

INSTITUTE OF OCEANOGRAPHIC SCIENCES

DEACON LABORATORY

CRUISE REPORT NO. 238

RS BJARNI SÆMUNDSSON CRUISE B8-93
10 JUN - 24 JUN 1993

Hydrothermal activity on the Reykjanes Ridge:
an ODP Site Survey

Principal Scientist
C R German

1993

DOCUMENT DATA SHEET

AUTHOR GERMAN, C R et al	PUBLICATION DATE 1993
TITLE RS Bjarni Sæmundsson Cruise B8-93, 10 Jun-24 Jun 1993. Hydrothermal activity on the Reykjanes Ridge: an ODP Site Survey.	
REFERENCE Institute of Oceanographic Sciences Deacon Laboratory, Cruise Report, No. 238, 22pp.	
ABSTRACT <p>The cruise addressed four objectives: to investigate the presence or absence of hydrothermal activity along the Reykjanes Ridge at seven specific sites targetted for ODP drilling; to investigate the presence or absence of hydrothermal activity along the remainder of the Reykjanes Ridge; to characterise, in detail, the nature and extent of hydrothermal plume dispersal at any discovered vent site; to collect suites of trace-element clean samples from any discovered hydrothermal plume for detailed shore-based investigations.</p> <p>Sampling was carried out using a CTD-Nephelometer-Transmissometer coupled with shipboard analytical facilities for total dissolvable Mn, dissolved Si, dissolved CH₄ and dissolved H₂ measurements. No evidence for hydrothermal activity was discovered at any of the seven designated ODP drill sites on the Reykjanes Ridge. Indeed, no such evidence was found at any of the 100 stations occupied within three areas of previous study (PARSON et al., 1993), nor at a further 75 stations occupied between principal work areas. This extended our survey from 57°45'N to 63°06'N along the Reykjanes Ridge axis. Evidence for hydrothermal activity was only discovered at the northern end of this transect.</p> <p>Hydrothermal activity was detected close to 63°06'N, 24°32'W based on CTD-Nephelometer-Transmissometer data and shipboard TDMn, Si CH₄ and H₂ analyses. The plume extended ~ 4 miles (E-W) by ~ 6 miles (N-S) and the active vent site was identified from bubble-rich plumes imaged on a 38 kHz echo-sounder. Complementary suites of twelve samples taken from close to the vent site have been stored for more detailed shore-based analyses.</p>	
KEYWORDS HYDROTHERMAL ACTIVITY OCEAN DRILLING PROGRAMME ODP REYKJANES RIDGE	
ISSUING ORGANISATION <p style="text-align: center;">Institute of Oceanographic Sciences Deacon Laboratory Wormley, Godalming Surrey GU8 5UB. UK.</p> <p style="text-align: center;">Director: Colin Summerhayes DSc</p> <p style="text-align: right;"><i>Telephone</i> Wormley (0428) 684141 <i>Telex</i> 858833 OCEANS G. <i>Facsimile</i> (0428) 683066</p>	
<p style="text-align: center;"><i>Copies of this report are available from: The Library,</i></p> <p style="text-align: right;">PRICE £6.00</p>	

<u>CONTENTS</u>	Page
SCIENTIFIC PERSONNEL	7
SHIP'S PERSONNEL	8
ITINERARY	9
OBJECTIVES	9
NARRATIVE	9
SCIENTIFIC REPORTS	12
CTD-Nephelometer-transmissometer array	12
Auto-analyser for TDMn/Si analyses	12
Portable Gas Chromatograph for CH ₄ /H ₂ Analyses	12
Trace Element Sampling for Shore-based Analyses	12
ENGINEERING	13
SUMMARY	13
ACKNOWLEDGEMENTS	14
REFERENCES	15
FIGURES	16
APPENDIX	18

SCIENTIFIC PERSONNEL

GERMAN, Christopher R. (Principal Scientist)

BRIEM, Johannes

CHIN, Carol

DANIELSEN, Magnus

HOLLAND, Sebastian

JAMES, Rachael H.

JÓNSDÓTTIR, Anna-Sif

LUDFORD, Emma M.

MOSE, Christopher

PALMER, Martin R.

RUDNICKI, Mark D.

