Project Title: Collaborative Research: East Antarctic Outlet Glacier Dynamics

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NSF AWARD NUMBER: 1141889

Award Abstract

This award supports a project to conduct a suite of experiments to study spatial and temporal variations of basal conditions beneath Beardmore Glacier, an East Antarctic outlet glacier that discharges into the Ross Sea Embayment. The intellectual merit of the project is that it should help verify whether or not global warming will play a much larger role in the future mass balance of ice sheets than previously considered. Recent observations of rapid changes in discharge of fast-flowing outlet glaciers and ice streams suggest that dynamical responses to warming could affect that ice sheets of Greenland and Antarctica. Assessment of possible consequences of these responses is hampered by the lack of information about the basal boundary conditions. The leading hypothesis is that variations in basal conditions exert strong control on the discharge of outlet glaciers. Airborne and surface-based radar measurements of Beardmore Glacier will be made to map the ice thickness and geometry of the sub-glacial trough and active and passive seismic experiments, together with ground-based radar and GPS measurements will be made to map spatial and temporal variations of conditions at the ice-bed interface. The observational data will be used to constrain dynamic models of glacier flow. The models will be used to address the primary controls on the dynamics of Antarctic outlet glaciers, the conditions at the bed, their spatial and temporal variation, and how such variability might affect the sliding and flow of these glaciers. The work will also explore whether or not these outlet glaciers could draw down the interior of East Antarctica, and if so, how fast. The study will take three years including two field seasons to complete and results from the work will be disseminated through public and professional meetings and journal publications. All data and metadata will be made available through the NSIDC web portal. The broader impacts of the work are that it will help elucidate the fundamental physics of outlet glacier dynamics which is needed to improve predictions of the response of ice sheets to changing environmental conditions. The project will also provide support for early career investigators and will provide training and support for one graduate and two undergraduate students. All collaborators are currently involved in scientific outreach and graduate student education and they are committed to fostering diversity.

Field Work and Location:

The active source seismic component of the project took place over two field seasons (see map). The 2012 season was conducted up glacier will the 2013 season was conducted just downstream of the grounding line on the Ross Ice Shelf.

Field Equipment and Procedures:

Datalogger: All data during both field seasons was acquired with a 64 channel Stratavisor that was provided by the PASSCAL instrument center.

Geophones and Cables: 40 Hz geophones provided by the PASSCAL instrument center were used for all surveys. Geophones were typically planted in holes ~1 meter below the surface and then recovered with snow. The exception is B12-Line5 which was conducted on blue ice, where geophones were placed directly on the surface in holes created by a hammering a spike into the ice.

We utilized 4 150-meter cables with 10-meter takeouts provided by the PASSCAL instrument center.

Source: For both field seasons, the sources were composed of single or multiple 400 g Pentex PPP Booster detonated with DaveyDet electric detonator. Explosives were typically placed at depth (usually 25 meters) with holes made by a hot water drill provided by the Ice Drilling Design and Operations (IDDO). GPS timing was utilized to synchronize detonation and data acquisition with shot boxes provided by Sridhar Anandakrishnan of Penn State University. The exception to this is several shots on B13-L3 where technical issues prevented utilization of the shot boxes. In these cases, both detonation and initiation of data acquisition were done manually, as a result there is absolute timing for these shots and must be estimated from direct arrivals.

