

Appendix DR1. Analytical methods

Major and trace elements

Major element and some trace element concentrations of whole rocks were determined by X-ray fluorescence spectrometry (XRF) on fused glass beads (dilution factor = 1:6) using a Philips X'Unique PW1480 X-ray fluorescence spectrometer at IFM-GEOMAR, Kiel. H₂O and CO₂ were analysed with an infrared photometer.

Trace element concentrations of whole rocks were determined by inductively coupled plasma-mass spectrometry (ICP-MS) on a ThermoFinnigan Element2 at the Institute of Geosciences, University of Bremen. Pressure digests were prepared by dissolving 50 mg of sample powder in an HF-aqua regia mixture in Teflon beakers at 210 °C using a MLS Ethos microwave. The analyte solution was spiked with 1 ng/ml indium as internal standard. The final dilution factor was 1:5,000 corresponding to 0.2 mg/ml of total dissolved solid. In order to avoid mass interferences, the REE and Hf were measured at high resolution (10,000), the transition metals at medium (4,000) and all other elements at low (300) resolution. External precision as determined by repeated analyses of standard reference materials is better than 5% for most elements. The accuracy of USGS standards BHVO-2 and BCR-2, analysed along with the samples, is better than 10% except for Cs, Cr and Cu (up to 15%) with respect to the USGS reference values.

For samples 395-2, 395-3 and 395-4, trace element concentrations were determined by laser ablation (LA) ICP-MS on pressed pellets using a NewWave UP193ss coupled to a ThermoFinnigan Element2 at the Institute of Geosciences, University of Bremen. Analytical conditions included a pulse rate of 5 Hz, irradiance of ca. 1 GW/cm², a spot size of 100 μm, and a line scan speed of 6 μm/sec. Helium (0.4 l/min) was used as sample gas and Argon (0.8 l/min) was subsequently added as make-up gas; plasma power was 1200 W. All isotopes were analysed at low resolution with five samples in a 20% mass window and a total dwell time of 25 ms per isotope. Blanks were measured during 20 s prior to ablation. NIST612 glass was used for external calibration with ⁴³Ca as internal standard. The accuracy of USGS standard BCR2G analysed along with the samples is generally better than 9%, and better than 4% for most elements, with respect to the values given by Gao et al. (2002).

Concentrations of trace elements, Ba and Sr of the dredged barite block were determined on a small fragment by LA-ICPMS at the conditions stated above. NIST612 and NIST610 glasses were used for external calibration with ¹³⁷Ba as internal standard. Owing to the large Ba interferences, the elements Nd, Eu, Yb, Lu and Hf could not be analyzed.

⁴⁰Ar/³⁹Ar age dating

⁴⁰Ar/³⁹Ar incremental heating experiments were carried out on K-feldspar phenocryst separates and matrix chips at the IFM-GEOMAR Geochronology Laboratory. The particles were hand-picked from crushed and sieved rock splits. Feldspar separates were leached in 5% HF for 15 minutes, and feldspar crystals and matrix chips (0.25-0.5 mm) cleaned ultrasonically. Samples were neutron-irradiated at the 5-MW reactor of the GKSS Research Center (Geesthacht, Germany) with crystals and matrix chips in aluminum trays and irradiation cans wrapped in 0.7 mm cadmium foil. Samples were step-heated with a defocussed 20-Watt Spectra Physics Ar-ion laser. Purified gas samples were analyzed using a MAP 216 noble gas mass spectrometer. Raw mass spectrometer peaks were corrected for mass discrimination, background, and blank values determined every fifth analysis. The neutron flux was monitored using TCR-2 sanidine (Taylor Creek Rhyolite = 27.87 Ma; Lanphere and Dalrymple, 2000); ages are calculated relative to this monitor. Corrections for interfering neutron reactions on Ca and K are based on co-irradiated optical grade CaF₂ and high-purity K₂SO₄ crystals. Alteration indices (A.I.) were determined from the measured ³⁶Ar/³⁹Ar_m ratios, corrected for reactor-produced ³⁶Ar = -(³⁶Ar/³⁷Ar)_{Ca}*(³⁷Ar/³⁹Ar)_C), and normalized to J = 0.01 and K₂O = 10 wt.% (Ajoy and Baksi, 2007). A.I. varies by 3–5 orders of magnitude depending on the uptake of atmospheric ³⁶Ar during alteration. Effective J-values are 0.00365 for 395-1 and 395-7 feldspars, and 0.00346 for 395-1 and 395-7 matrix. Whole-rock K₂O contents are ~6 wt.%, which was also used to calculate the normalized A.I. of K-feldspar and matrix. Age spectra, plateaus, and statistics were calculated using Isoplot-3 (Ludwig, 2003).

