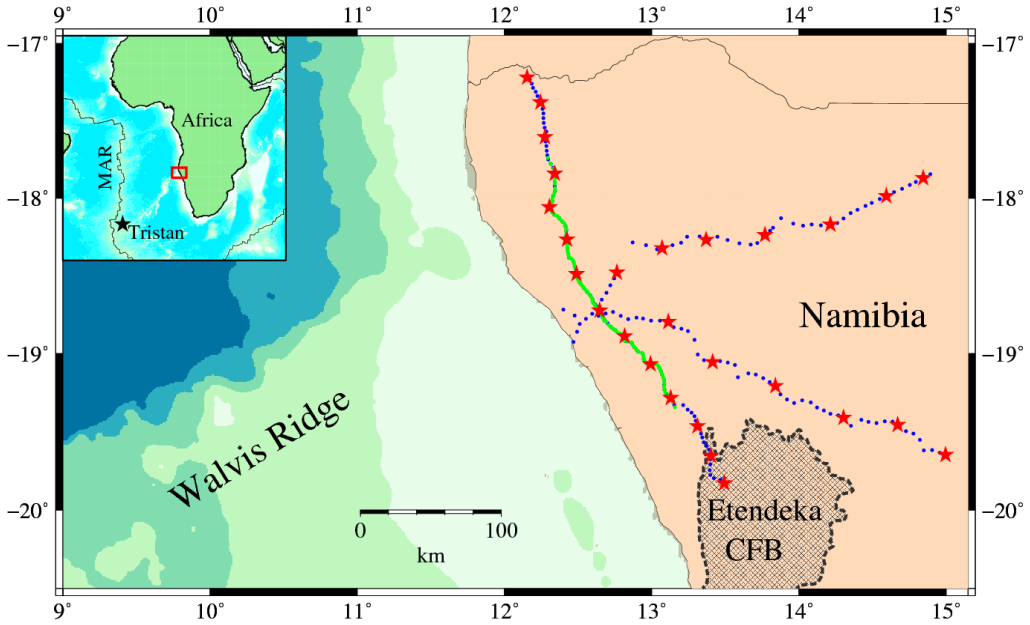

Figure 1: Map of the study region in Northern Namibia involving previously shot seismic profiles (blue dots, red stars, project LISPWAL). The green line indicates the location of the high-resolution reflection seismic line (this report, project LISPWAL II).

2.2 Geometry/Location

The shot and sensor coordinates and ID's can be found in file INFO/master.dat. The roll-along scheme is given here:

day [dd/mm/yy]	*1st sensor location (ID)*	*Last sensor location (ID)*	*Shot location (ID)*
09/01/12	1	300	1 43 86 128 171 213 256 298 50 100 150
10/01/12	101	400	101 143 186 228 271 313 356 398
11/01/12	201	500	201 243 286 328 371 413 456 498
12/01/12	301	600	301 343 386 428 471 513 556 598
13/01/12	401	700	401 443 486 528 571 656 698
14/01/12	501	800	501 543 586 628 671 713 798
15/01/12	601	900	601 643 686 728 771 813 898
16/01/12	701	1000	701 743 786 828 871 913 956 998
17/01/12	801	1100	801 843 886 928 971 1013 1056 1098
18/01/12	901	1200	901 943 986 1028 1071 1113 1156 1198

19/01/12	1001	1300	1001 1043 1086 1128 1171 1213 1256 1298
20/01/12	1101	1400	1101 1143 1186 1228 1271 1313 1356 1398
21/01/12	1201	1500	1201 1243 1286 1328 1371 1413 1456 1498
22/01/12	1301	1600	1301 1343 1386 1428 1471 1513 1556 1598
23/01/12	1401	1700	1401 1443 1486 1528 1571 1613 1656 1698
24/01/12	1501	1800	1501 1543 1586 1628 1671 1713 1756
25/01/12	1601	1900	1601 1643 1686 1728 1771 1813 1856 1898
26/01/12	1701	2000	1701 1743 1786 1828 1871 1913 1956 1998 1850 1900 1950

2.3 Instrumentation

We used 300 seismic dataloggers (1- and 3-channel CUBE recorders; see www.gfz-potsdam.de/gipp or www.digos.eu) with vertical component and three-component geophones having Eigen frequencies of 4.5 Hz. Every third location was equipped with a three-component sensor (starting with location 3, 6, 9, …). The data loggers recorded continuously at a sampling rate of 200 samples per second.