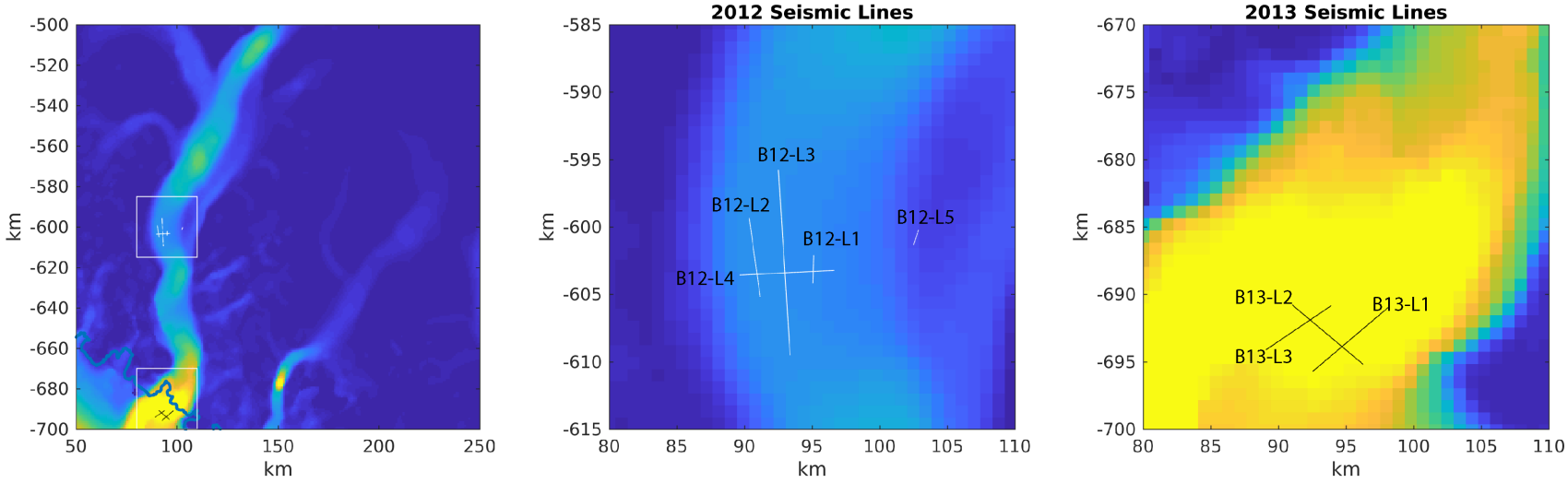
Geometry: All data was collected in linear profiles. Lines were surveyed with a laser range finder. The geographic coordinates of the first and last "flag" positions are provided. Geophone were spaced approximately 10 meters. Shot and geophone positions are approximate distance (in meters) from flag 0 of each line, however, there may be discrepancies actual offset due to surveying errors.

File list

B12-L1a.sgy
B12-L1b.sgy
B12-L2.sgy
B12-L3.sgy
B12-L4.sgy
B12-L5.sgy
B13-L1.sgy
B13-L2.sgy
B13-L3a.sgy ***No GPS Timing to sync shot and recording***
B13-L3b.sgy

Location Map

Left Panel shows regional view of the Beardmore Glacier. Background is ice velocity (yellow > 250 m/yr). Right two panels show the locations and names of the seismic lines in 2012 and 2013.



LOGBOOKS

Line ID	B12-L1	
	LAT	LONG
Flag 0	-84.3753	171.05904
Flag 2100	-84.39396	171.023654

						TIME(UTC)						
FID	SHOT LOCOCATION	GEOPHONE 1 Location (m)	GEOPHONE 60 Location (m)	SHOT DEPTH (m)	SHOT SIZE	Year	Month	Day	Hour	Min	Sec	File
8	0	310	900	10	800g	2012	11	14	21	15	0	B12-L1a.sgy
10	0	310	900	20	800g	2012	11	14	21	20	0	B12-L1a.sgy
13	300	310	900	25	400g	2012	11	15	4	37	0	B12-L1a.sgy
17	300	310	900	10	400g	2012	11	15	4	52	0	B12-L1a.sgy
19	0	310	900	20	400g	2012	11	15	5	1	0	B12-L1a.sgy
20	0	310	900	10	400g	2012	11	15	5	3	0	B12-L1a.sgy
21	2100	310	900	14	400g	2012	11	16	1	39	0	B12-L1a.sgy
22	2100	310	900	14	400g	2012	11	16	1	44	0	B12-L1a.sgy
23	1800	310	900	5	400g	2012	11	16	5	35	0	B12-L1b.sgy
25	1800	310	900	10	400g	2012	11	16	5	39	0	B12-L1b.sgy

Line ID	B12-2	
	LAT	LONG
Flag -3000 m	-84.425641	171.42707
Flag 3000 m	-84.371709	171.433166