¹⁴C AMS dating

Radiocarbon ages of two shell fragments and one coral were obtained by accelerator mass spectrometry (AMS) at the Leibniz-Laboratory for Radiometric Dating (Kiel, Germany) (Grootes et al., 2004). The samples were cleaned with H₂O₂ in an ultrasonic bath to remove adhering dust as well as organic surface coating. The CO₂ was liberated from the sample with 100 % phosphoric acid at 90 °C. The sample CO₂ was reduced to graphite with H₂ over Fe powder as catalyst, and the resulting carbon/iron mixture was pressed into a pellet in the target holder.

The ¹⁴C concentration of the sample was measured by comparing the simultaneously collected ¹⁴C, ¹³C, and ¹²C beams of the sample with those of oxalic acid standard CO₂ and of pre-Eemian foraminifera background (¹⁴C blank). The conventional ¹⁴C age was calculated according to Stuiver and Polach (1977) with a δ¹³C correction for isotopic fractionation based on the ¹³C/¹²C ratio measured by the AMS system simultaneously with the ¹⁴C/¹²C ratio. A global 400-yr reservoir age correction was not applied. The quoted 1σ uncertainty is based on

counting statistics, instrument stability, and the uncertainty connected with the subtraction of the ^{14}C blank.

Sulfur and oxygen isotopes

Different preparation techniques were applied for sulfur and oxygen isotope analyses of the barite. Pure barite was analyzed directly. Barite impregnations were chemically extracted from finely ground rock powder using Thode solution (a mixture of HI-HCl- H_3PO_2 ; Thode et al., 1961). Sulfate was liberated as hydrogen sulfide, precipitated initially as zinc acetate in a 3% zinc acetate solution, and finally converted to silver sulfide, using a 0.1M silver nitrate solution.

For sulfur isotope analyses, 200-300 micrograms of finely ground natural barite or silver sulfide precipitate were mixed with equal amounts of V_2O_5 in a small tin capsule. Samples were measured on-line involving combustion in a Carlo Erba Elemental Analyzer and transfer of resulting sulfur dioxide in a stream of helium carrier gas to a ThermoFinnigan Delta Plus mass spectrometer. Results are presented in the standard delta notation ($\delta^{34}\text{S}$) as per mil difference to VCDT. Reproducibility was better than $\pm 0.3\text{\textperthousand}$ as determined through replicate analyses of samples and standard materials.

For oxygen isotope analyses, 200-300 micrograms of barium sulfate were placed in a small silver capsule. Samples were measured on-line involving combustion in a high-temperature pyrolysis unit (TC/EA) and transfer of resulting carbon monoxide in a stream of helium carrier gas to a ThermoFinnigan Delta Plus XL mass spectrometer. Results are presented in the standard delta notation ($\delta^{18}\text{O}$) as per mil difference to VSMOW. Reproducibility was better than $\pm 0.5\text{\textperthousand}$ as determined through replicate analyses of samples and standard materials.

Sr-Nd-Pb isotopes

Sr-Nd-Pb isotopes were analyzed by static multi-collection on a ThermoFinnigan TRITON (Sr, Nd) and a Finnigan MAT 262-RPQ²⁺ (Pb) thermal ionization mass spectrometer (TIMS) at IFM-GEOMAR. The trachytes were analyzed in separate dissolutions of unleached and leached (6 N HCL for 1 hour at 125° C) powders in order to control seawater alteration effects. All samples were dissolved in a 5:1 HF- HNO_3 mixture at 150°C for 48 hrs. For the barytes ca. 10 mg of fine-grained particles were used and dissolved in a similar fashion as the silicates but using repeated ultrasonification and optical control to ensure dissolution. Sr, Nd, and Pb chromatography followed closely the procedure outlined by Hoernle and Tilton (1991). Analyses of NBS981 (n=189) with corresponding 2 sigma external errors are $^{206}\text{Pb}/^{204}\text{Pb} = 16.899 \pm 0.007$, $^{207}\text{Pb}/^{204}\text{Pb} = 15.437 \pm 0.009$, and $^{208}\text{Pb}/^{204}\text{Pb} = 36.525 \pm 0.029$ resulting in an external reproducibility of 0.020 %/amu. The measured NBS981 isotopic ratios were normalized to the NBS981 values given by Todt et al. (1996) and these external mass-