2.4 Acquisition parameters

Parameter	*Value*
Length of profile	Along the coast: ~200 km
Length of active spread	~30 km
Sensor spacing	~100 m, 300 sensors
Shot spacing	~1400 m
Sampling rate	200 Hz
Acquisition length	Continuous recordings
Nominal CDP fold	~12

3. Data Pre-Processing

The data set was pre-processed at the Helmholtz Centre Potsdam GFZ German Research Centre for Geosciences (GFZ). Time series for the 146 shots were cut out from the continuously recorded data stream of the data loggers, and consequently converted to the commonly used data format SEG-Y (Barry et al., 1975).

4. Data Description

One SEG-Y file contains the recordings of all vertical component record and all sources along the line. Three more files contain the vertical, NS and EW component records of the 3-channel CUBES. See section 4.2 for an overview on file names.

4.1 File formats

We provide two file formats: raw (CUBE proprietary format) and SEG-Y data. Only minimal information is set in the SEG-Y headers. All SEG-Y files have a length of 31 sec, starting at -1 sec, i.e. one second before the actual shot time.

SU Header[1]	*Byte Position*	*Byte Length*	*SEG description*	*Comment*
fldr	009-012	4	Shot point number	1-150, see 6th column in master.dat
tracf	013-016	4	Station numbers	1-2000, see 2nd column in master.dat
offset	037-040	4	Source-receiver distance	
gelev	041-044	4	Receiver elevation	
selev	045-048	4	Source elevation	

4.2 Data content and structure:

File name	*Stations*	*Size*	*Comment*
SEGY/csp_all.segy	all	1092MB	Vertical component
SEGY/csp_all_p0.segy	every 3rd	365MB	Vertical component
SEGY/csp_all_p1.segy	every 3rd	365MB	NS component
SEGY/csp_all_p2.segy	every 3rd	365MB	EW component
Raw data sorted by cube number (see INFO/master.dat)			
RAW/cube-xxx			
Geometry & shot times			
INFO/master.dat			Station geometry, shot information

5. Data Quality/Accuracy

Generally, the data quality (signal-to-noise ratio) and the GPS timing of the data are good. All blasting operations went smoothly. In addition to our controlled-source events, due to continuous data logging, we recorded several local and teleseismic events.

6. Data Availability/Access

Data is archived at the *GIPP Experiment and Data Archive* where it is freely available for further use under a CC-BY 4.0 license. When using the data, please give reference to this data publication. Recommended citation is:

> T. Ryberg & C. Haberland (2021) Data of the controlled source seismic profile LISPWAL2: Lithospheric structure of the Namibian continental passive margin at the intersection with the Walvis Ridge. GFZ Data Services. https://doi.org/10.5880/GIPP.201111.1

Acknowledgments

We thank the Geological Survey of Namibia (GSN) for the support of this experiment. Thanks to the GSN, the temporary importation of the seismic equipment and the actual field work could be carried out without any problems, especially due to the permits provided by the GSN. The drill contractor Daniel van Rhyn and blasting contractor Lee also conducted an excellent job. Funding was provided by the German Research Foundation (DFG) and GFZ. Instruments were provided by Geophysical Instrument Pool Potsdam (GIPP) of the GFZ (Haberland and Ritter, 2016).

1 Seismic Un*x (Cohen & Stockwell, 2010)

References

Barry, K.M.; Cavers, D.A.; Kneale, C.W. (1975): *Recommended standards for digital tape formats*. Geophysics 40 (2), pp. 344–352, https://doi.org/10.1190/1.1440530

Cohen, J. K. and Stockwell, Jr. J. W., (2010), CWP/SU: Seismic Un*x Release No. 4.2: an open source software package for seismic research and processing, Center for Wave Phenomena, Colorado School of Mines.

Ryberg, T.; Haberland, C.; Weber, M.; Jokat, W.; Behrmann, J.; Gassner, Alexandra (2014): LISPWAL: Lithospheric structure of the Namibian continental passive margin at the intersection with the Walvis Ridge from amphibious seismic investigations November 2010 – January 2011, Namibia - Datasets. Deutsches GeoForschungsZentrum GFZ. https://doi.org/10.5880/GIPP.201019.1

Ryberg, T., Haberland, C., Weber, M., Jokat, W., Behrmann, J., Gassner, A. (2014): LISPWAL: Lithospheric structure of the Namibian Continental passive margin at the intersection with the Walvis Ridge from amphibious seismic investigations; November 2010 - January 2011 Namibia, (Scientific Technical Report - Data ; 14/12)(GIPP Experiment- and Data Archive), Potsdam : Deutsches GeoForschungsZentrum GFZ, 8 p. https://doi.org/10.2312/GFZ.b103-14122

Ryberg, T., Haberland, C., Haberlau, T., Weber, M., Bauer, K., Behrmann, J.H., & Jokat, W. (2015). Crustal structure of northwest Namibia: Evidence for plume-rift-continent interaction. Geology, 43, 739-742. https://doi.org/10.1130/G36768.1