						TIME(UTC)						
FID	SHOT LOCOCATION	GEOPHONE 1 Location (m)	GEOPHONE 60 Location (m)	SHOT DEPTH (m)	SHOT SIZE	Year	Month	Day	Hour	Min	Sec	File
28	0	2410	3000	10	800g	2012	11	18	2	16	0	B12-L2.sgy
29	600	2410	3000	20	800g	2012	11	18	22	21	0	B12-L2.sgy
30	1200	2410	3000	25	800g	2012	11	17	22	25	0	B12-L2.sgy
33	-1200	2410	3000	10	1200g	2012	11	20	4	8	0	B12-L2.sgy
35	-1800	2410	3000	20	1200g	2012	11	20	4	37	0	B12-L2.sgy
37	-2400	2410	3000	10	1200g	2012	11	20	4	43	0	B12-L2.sgy
38	-3000	2410	3000	14	1200g	2012	11	20	4	48	0	B12-L2.sgy

Line ID	B12-L3	
	LAT	LONG
Flag 0	-84.32915	171.29041
Flag 13500	-84.449645	171.119982

						TIME(UTC)						File
FID	SHOT LOCOCATION	GEOPHONE 1 Location (m)	GEOPHONE 60 Location (m)	SHOT DEPTH (m)	SHOT SIZE	Year	Month	Day	Hour	Min	Sec	File
43	0	6010	6600	25	1600g	2012	11	26	3	40	0	B12-L3-sgy
46	1200	6010	6600	25	1600g	2012	11	26	3	51	0	B12-L3-sgy
47	2400	6010	6600	25	1600g	2012	11	26	4	2	0	B12-L3-sgy
50	300	6310	6900	25	1600g	2012	11	26	20	57	0	B12-L3-sgy
59	1500	6310	6900	25	1600g	2012	11	26	21	11	0	B12-L3-sgy
60	2700	6310	6900	25	1600g	2012	11	26	21	19	0	B12-L3-sgy
61	600	6610	7200	25	1600g	2012	11	26	22	1	0	B12-L3-sgy
62	1800	6610	7200	25	1600g	2012	11	26	22	13	0	B12-L3-sgy
63	3000	6610	7200	25	1600g	2012	11	26	22	22	0	B12-L3-sgy
65	900	6910	7500	25	1600g	2012	11	26	22	56	0	B12-L3-sgy
999	2100	6910	7500	25	1600g	2012	11	26	23	6	0	B12-L3-sgy
69	3300	6910	7500	25	1600g	2012	11	27	23	31	0	B12-L3-sgy
72	1200	7210	7800	25	1600g	2012	11	27	0	55	0	B12-L3-sgy
73	2400	7210	7800	25	1600g	2012	11	27	1	6	0	B12-L3-sgy
74	3600	7210	7800	25	1600g	2012	11	27	1	16	0	B12-L3-sgy
76	1500	7510	8100	25	1600g	2012	11	27	1	50	0	B12-L3-sgy
77	2700	7510	8100	25	1600g	2012	11	27	1	59	0	B12-L3-sgy
78	3900	7510	8100	25	1600g	2012	11	27	2	7	0	B12-L3-sgy

79	1800	7810	8400	25	1600g	2012	11	27	2	41	0	B12-L3-sgy
80	3000	7810	8400	25	1600g	2012	11	27	2	50	0	B12-L3-sgy
81	4200	7810	8400	25	1600g	2012	11	27	2	58	0	B12-L3-sgy
82	2100	8110	8700	25	1600g	2012	11	27	3	30	0	B12-L3-sgy
83	3300	8110	8700	25	1600g	2012	11	27	3	38	0	B12-L3-sgy
84	4500	8110	8700	25	1600g	2012	11	27	3	47	0	B12-L3-sgy
85	2400	8410	9000	25	1600g	2012	11	27	4	18	0	B12-L3-sgy
86	3600	8410	9000	25	1600g	2012	11	27	4	26	0	B12-L3-sgy
87	4800	8410	9000	25	1600g	2012	11	27	4	34	0	B12-L3-sgy
88	2700	8710	9300	25	1600g	2012	11	27	5	9	0	B12-L3-sgy
90	3900	8710	9300	25	1600g	2012	11	28	0	52	0	B12-L3-sgy
91	5100	8710	9300	25	1600g	2012	11	28	1	1	0	B12-L3-sgy
94	3000	9010	9600	25	1600g	2012	11	28	1	33	0	B12-L3-sgy
95	4200	9010	9600	25	1600g	2012	11	28	1	41	0	B12-L3-sgy
96	5400	9010	9600	25	1600g	2012	11	28	1	48	0	B12-L3-sgy
97	3300	9310	9900	25	1600g	2012	11	28	2	18	0	B12-L3-sgy
98	4500	9310	9900	25	1600g	2012	11	28	2	26	0	B12-L3-sgy
99	5700	9310	9900	25	1600g	2012	11	28	2	33	0	B12-L3-sgy
102	3600	9610	10200	25	1600g	2012	11	28	3	3	0	B12-L3-sgy
103	4800	9610	10200	25	1600g	2012	11	28	3	12	0	B12-L3-sgy
104	6000	9610	10200	25	1600g	2012	11	28	3	18	0	B12-L3-sgy
105	3900	9910	10500	25	1600g	2012	11	28	3	46	0	B12-L3-sgy
106	5100	9910	10500	25	1600g	2012	11	28	3	55	0	B12-L3-sgy
107	6300	9910	10500	25	1600g	2012	11	28	4	2	0	B12-L3-sgy
108	4200	10210	10800	25	1600g	2012	11	28	4	30	0	B12-L3-sgy
109	5400	10210	10800	25	1600g	2012	11	28	4	38	0	B12-L3-sgy
110	6600	10210	10800	25	1600g	2012	11	28	4	44	0	B12-L3-sgy
112	4500	10510	11100	25	1600g	2012	11	28	5	13	0	B12-L3-sgy