bias correction factors were applied to the sample data. Sr and Nd isotope ratios were fractionation corrected within run to $^{86}\text{Sr}/^{88}\text{Sr} = 0.1194$ and $^{146}\text{Nd}/^{144}\text{Nd} = 0.7219$. NBS987 ($n=4$) measured along with the samples gave $^{87}\text{Sr}/^{86}\text{Sr} = 0.710219 \pm 0.000006$ (external 2 sigma error) and was normalized to 0.710250. Similarly the inhouse Nd monitor “SPEX” gave $^{143}\text{Nd}/^{144}\text{Nd} = 0.511720 \pm 0.000004$ ($n=6$) and was renormalized to $^{143}\text{Nd}/^{144}\text{Nd} = 0.511715$ to correspond to the cross-calibrated La Jolla value of $^{143}\text{Nd}/^{144}\text{Nd} = 0.511850$.

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Appendix DR2. Mixing calculations

A common binary mixing calculation was carried out to derive $^{87}\text{Sr}/^{86}\text{Sr}$ of the hydrothermal fluid by mixing variable amounts of basement and seawater. The following Sr concentrations and isotope compositions of the endmembers were used:

- Modern seawater: Sr = 8 µg/g, $^{87}\text{Sr}/^{86}\text{Sr} = 0.709175$ (Paytan et al., 1993)
- Jurassic ocean crust: Sr = 113 µg/g (N-MORB of Sun and McDonough, 1989), $^{87}\text{Sr}/^{86}\text{Sr} = 0.70327$ (Hoernle, 1998)
- Submarine El Hierro basanites: Sr = 525-1220 µg/g (Table DR1), $^{87}\text{Sr}/^{86}\text{Sr} = 0.7029\text{-}0.7032$ (Abratis et al., 2002)

In order to achieve a $^{87}\text{Sr}/^{86}\text{Sr}$ between 0.708176 and 0.708468 in the hydrothermal fluid (values for barite in Table DR2), the Sr inventory must have included 12.0-16.9 wt.% of ocean crust-derived Sr or 11.2-16.7 wt.% of El Hierro-derived Sr. This translates into a contribution of 0.96-1.42 wt.% of ocean crust or 0.08-0.31 wt.% of El Hierro basanite to the reaction, which translates into water/rock ratios of 100-70 or 1250-320, respectively, in accordance with the formula given by Albarède et al. (1981).

Further mixing calculations were carried out to place constraints on the composition and amount of the hydrothermal fluid from which barite precipitated:

$$\delta^{34}\text{S}_{\text{Mix}} = \left\{ f \cdot \frac{[\text{SO}_4]_A}{[\text{SO}_4]_{\text{Mix}}} \cdot \left(\frac{\delta^{34}\text{S}_A}{1000} + 1 \right) + (1-f) \cdot \frac{[\text{SO}_4]_B}{[\text{SO}_4]_{\text{Mix}}} \cdot \left(\frac{\delta^{34}\text{S}_B}{1000} + 1 \right) - 1 \right\} 1000$$

where A and B denote endmembers, f is the mixing parameter, and brackets denote concentrations. The following sulfate concentrations and isotope compositions of the endmembers A and B were used:

- A: modern seawater; $\text{SO}_4^{2-} = 28 \text{ mmol/kg}$, $\delta^{34}\text{S} = 20$ (Claypool et al., 1980)
- B: hydrothermal fluid; SO_4^{2-} was deliberately varied between 0.28 and 14 mmol/kg (0.1-50 % of the concentration in seawater), and $\delta^{34}\text{S}$ was deliberately set to 47, the highest value measured in our study.