IOSDL

IMRI, Reykjavík, Iceland

Oregon State University, USA

IMRI, Reykjavík, Iceland

University of Cambridge

University of Cambridge

IMRI, Reykjavík, Iceland

University of Bristol

Oregon State University, USA

University of Bristol

University of Cambridge

SHIP'S PERSONNEL

LÁRUSSON, I.	Master
GUNNARSON, G.	Chief Officer
SVERRISON, Á.	Second Officer
GUDBJÖRNSSON, B.	Chief Engineer
SVEINBJÖRNSSON, B.	First Engineer
JÓHANNESON, E.	Steward
INGÓLFSON, J.	First Cook
OLAFSSÓN, R.	Bosun
SIGURDSSON, G.	Seaman
KRISTJÁNSSON, K.	Seaman
GUDMUNDSSON, A.	Seaman
STEFÁNSSON, T.	Seaman
ARNGRÍMSSON, S.	Engineering Assistant

ITINERARY

Departed:	Reykjavík	10 June 1993
Arrived:	Reykjavík	24 June 1993

OBJECTIVES

To investigate the presence or absence of hydrothermal activity along the Reykjanes Ridge, as revealed by water column geochemical anomalies, at sites of previous swath bathymetry/TOBI sidescan sonar investigations (Parson *et al.*, 1993), particularly those sites targeted for ODP drilling (Cann *et al.*, 1992).

To investigate the presence or absence of hydrothermal activity along the remainder of the Reykjanes Ridge wherever possible, within the time constraints of the cruise.

To characterise, in detail, the nature and extent of hydrothermal plume dispersal at any discovered vent-site, using *in-situ* sensors and shipboard analytical techniques.

To collect further water-column samples for subsequent shore-based laboratory analyses from within any given vent-plume and also from representative background stations.

NARRATIVE

The majority of the scientific personnel arrived in Reykjavík on 7 June by which time the container holding all UK equipment had arrived alongside the *Bjarni Sæmundsson*, in dock. Loading of the UK equipment was completed on the morning of 8 June. Installation of all sea-going equipment continued during 8 June and was completed on 9 June.

The *Bjarni Sæmundsson* sailed from Reykjavík at 10.00z on 10 June. Passage was made towards a proposed shakedown station at 60°15'N, 29°06'W at a speed of 12 knots.

We arrived at our shakedown station (station 372), 60°13'N, 29°09'W, at 15.15z on 11 June. This was situated in the centre of an axial volcanic ridge in the northern part of area B (Figure 1). Our instrument package (CTD-Nephelometer-Transmissometer array) was deployed to a depth of 600 m. No data was obtained from the *in-situ* sensors due to an error in the computer control system

but water samples were collected to test the shipboard TDMn/dissolved Si auto-analyser system and the dissolved CH₄/H₂ portable gas chromatograph. Further samples were archived for shore based analyses (Appendix A).

Passage was continued SW at 16.30z until 19.40z when a second shakedown station was occupied at 59°49'N, 29°43'W to test the CTD-sensor package again (station 373, Appendix A). The full sensor system was deployed to 260 m and was now found to be operating satisfactorily. Passage commenced again at 20.00z towards Area C (Figure 1) at a continuing speed of twelve knots.

We arrived at the first station in Area C on 12 June at 08.30z. A series of fifteen CTD stations (374-389) were then occupied at close proximity within this area, including proposed ODP drilling sites RR2 and RR3 (stations 380 and 385, respectively). CTD operations were interrupted at 12.30z on 13 June due to problems with the sea cable connected to the CTD. Operations recommenced at 19.10z on 13 June and a further fifteen CTD stations (390-403) were completed in Area C including proposed ODP drilling sites RR4 and RR5 (stations 390 and 394, respectively). No water-column evidence for hydrothermal activity was observed throughout Area C.

Station work at Area C was completed at 19.52z on 14 June. A transect was then started, NE, from Area C towards Area B, 58°28'N-59°40'N, with a CTD station occupied every ten nautical miles along track. A total of ten CTD stations were occupied along the transect from Area C to Area B; no water-column evidence for hydrothermal activity was observed throughout.

We arrived at the first station in Area B on 15 June at 16.21z. A series of 45 CTD stations (414-458) were occupied at close proximity within this area. No water-column evidence for hydrothermal activity was observed throughout Area B.

Station work at Area B was completed at 19.00z on 17 June. A transect was then started, NE, from Area B towards Area A, 60°40'N-61°38'N, with a CTD station occupied every five nautical miles along track. Initially, ten CTD stations (459-468) were occupied along this transect as far as 61°18'N. We then broke off from the transect at 07.28z on 18 June and followed a westerly passage away from the ridge crest to occupy a station at 61°22'N, 28°29'W in order to determine background levels of TDMn, Si, CH₄, H₂ and trace metals in this portion of the N. Atlantic Ocean. We arrived at the station (469) at 10.41z and occupied a station for background trace element sampling. The background station was completed at 11.31z on 18 June and passage was commenced back towards the Reykjanes Ridge. We arrived back at the Reykjanes Ridge at 14.56z on 18 June and recommenced our transect survey from Area B to Area A, occupying a further five CTD stations (470-474). No water-column evidence for hydrothermal activity was observed at any stations between Area B and Area A.