113	5700	10510	11100	25	1600g	2012	11	28	5	21	0	B12-L3-sgy
114	6900	10510	11100	25	1600g	2012	11	28	5	29	0	B12-L3-sgy
116	4800	10810	11400	25	1600g	2012	11	28	20	37	0	B12-L3-sgy
117	6000	10810	11400	25	1600g	2012	11	28	20	47	0	B12-L3-sgy
118	7200	10810	11400	25	1600g	2012	11	28	20	55	0	B12-L3-sgy
121	5100	11110	11700	25	1600g	2012	11	28	21	29	0	B12-L3-sgy
122	6300	11110	11700	25	1600g	2012	11	28	21	41	0	B12-L3-sgy
123	7500	11110	11700	25	1600g	2012	11	28	21	48	0	B12-L3-sgy
124	5400	11410	12000	25	1600g	2012	11	28	22	18	0	B12-L3-sgy
126	6600	11410	12000	25	1600g	2012	11	28	22	29	0	B12-L3-sgy
127	7800	11410	12000	25	1600g	2012	11	28	22	36	0	B12-L3-sgy
128	5700	11710	12300	25	1600g	2012	11	28	23	8	0	B12-L3-sgy
129	6900	11710	12300	25	1600g	2012	11	28	23	18	0	B12-L3-sgy
130	8100	11710	12300	25	1600g	2012	11	28	23	25	0	B12-L3-sgy
131	6000	12010	12600	25	1600g	2012	11	29	20	11	0	B12-L3-sgy
132	7200	12010	12600	25	1600g	2012	11	29	20	18	0	B12-L3-sgy
133	8400	12010	12600	25	1600g	2012	11	29	20	26	0	B12-L3-sgy
134	6300	12310	12900	25	1600g	2012	11	29	21	9	0	B12-L3-sgy
135	7500	12310	12900	25	1600g	2012	11	29	21	15	0	B12-L3-sgy
136	8700	12310	12900	25	1600g	2012	11	29	21	21	0	B12-L3-sgy
137	6600	12610	13200	25	1600g	2012	11	29	21	58	0	B12-L3-sgy
138	7800	12610	13200	25	1600g	2012	11	29	22	4	0	B12-L3-sgy
139	9000	12610	13200	25	1600g	2012	11	29	22	10	0	B12-L3-sgy
140	6900	12910	13500	25	1600g	2012	11	29	22	47	0	B12-L3-sgy
141	8100	12910	13500	25	1600g	2012	11	29	22	53	0	B12-L3-sgy
142	9300	12910	13500	25	1600g	2012	11	29	23	0	0	B12-L3-sgy

Line ID	B14-L4	
	LAT	LONG
Flag 0	-84.38116	170.89725
Flag 7200	-84.388342	171.553028

						TIME(UTC)						
FID	SHOT LOCOCATION	GEOPHONE 1 Location (m)	GEOPHONE 60 Location (m)	SHOT DEPTH (m)	SHOT SIZE	Year	Month	Day	Hour	Min	Sec	File
150	3000	3610	4200	20	1600g	2012	12	1	22	21	0	B12-L4-.sgy
200	0	3610	4200	10	1600g	2012	12	3	0	3	0	B12-L4-.sgy
201	300	3910	4500	10	1600g	2012	12	3	0	34	0	B12-L4-.sgy
205	2700	3910	4500	20	1600g	2012	12	3	0	47	0	B12-L4-.sgy
206	600	4210	4800	15	1600g	2012	12	3	1	16	0	B12-L4-.sgy
207	900	4510	5100	15	1600g	2012	12	3	1	45	0	B12-L4-.sgy
208	2100	4510	5100	15	1600g	2012	12	3	1	52	0	B12-L4-.sgy
210	0	4810	5400	10	1600g	2012	12	3	2	25	0	B12-L4-.sgy
213	1200	4810	5400	15	1600g	2012	12	3	2	34	0	B12-L4-.sgy
214	300	5110	5700	10	1600g	2012	12	3	3	4	0	B12-L4-.sgy
215	1500	5110	5700	15	1600g	2012	12	3	3	12	0	B12-L4-.sgy
217	600	5410	6000	15	1600g	2012	12	3	3	42	0	B12-L4-.sgy
218	1800	5410	6000	15	1600g	2012	12	3	3	49	0	B12-L4-.sgy
220	900	5710	6300	15	1600g	2012	12	3	4	24	0	B12-L4-.sgy
221	2100	5710	6300	15	1600g	2012	12	3	4	30	0	B12-L4-.sgy
223	1200	6010	6600	15	1600g	2012	12	3	4	59	0	B12-L4-.sgy
224	2400	6010	6600	15	1600g	2012	12	3	5	27	0	B12-L4-.sgy
225	300	6310	6900	10	1600g	2012	12	3	5	36	0	B12-L4-.sgy

226	1500	6310	6900	15	1600g	2012	12	3	5	45	0	B12-L4-.sgy
228	2700	6310	6900	20	1600g	2012	12	3	5	51	0	B12-L4-.sgy
230	1800	6610	7200	15	1600g	2012	12	3	6	24	0	B12-L4-.sgy
231	3000	6610	7200	20	1600g	2012	12	3	6	31	0	B12-L4-.sgy

Line ID B12-L5

	LAT	LONG
Flag 0	-84.3899	170.325519
Flag 1190	-84.399671	170.274869

Shot Locations	Latitude	Longitude	Approximate "Flag" Location
Shot Loc 1	-84.39719	170.28793	900
Shot Loc 2	-84.40206	170.26163	1500
Shot Loc 3	-84.40686	170.23622	2100
Shot Loc 4	-84.41163	170.20987	2700
Shot Loc 5	-84.41647	170.18671	3300
Shot Loc 6	-84.42124	170.16109	3900
Shot Loc 7	-84.40926	170.2247	2400
Shot Loc 8	-84.41396	170.19797	3000
Shot Loc 9	-84.41869	170.17177	3600
Shot Loc 10	-84.42351	170.14507	4200
Shot Loc 11	-84.42593	170.13496	4500

Seismic Line was not surveyed
Positions from handheld GPS

						TIME(UTC)						
FID	SHOT LOCOCATION	GEOPHONE 1 Location (m)	GEOPHONE 60 Location (m)	SHOT DEPTH (m)	SHOT SIZE	Year	Month	Day	Hour	Min	Sec	File
234	900	0	590	surface	400g	2012	12	6	0	40	0	B12-L5.sgy
239	1500	0	590	surface	400g	2012	12	6	1	33	0	B12-L5.sgy
240	2700	0	590	surface	400g	2012	12	6	1	51	0	B12-L5.sgy
242	2100	0	590	surface	400g	2012	12	6	3	47	0	B12-L5.sgy
246	3300	0	590	surface	400g	2012	12	6	4	9	0	B12-L5.sgy
249	3900	0	590	surface	400g	2012	12	6	23	43	0	B12-L5.sgy
250	2400	300	890	surface	400g	2012	12	7	2	3	0	B12-L5.sgy
251	3000	300	890	surface	400g	2012	12	7	2	24	0	B12-L5.sgy
252	3600	300	890	surface	400g	2012	12	7	2	40	0	B12-L5.sgy
253	4200	300	890	surface	400g	2012	12	7	3	6	0	B12-L5.sgy
255	2700	600	1190	surface	400g	2012	12	7	4	21	0	B12-L5.sgy
256	3300	600	1190	surface	400g	2012	12	7	4	33	0	B12-L5.sgy
257	3900	600	1190	surface	400g	2012	12	7	4	43	0	B12-L5.sgy
258	4500	600	1190	surface	400g	2012	12	7	4	55	0	B12-L5.sgy