We arrived at the first station in Area A on 18 June at 20.13z. A series of sixteen CTD stations (475-490) were occupied at close proximity within this area, including proposed ODP drilling sites RR1, RR6 and RR7 (stations 485, 482 and 490, respectively). No water-column evidence for hydrothermal activity was observed throughout Area A.

Station work in Area A was completed at 23.09z on 19 June. Passage was then made directly for the Steinahóll Area (~63°00'N, 24°30'W - Figure 1) at twelve knots. We arrived at the first station in the Steinahóll Area at 09.41z on 21 June. Hydrothermal activity was identified close to 63°06'N, 24°32'W and a series of 33 CTD stations (491-523) were then occupied along a systematic grid centred on this location, with spacing every 1-2 miles along arms radiating from the vent-site at 45° separations (bearings 000°, 045°, 090°, 135°, 180°, 225°, 270° and 315°). Evidence for hydrothermal activity was identified at all but ten of these stations, based on *in-situ* sensor records and shipboard analyses. A hydrothermal plume was apparent covering an area measuring approximately four miles (E-W) by six miles (N-S) between 63°02'-63°08'N and 24°28'-24°35'W (Figure 2).

CTD sampling was completed at 08.30z on 20 June and a 38 kHz survey around the ridge crest at 63°06'N was then commenced at ≤ 2 knots following the route from (63°06.18'N, 24°31.73'W) to (63°06.04'N, 24°32.23'W) to (63°06.25'N, 24°32.51'W) to (63°06.10'N, 24°31.85'W). Gas-bubble rich plumes were repeatedly observed rising from the sea bed along these short transects.

The 38 kHz survey across the Steinahóll ridge-crest was completed at 09.50z on 21 June and a transect SW from the Steinahóll Area towards Area A was initiated, occupying a CTD station every five nautical miles along the transect. A total of sixteen CTD stations were occupied along the transect from the Steinahóll Area to Area A (stations 524-539); no water-column evidence for hydrothermal activity was observed throughout.

The transect from the Steinahóll Area to the northern end of Area A (63°03'N - 62°03'N) was completed at 02.39z on 22 June 1993. A final series of seven CTD stations (540-546) were then occupied at the northern end of Area A (61°44'N-62°01'N). Again, no water-column evidence for hydrothermal activity was observed at these stations.

Station work at the northern end of Area A was completed at 15.40z on 22 June 1993 and a course was set to return to Reykjavík. The vessel docked in Reykjavík harbour at 19.30z on 24 June 1993.

CRG

SCIENTIFIC REPORTS

CTD-Nephelometer-transmissometer array

The CTD system employed for this cruise was the Icelandic Marine Research Institute's SeaBird 911 *plus* system, equipped with a SeaTech 25 cm path-length transmissometer. For the purposes of this expedition, the package was augmented by Oregon State University's low-background Chelsea Instruments Aquatracka III Nephelometer. With the exception of an initial computing problem at the first shakedown station and the need to repair the CTD-sea cable connection after deployment in foul weather after station 489 (Area C), this system operated faultlessly during continuous operations, occupying 175 CTD stations in a period of just eleven days.

Auto-analyser for TDMn/Si analyses

The autoanalyser system worked well throughout the cruise. Combined TDMn and dissolved Si analyses were performed on 776 unfiltered sea water samples collected from 88 separate CTD stations (Appendix A). The method used for dissolved Si analyses was an adaptation of that described by Grasshoff (1970). Total dissolvable Mn analyses were determined using the method of Ólafsson (1986).

Portable Gas Chromatograph for CH₄/H₂ Analyses

Samples for dissolved CH₄ and H₂ analyses were drawn into brown glass bottles in a nitrogen filled glove bag and sealed with a known head-space volume. The samples were then placed on a roller-table for ≥ 1 hour prior to extraction of the head-space gas and injection into the gas chromatograph (Dando *et al.*, 1991). A total of 320 combined dissolved CH₄ and H₂ analyses were performed on board ship during the cruise, from 38 separate CTD stations. Of these, a duplicate set of 114 samples were taken from 18 stations and preserved with NaOH for subsequent shore-based analyses.

Trace Element Sampling for Shore-based Analyses

Trace element sampling during the cruise included the collection of archived, unfiltered, acidified samples for shore-based TDMn analyses to complement the shipboard analytical programme. A total of 952 archived 20 ml TDMn samples were collected from 109 of the 175 CTD

stations occupied (Appendix A). In addition, two suites of large-volume (1-litre) filtered sea water samples were collected and stored under trace element clean conditions for subsequent analyses at the University of Cambridge and the University of British Columbia, Vancouver. Eighty-one 1-litre samples were collected for the University of Cambridge at seven background stations (380, 394, 427, 436, 451, 455, 479) and three stations in the Steinahóll plume (516, 517, 521). Profiles of twelve 1-litre samples were also collected for UBC, Vancouver, at background station 469 and at station 517 in the Steinahóll plume. A further eleven 125 ml samples were also taken at the two other stations in the Steinahóll plume sampled for the University of Cambridge (516, 521). Further details are given in Appendix A.