Line ID	B13-L1	
	LAT	LONG
Flag 0	-83.5471	172.4224
Flag 2100	-83.5752	171.9343

						TIME(UTC)						
FID	SHOT LOCOCATION	GEOPHONE 1 Location (m)	GEOPHONE 60 Location (m)	SHOT DEPTH (m)	SHOT SIZE	Year	Month	Day	Hour	Min	Sec	File
2	600	0	590	25	1200g	2013	12	18	0	56	0	B13-L1.sgy
3	1200	0	590	25	1200g	2013	12	18	1	7	0	B13-L1.sgy
4	1800	0	590	25	1200g	2013	12	18	1	13	0	B13-L1.sgy
7	0	10	600	25	1200g	2013	12	21	3	37	0	B13-L1.sgy
9	300	310	900	25	1200g	2013	12	21	4	32	0	B13-L1.sgy
10	0	610	1200	25	1200g	2013	12	21	22	37	0	B13-L1.sgy
11	600	610	1200	25	1200g	2013	12	21	22	42	0	B13-L1.sgy
12	300	910	1500	25	1200g	2013	12	21	23	22	0	B13-L1.sgy
13	900	910	1500	25	1200g	2013	12	21	23	27	0	B13-L1.sgy
14	600	1210	1800	25	1200g	2013	12	22	0	44	0	B13-L1.sgy
15	1200	1210	1800	25	1200g	2013	12	22	0	48	0	B13-L1.sgy
16	900	1510	2100	25	1200g	2013	12	22	2	4	0	B13-L1.sgy
17	1500	1510	2100	25	1200g	2013	12	22	2	10	0	B13-L1.sgy
19	1200	1810	2400	25	1200g	2013	12	22	2	51	0	B13-L1.sgy
20	1800	1810	2400	25	1200g	2013	12	22	2	57	0	B13-L1.sgy
21	1500	2110	2700	25	1200g	2013	12	22	3	42	0	B13-L1.sgy
22	2100	2110	2700	25	1200g	2013	12	22	3	48	0	B13-L1.sgy
23	1800	2410	3000	25	1200g	2013	12	22	4	22	0	B13-L1.sgy
24	2400	2410	3000	25	1200g	2013	12	22	4	38	0	B13-L1.sgy

25	2700	2710	3300	25	1200g	2013	12	22	5	13	0	B13-L1.sgy
26	2400	3010	3600	25	1200g	2013	12	22	21	48	0	B13-L1.sgy
27	3000	3010	3600	25	1200g	2013	12	22	21	53	0	B13-L1.sgy
28	2700	3310	3900	25	1200g	2013	12	22	22	27	0	B13-L1.sgy
29	3300	3310	3900	25	1200g	2013	12	22	22	31	0	B13-L1.sgy
30	3000	3610	4200	25	1200g	2013	12	22	23	3	0	B13-L1.sgy
31	3600	3610	4200	25	1200g	2013	12	23	0	32	0	B13-L1.sgy
32	3300	3910	4500	25	1200g	2013	12	23	0	36	0	B13-L1.sgy
33	3900	3910	4500	25	1200g	2013	12	23	1	13	0	B13-L1.sgy
34	3600	4210	4800	25	1200g	2013	12	23	1	18	0	B13-L1.sgy
35	4200	4210	4800	25	1200g	2013	12	23	2	6	0	B13-L1.sgy
351	3900	4510	5100	25	1200g	2013	12	23	2	12	0	B13-L1.sgy
36	4500	4510	5100	25	1200g	2013	12	23	2	49	0	B13-L1.sgy
39	4800	4810	5400	25	1200g	2013	12	23	2	53	0	B13-L1.sgy
40	4500	5110	5700	25	1200g	2013	12	23	3	24	0	B13-L1.sgy
41	5100	5110	5700	25	1200g	2013	12	23	3	28	0	B13-L1.sgy
42	4800	5410	6000	25	1200g	2013	12	23	3	58	0	B13-L1.sgy
43	5400	5410	6000	25	1200g	2013	12	23	4	5	0	B13-L1.sgy
44	5100	5710	6300	25	1200g	2013	12	23	4	43	0	B13-L1.sgy
45	5700	5710	6300	25	1200g	2013	12	23	4	7	0	B13-L1.sgy
46	5400	6010	6600	25	1200g	2013	12	23	5	21	0	B13-L1.sgy
47	6000	6010	6600	25	1200g	2013	12	23	5	25	0	B13-L1.sgy
48	5700	6310	6900	25	1200g	2013	12	23	5	55	0	B13-L1.sgy
49	6300	6310	6900	25	1200g	2013	12	23	5	59	0	B13-L1.sgy

Line ID	B13-L2	
	LAT	LONG
Flag 0	-83.5472	172.116
Flag 6600	-83.5937	172.439443

						TIME(UTC)						FID
FID	SHOT LOCOCATION	GEOPHONE 1 Location (m)	GEOPHONE 60 Location (m)	SHOT DEPTH (m)	SHOT SIZE	Year	Month	Day	Hour	Min	Sec	
50	0	10	600	25	1200g	2013	12	28	0	4	0	B13-L2.sgy
51	300	310	900	25	1200g	2013	12	28	0	52	0	B13-L2.sgy
52	600	610	1200	25	1200g	2013	12	28	1	27	0	B13-L2.sgy
53	900	910	1500	25	1200g	2013	12	28	2	5	0	B13-L2.sgy
54	1200	1210	1800	25	1200g	2013	12	28	2	37	0	B13-L2.sgy
55	1500	1510	2100	25	1200g	2013	12	28	3	9	0	B13-L2.sgy
56	1800	1810	2400	25	1200g	2013	12	28	3	42	0	B13-L2.sgy
57	2100	2110	2700	25	1200g	2013	12	28	4	17	0	B13-L2.sgy
58	2400	2410	3000	25	1200g	2013	12	28	4	59	0	B13-L2.sgy
59	2700	2710	3300	25	1200g	2013	12	28	23	18	0	B13-L2.sgy
60	3000	3010	3600	25	1200g	2013	12	28	23	47	0	B13-L2.sgy
61	3300	3310	3900	25	1200g	2013	12	29	0	14	0	B13-L2.sgy
62	3600	3610	4200	25	1200g	2013	12	29	0	44	0	B13-L2.sgy
63	3900	3910	4500	25	1200g	2013	12	29	2	9	0	B13-L2.sgy
64	4200	4210	4800	25	1200g	2013	12	29	2	41	0	B13-L2.sgy
65	4800	4210	4800	25	1200g	2013	12	29	2	47	0	B13-L2.sgy
66	4800	4810	5400	25	1200g	2013	12	29	3	51	0	B13-L2.sgy
67	5100	5110	5700	25	1200g	2013	12	29	4	22	0	B13-L2.sgy
68	5400	5410	6000	25	1200g	2013	12	29	4	50	0	B13-L2.sgy

69	5700	5710	6300	25	1200g	2013	12	29	23	5	0	B13-L2.sgy
70	6000	6010	6600	25	1200g	2013	12	29	23	33	0	B13-L2.sgy