ENGINEERING

No problems were encountered with the main CTD-winch throughout the cruise. One hundred and seventy-five deployments were made during ten days of station time, to depths of 250-2200 m.

SUMMARY

A detailed investigation has been completed to deduce the presence or absence of hydrothermal activity along the Reykjanes Ridge at sites of previous swath bathymetry/TOBI sidescan sonar investigations (Parson *et al.*, 1993). A total of 100 CTD-Nephelometer-Transmissometer stations have been occupied in the three main areas of study, C, B and A. In particular, shipboard TDMn and dissolved Si, CH₄ and H₂ analyses have all been performed at each of seven proposed sites of ODP drilling; RR1-RR7 (Cann *et al.*, 1991). Archived TDMn and dissolved CH₄ samples have also been collected from each of these stations for shorebased duplicate analyses.

We have also investigated the presence or absence of hydrothermal activity along the remainder of the Reykjanes Ridge occupying a further ten stations over 100 miles between Areas B and C, sixteen stations over eighty miles between Areas B and A and sixteen further stations between Area A and the Steinahóll vent-area at 63°N.

Finally, a gridded series of 33 stations have been occupied at high sampling resolution (every 1-2 miles) across the Steinahóll vent-field, 63°06'N. The extent of the plume has been characterised utilising shipboard determinations of TDMn and dissolved Si in a total of approximately 180 samples from thirty stations and dissolved CH₄ and H₂ analyses in a total of 78

samples from sixteen stations. Duplicate suites of twelve 1-litre trace-element clean filtered sea water samples have also been collected from directly above the vent-site for detailed shore-based trace element investigations.

ACKNOWLEDGEMENTS

On behalf of the scientific personnel, I wish to express my thanks to the Master, officers and crew for their great efforts and timely advice in support of the scientific programme.

I would also like to express my gratitude to the scientific party for their unflagging hard work and encouragement, even after the 110th "background" profile, of what was surely a character-building expedition.

REFERENCES

- DANDO, P.R., AUSTEN, M.C., BURKE, Jr., R.A., KENDALL, M.A., KENNICUTT II, M.C., JUDD, A.G., MOORE, D.C., O'HARA, S.C.M., SCHMALJOHANN, R. & SOUTHWARD, A.J. 1991 Ecology of a North Sea pockmark with an active methane seep. *Marine Ecology* 70, 49-63.
- GRASSHOFF, K. 1970 A simultaneous multiple channel system for nutrient analyses in seawater with analog and digital data record. *Technicon Quarterly*, 3, 7-17.
- ÓLAFSSON, J. 1986 The semi-automated determination of manganese in seawater with leuco-malachite green. *Science of the Total Environment*, 49, 101-113.
- PARSON, L.M., MURTON, B.J., SEARLE, R.C., BOOTH, D.J., EVANS, D., FIELD, P., KEETIN, J., LAUGHTON, A., McALLISTER, E., MILLARD, N., REDBOURNE, L., ROUSE, I., SHOR, A., SMITH, D., SPENCER, S., SUMMERHAYES, C. & WALKER, C. 1993 En echelon axial volcanic ridges at the Reykjanes Ridge: a life cycle of volcanism and tectonics. *Earth and Planetary Scientific Letters*, 117, 73-87.