Line ID	B13-L3	
	LAT	LONG
Flag 0	-83.5657	172.687
Flag 6000	-83.5897	172.2589

						TIME(UTC)						File
FID	SHOT LOCOCATION	GEOPHONE 1 Location (m)	GEOPHONE 60 Location (m)	SHOT DEPTH (m)	SHOT SIZE	Year	Month	Day	Hour	Min	Sec	
76	0	10	600	25	1200g	2014	1	2	21	6	0	B13-L3a.sgy
77	300	310	900	25	800g	2014	1	2	21	43	0	B13-L3a.sgy
78	0	610	1200	25	1200g	2014	1	2	22	15	0	B13-L3a.sgy
79	600	610	1200	25	800g	2014	1	2	22	24	0	B13-L3a.sgy
80	300	910	1500	25	1200g	2014	1	2	22	53	0	B13-L3a.sgy
81	900	910	1500	25	800g	2014	1	2	22	58	0	B13-L3a.sgy
82	600	1210	1800	25	1200g	2014	1	2	23	58	0	B13-L3a.sgy
83	1200	1210	1800	25	800g	2014	1	3	0	3	0	B13-L3a.sgy
84	900	1510	2100	25	1200g	2014	1	3	0	35	0	B13-L3a.sgy
85	1500	1510	2100	25	800g	2014	1	3	0	40	0	B13-L3a.sgy
86	1200	1810	2400	25	1200g	2014	1	3	1	9	0	B13-L3a.sgy
87	1800	1810	2400	25	800g	2014	1	3	1	14	0	B13-L3a.sgy
88	1500	2110	2700	25	1200g	2014	1	3	1	47	0	B13-L3a.sgy
89	2100	2110	2700	25	800g	2014	1	3	1	51	0	B13-L3a.sgy
90	1800	2410	3000	25	1200g	2014	1	3	2	19	0	B13-L3a.sgy
91	2400	2410	3000	25	800g	2014	1	3	2	23	0	B13-L3a.sgy
92	2100	2710	3300	25	1200g	2014	1	3	3	3	0	B13-L3a.sgy
93	2700	2710	3300	25	800g	2014	1	3	3	7	0	B13-L3a.sgy
95	2400	3010	3600	25	1200g	2014	1	3	3	51	0	B13-L3a.sgy

96	3000	3010	3600	25	800g	2014	1	3	3	55	0	B13-L3a.sgy
97	3300	3310	3900	25	800g	2014	1	5	21	20	0	B13-L3a.sgy
98	2700	3310	3900	25	1200g	2014	1	5	21	30	0	B13-L3b.sgy
99	3000	3310	3900	25	1200g	2014	1	5	21	33	0	B13-L3b.sgy
100	3000	3610	4200	25	1200g	2014	1	5	22	8	0	B13-L3b.sgy
101	3300	3610	4200	25	1200g	2014	1	5	22	11	0	B13-L3b.sgy
102	3600	3610	4200	25	800g	2014	1	5	22	4	0	B13-L3b.sgy
103	3300	3910	4500	25	1200g	2014	1	5	22	42	0	B13-L3b.sgy
104	3600	3910	4500	25	1200g	2014	1	5	22	45	0	B13-L3b.sgy
105	3900	3910	4500	25	800g	2014	1	5	22	49	0	B13-L3b.sgy
106	3600	4210	4800	25	1200g	2014	1	5	23	42	0	B13-L3b.sgy
107	3900	4210	4800	25	1200g	2014	1	5	23	45	0	B13-L3b.sgy
108	4200	4210	4800	25	800g	2014	1	5	23	48	0	B13-L3b.sgy
109	3900	4510	5100	25	1200g	2014	1	6	0	15	0	B13-L3b.sgy
110	4200	4510	5100	25	1200g	2014	1	6	0	18	0	B13-L3b.sgy
111	4500	4510	5100	25	800g	2014	1	6	0	21	0	B13-L3b.sgy
112	4200	4810	5400	25	1200g	2014	1	6	0	49	0	B13-L3b.sgy
113	4500	4810	5400	25	1200g	2014	1	6	0	53	0	B13-L3b.sgy
114	4800	4810	5400	25	800g	2014	1	6	0	55	0	B13-L3b.sgy
115	4500	5110	5700	25	1200g	2014	1	6	1	27	0	B13-L3b.sgy
116	4800	5110	5700	25	1200g	2014	1	6	1	30	0	B13-L3b.sgy
117	5100	5110	5700	25	800g	2014	1	6	1	33	0	B13-L3b.sgy
125	4800	5410	6000	25	1200g	2014	1	6	2	38	0	B13-L3b.sgy
127	5100	5410	6000	25	1200g	2014	1	6	2	42	0	B13-L3b.sgy
128	5400	5410	6000	25	800g	2014	1	6	2	45	0	B13-L3b.sgy
129	5700	5410	6000	25	400g	2014	1	6	2	48	0	B13-L3b.sgy
130	6000	5410	6000	25	800g	2014	1	6	2	50	0	B13-L3b.sgy