B8-1993 Cruise Track Data

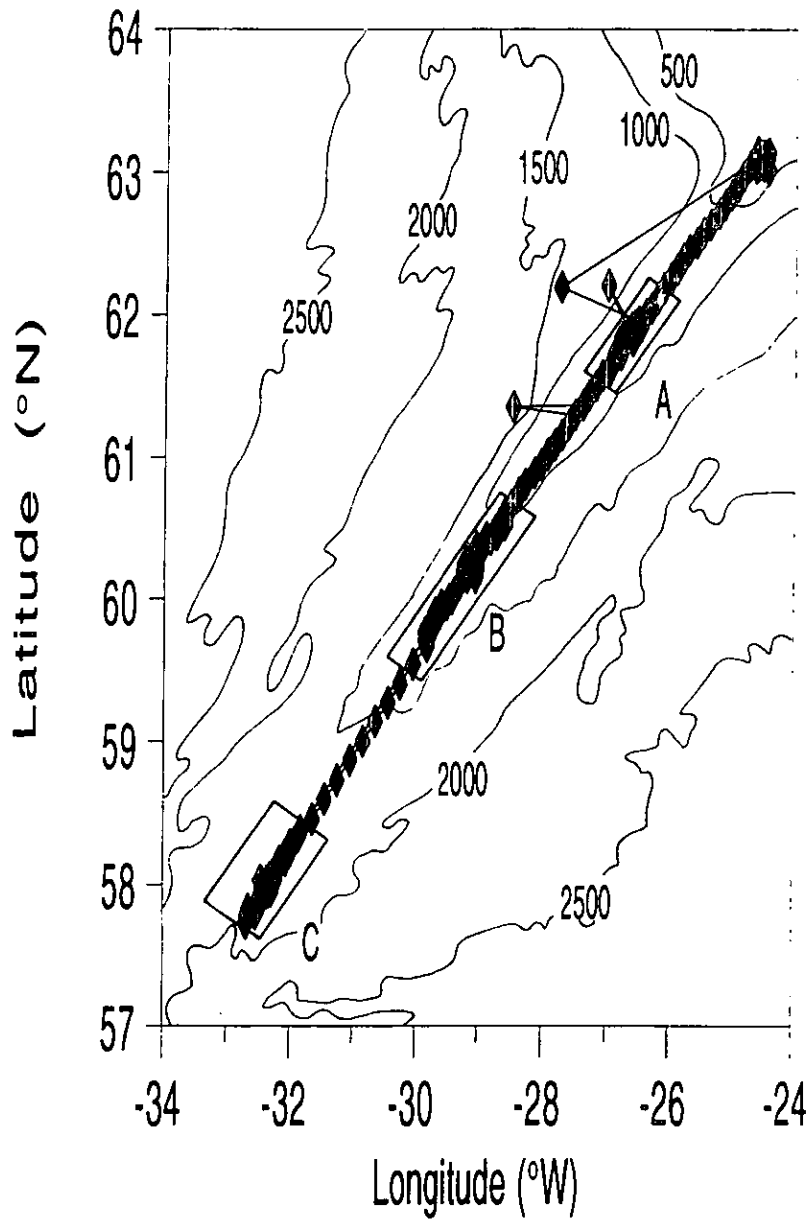


Figure 1 RS *Bjarni Sæmundsson* Cruise B8-93, 10 June-24 June 1993. Cruise track for B8-1993 showing the positions of all station locations (diamonds) and principal study areas A, B and C. The Steinahóll vent field is located at the most north-eastern end of the sampling track.

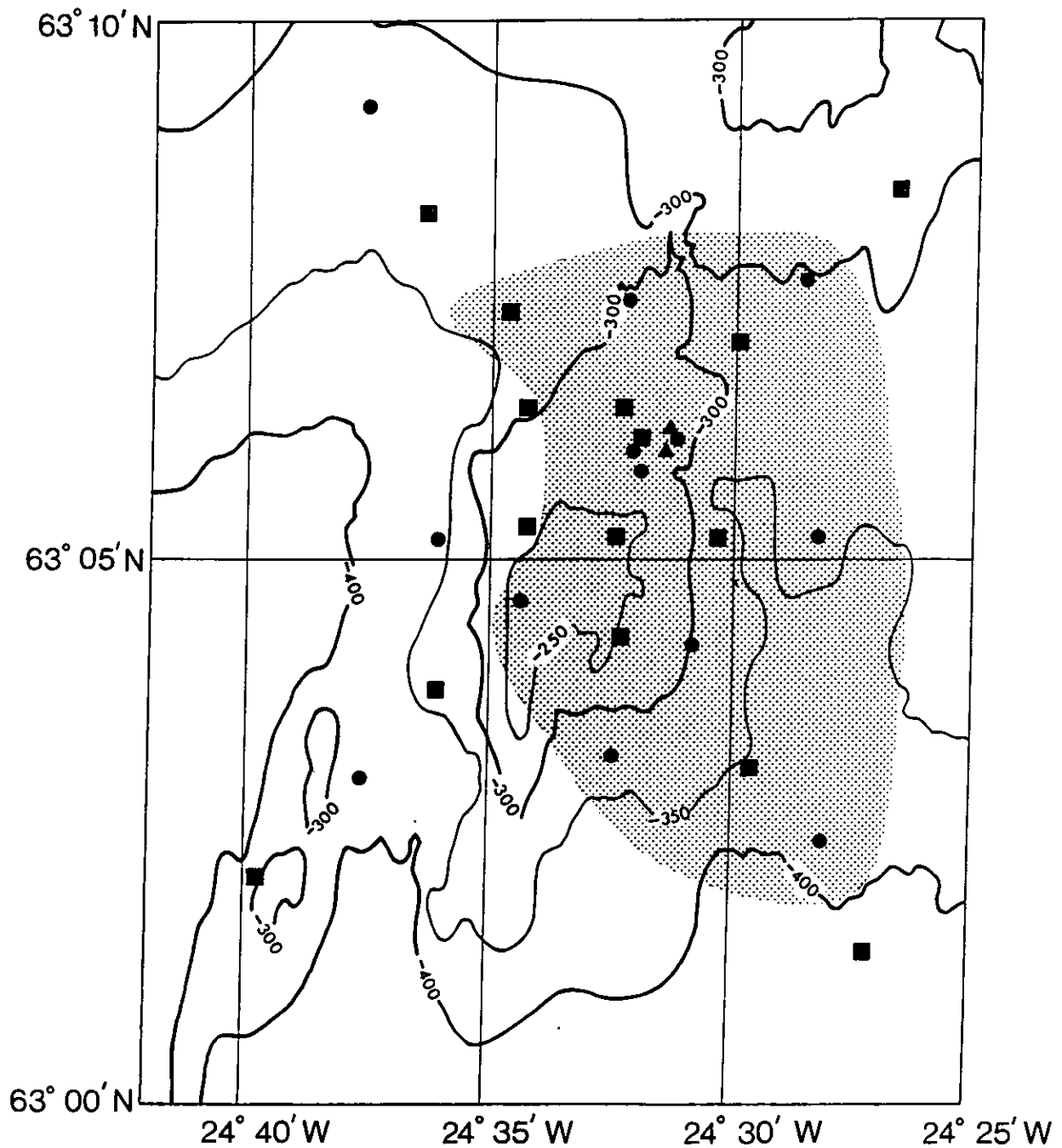


Figure 2 RS *Bjarni Sæmundsson* Cruise B8-93, 10 June-24 June 1993. Detailed sampling locations at the Steinahóll vent field. Solid squares = sites for CTD stations with shipboard TDMn, Si, CH₄ and H₂ analyses; solid circles = sites for CTD stations with shipboard TDMn only; solid triangles = sites for CTD stations only. The stippled area indicates the extent of the hydrothermal plume at Steinahóll, as deduced from shipboard TDMn analyses.

Appendix A; Station Locations for B8-1993

Station	Work Area	Latitude	Longitude	Depth (m)	Shipboard Samples	Shorebased Samples
372	Shakedown 1	60°13'N	29°09'W	800	A,G	M
373	Shakedown 2	59°49'N	29°43'W	888		
374	Area C	58°01'N	32°22'W	1898	A	M
375	Area C	58°00'N	32°19'W	1815	A,G	M
376	Area C	57°58'N	32°17'W	1960	A	M
377	Area C	57°58'N	32°26'W	1930	A,G	M,C
378	Area C	57°58'N	32°25'W	1497	A	M
379	Area C	57°59'N	32°21'W	1500		
380	Area C (RR2)	58°01'N	32°20'W	1548	A,G	M,C,T1
381	Area C	58°03'N	32°19'W	1709		
382	Area C	58°04'N	32°14'W	1640	A	M
383	Area C	58°02'N	32°15'W	1533		
384	Area C	57°59'N	32°17'W	1525		
385	Area C (RR3)	57°57'N	32°21'W	1674	A,G	M,C
386	Area C	57°55'N	32°26'W	1610	A	M
387	Area C	57°52'N	32°28'W	1731		
388	Area C	57°48'N	32°33'W	1631		
389	Area C	57°51'N	32°33'W	2125	A	M
390	Area C (RR4)	57°58'N	32°23'W	1743	A, G	M
391	Area C	57°50'N	32°39'W	1750		
392	Area C	57°47'N	32°41'W	1620	A	M
393	Area C	57°44'N	32°42'W	1526		
394	Area C (RR5)	58°02'N	32°28'W	1341	A,G	M,C,T1
395	Area C	58°07'N	32°12'W	1633		
396	Area C	58°09'N	32°09'W	1710		
397	Area C	58°10'N	32°04'W	1570		
398	Area C	58°13'N	32°04'W	1630		
399	Area C	58°14'N	32°00'W	1500	A,G	M
400	Area C	58°17'N	31°59'W	1883		
401	Area C	58°18'N	31°55'W	1760		
402	Area C	58°21'N	31°51'W	1340		
403	Area C	58°23'N	31°50'W	1460		
404	C-B Transect	58°28'N	31°38'W	1660		
405	C-B Transect	58°36'N	31°27'W	1599		
406	C-B Transect	58°44'N	31°15'W	1629		
407	C-B Transect	58°52'N	31°03'W	1530	A	M
408	C-B Transect	59°00'N	30°50'W	1107		
409	C-B Transect	59°08'N	30°38'W	1130		
410	C-B Transect	59°16'N	30°26'W	1055		
411	C-B Transect	59°24'N	30°15'W	1350	A	M
412	C-B Transect	59°32'N	30°03'W	1121	A	M
413	C-B Transect	59°40'N	29°50'W	974		

Appendix A; Station Locations for B8-1993 (contd).

Station	Work Area	Latitude	Longitude	Depth (m)	Shipboard Samples	Shorebased Samples
414	Area B	59°43'N	29°51'W	720	A,G	M,C
415	Area B	59°43'N	29°49'W	781		
416	Area B	59°46'N	29°51'W	743		M
417	Area B	59°47'N	29°48'W	853	A	M
418	Area B	59°50'N	29°46'W	910	A	M
419	Area B	59°50'N	29°43'W	650	A	M
420	Area B	59°52'N	29°42'W	680	A,G	M
421	Area B	59°54'N	29°43'W	846		M
422	Area B	59°54'N	29°37'W	832	A	M
423	Area B	59°58'N	29°36'W	802		
424	Area B	59°58'N	29°30'W	806	A	M
425	Area B	59°60'N	29°26'W	922	A	M
426	Area B	60°00'N	29°28'W	824		
427	Area B	60°02'N	29°24'W	759	A,G	M, T1
428	Area B	60°06'N	29°19'W	862	A	M
429	Area B	60°09'N	29°16'W	589		
430	Area B	60°09'N	29°11'W	805	A,G	M
431	Area B	60°09'N	29°04'W	1190		
432	Area B	60°12'N	29°03'W	1050		
433	Area B	60°12'N	29°09'W	750		M
434	Area B	60°12'N	29°14'W	806		
435	Area B	60°15'N	29°14'W	1036		
436	Area B	60°15'N	29°06'W	458	A,G	M,C,T1
437	Area B	60°14'N	29°02'W	985		
438	Area B	60°17'N	29°02'W	885		
439	Area B	60°17'N	29°06'W	580	A,G	M
440	Area B	60°17'N	29°12'W	899		
441	Area B	60°19'N	29°06'W	774	A	M
442	Area B	60°19'N	29°01'W	990		
443	Area B	60°22'N	29°03'W	748	A	M
444	Area B	60°22'N	28°56'W	836	A	M
445	Area B	60°26'N	28°53'W	735	A	M
446	Area B	60°25'N	28°49'W	1224	A	M
447	Area B	60°27'N	28°43'W	898	A	M
448	Area B	60°27'N	28°47'W	1302	A,G	M
449	Area B	60°29'N	28°45'W	1282		
450	Area B	60°29'N	28°41'W	750	A	M
451	Area B	60°32'N	28°39'W	649	A,G	M,T1
452	Area B	60°34'N	28°38'W	533		
453	Area B	60°32'N	28°39'W	642	A	M
454	Area B	60°32'N	28°41'W	730		
455	Area B	60°31'N	28°39'W	582	A	M,T1

Appendix A; Station Locations for B8-1993 (contd).

Station	Work Area	Latitude	Longitude	Depth (m)	Shipboard Samples	Shorebased Samples
456	Area B	60°32'N	28°39'W	545	A	M
457	Area B	60°31'N	28°36'W	620		
458	Area B	60°36'N	28°36'W	610		M
459	B-A Transect	60°40'N	28°30'W	779		M
460	B-A Transect	60°45'N	28°23'W	695		M
461	B-A Transect	60°49'N	28°17'W	658		
462	B-A Transect	60°53'N	28°09'W	940		
463	B-A Transect	60°57'N	28°03'W	1008		M
464	B-A Transect	61°01'N	27°56'W	818		
465	B-A Transect	61°06'N	27°50'W	686		M
466	B-A Transect	61°09'N	27°43'W	797		M
467	B-A Transect	61°14'N	27°37'W	601		M
468	B-A Transect	61°18'N	27°31'W	869		
469	B-A Transect	61°22'N	28°29'W	1330	A,G	M,T2
470	B-A Transect	61°22'N	27°24'W	960		
471	B-A Transect	61°26'N	27°18'W	800		M
472	B-A Transect	61°31'N	27°11'W	724		M
473	B-A Transect	61°35'N	27°06'W	773	A	M
474	B-A Transect	61°38'N	26°59'W	735		
475	Area A	61°37'N	26°59'W	538	A,G	M
476	Area A	61°39'N	26°57'W	771		
477	Area A	61°42'N	26°55'W	773	A	M
478	Area A	61°44'N	26°53'W	623		
479	Area A	61°46'N	26°49'W	880	A,G	M,T1
480	Area A	61°53'N	26°42'W	720	A	M
481	Area A	61°53'N	26°36'W	745	A	M
482	Area A (RR6)	62°12'N	27°01'W	1443	A,G	M,C
483	Area A	61°49'N	26°37'W	890		M
484	Area A	61°56'N	26°35'W	550		M
485	Area A (RR1)	61°50'N	26°43'W	497	A,G	M,C
486	Area A	61°48'N	26°45'W	660	A	M
487	Area A	61°51'N	26°48'W	1033		M
488	Area A	61°55'N	26°32'W	1062		M
489	Area A	61°57'N	26°32'W	852	A	M
490	Area A (RR7)	62°12'N	27°45'W	1510	A,G	M,C
491	Steinahóll	63°07'N	24°35'W	337	A,G	M,C
492	Steinahóll	63°05'N	24°32'W	250	A,G	M,C
493	Steinahóll	63°04'N	24°31'W	292	A	M
494	Steinahóll	63°03'N	24°30'W	358	A,G	M,C
495	Steinahóll	63°02'N	24°28'W	390	A	M
496	Steinahóll	63°01'N	24°27'W	409	A,G	M,C
497	Steinahóll	63°06'N	24°34'W	277	A	M

Appendix A; Station Locations for B8-1993 (contd).

Station	Work Area	Latitude	Longitude	Depth (m)	Shipboard Samples	Shorebased Samples
498	Steinahóll	63°08'N	24°36'W	311	A	M
499	Steinahóll	63°09'N	24°38'W	303	A,G	M
500	Steinahóll	63°02'N	24°40'W	319	A,G	M
501	Steinahóll	63°03'N	24°38'W	398	A	M
502	Steinahóll	63°04'N	24°36'W	336	A,G	M,C
503	Steinahóll	63°05'N	24°34'W	237	A	M
504	Steinahóll	63°06'N	24°31'W	265	A	M
505	Steinahóll	63°07'N	24°30'W	342	A,G	M,C
506	Steinahóll	63°08'N	24°29'W	314	A	M
507	Steinahóll	63°08'N	24°27'W	237	A,G	M,C
508	Steinahóll	63°07'N	24°32'W	315	A	M
509	Steinahóll	63°06'N	24°32'W	276	A,G	M,C
510	Steinahóll	63°05'N	24°36'W	357	A	M
511	Steinahóll	63°05'N	24°34'W	265	A,G	M,C
512	Steinahóll	63°03'N	24°32'W	336	A	M
513	Steinahóll	63°04'N	24°32'W	258	A,G	M
514	Steinahóll	63°05'N	24°28'W	331	A	M
515	Steinahóll	63°05'N	24°30'W	306	A,G	M
516	Steinahóll	63°06'N	24°32'W	261	A	T1,T2
517	Steinahóll	63°06'N	24°31'W	292		T1,T2
518	Steinahóll	63°06'N	24°31'W	264		
519	Steinahóll	63°06'N	24°32'W	274	A	M
520	Steinahóll	63°06'N	24°32'W	304	A	M
521	Steinahóll	63°06'N	24°32'W	302	A	M,T1,T2
522	Steinahóll	63°06'N	24°32'W	307		
523	Steinahóll	63°06'N	24°32'W	304	A,G	M,C
524	S-A Transect	63°03'N	24°45'W	450		M
525	S-A Transect	62°59'N	24°51'W	528		M
526	S-A Transect	62°55'N	24°57'W	460		
527	S-A Transect	62°51'N	25°03'W	617		
528	S-A Transect	62°47'N	25°09'W	524	A	M
529	S-A Transect	62°43'N	25°15'W	473		
530	S-A Transect	62°39'N	25°24'W	536	A	M
531	S-A Transect	62°35'N	25°30'W	640		
532	S-A Transect	62°31'N	25°36'W	825		
533	S-A Transect	62°28'N	25°44'W	789		M
534	S-A Transect	62°24'N	25°49'W	750		
535	S-A Transect	62°20'N	25°55'W	612		
536	S-A Transect	62°16'N	26°01'W	665		M
537	S-A Transect	62°12'N	26°08'W	445		
538	S-A Transect	62°07'N	26°14'W	792		M
539	S-A Transect	62°03'N	26°20'W	688		

Appendix A; Station Locations for B8-1993 (contd).

Station	Work Area	Latitude	Longitude	Depth (m)	Shipboard Samples	Shorebased Samples
540	Area A	61°55'N	26°38'W	1002	G	M
541	Area A	61°47'N	26°46'W	618		M
542	Area A	61°46'N	26°52'W	753		
543	Area A	61°44'N	26°49'W	715		
544	Area A	61°52'N	26°39'W	798		
545	Area A	61°56'N	26°29'W	875		
546	Area A	62°01'N	26°24'W	615	A,G	M

KEY: A-Autonalayser G-Gas chromatograph
M-Mn archive C-Methane archive
T1-Trace metals (Camb.) T2-Trace metals (UBC)