In order to achieve a $\delta^{34}\text{S}_{\text{Mix}}$ between 24.7 and 31.8 (values for barite in Table DR4), the amount of admixed seawater would have to be 1.3-4.5 wt% if the hydrothermal fluid contained 0.28 mmol/kg of sulfate, 12-32 wt% for 2.8 mmol/kg of sulfate, and 39-71 wt% for 14 mmol/kg of sulfate. For lower or higher $\delta^{34}\text{S}$ of the fluid the amount of seawater decreases or increases, respectively.

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Table DR1. A) Whole-rock analyses of trachytes and barite from Henry seamount

	Method	Sample					
		395-1	395-2	395-3	395-4	395-7	395-8
SiO ₂	wt.%	XRF	61.23	47.94	53.15	58.27	55.83
TiO ₂	wt.%	XRF	0.34	0.38	0.36	0.34	0.35
Al ₂ O ₃	wt.%	XRF	17.70	14.28	15.68	17.07	16.27
Fe ₂ O ₃	wt.%	XRF	2.29	1.37	1.68	2.92	2.15
MnO	wt.%	XRF	0.09	0.04	0.05	0.08	0.10
MgO	wt.%	XRF	0.45	0.31	0.30	0.38	0.35
CaO	wt.%	XRF	0.76	0.62	0.65	0.89	0.79
Na ₂ O	wt.%	XRF	6.18	5.02	5.38	5.90	5.83
K ₂ O	wt.%	XRF	5.95	4.64	5.15	5.70	5.41
P ₂ O ₅	wt.%	XRF	0.08	0.09	0.07	0.21	0.15
H ₂ O	wt.%	IR	1.08	0.73	0.85	0.81	0.95
CO ₂	wt.%	IR	0.05	0.06	0.05	0.04	0.06
Sum	wt.%		97.80	86.25	90.14	95.54	92.97
V	µg/g	ICP-MS	13.5	28.4	19.0	109	46.2
Cr	µg/g	ICP-MS	8.59	9.11	12.8	13.8	4.96
Co	µg/g	ICP-MS	0.78	0.55	0.50	1.09	0.54
Cu	µg/g	ICP-MS	8.86	10.9	16.7	10.7	12.2
Zn	µg/g	ICP-MS	70.3	67.2	76.3	134	68.7
Rb	µg/g	ICP-MS	121	56.8	93.6	147	112
Sr	µg/g	XRF	697	2542	1883	683	1387
Y	µg/g	ICP-MS	21.6	9.92	13.9	20.9	20.0
Zr	µg/g	ICP-MS	495	187	300	542	443
Nb	µg/g	ICP-MS	101	53.9	91.4	160	132
Cs	µg/g	ICP-MS	0.51	0.63	0.50	0.46	0.55
Ba	µg/g	XRF	13945	104470	64876	26896	44631
La	µg/g	ICP-MS	128	62.0	69.7	117	99.9
Ce	µg/g	ICP-MS	187	103	127	180	129
Pr	µg/g	ICP-MS	20.0	9.23	11.2	19.0	15.6
Nd	µg/g	ICP-MS	59.9	27.6	33.4	55.5	47.4
Sm	µg/g	ICP-MS	8.77	3.89	4.78	7.33	6.96
Eu	µg/g	ICP-MS	1.94	0.87	1.03	1.15	1.73
Gd	µg/g	ICP-MS	6.28	2.74	3.32	4.87	4.79
Tb	µg/g	ICP-MS	0.91	0.37	0.47	0.69	0.67
Dy	µg/g	ICP-MS	5.03	2.17	2.85	4.19	3.84
Ho	µg/g	ICP-MS	0.86	0.37	0.50	0.76	0.68
Er	µg/g	ICP-MS	2.16	0.91	1.35	2.11	1.81
Tm	µg/g	ICP-MS	0.31	0.12	0.20	0.33	0.27
Yb	µg/g	ICP-MS	1.84	0.75	1.33	2.39	1.61
Lu	µg/g	ICP-MS	0.26	0.09	0.17	0.29	0.23
Hf	µg/g	ICP-MS	18.4	7.30	10.3	14.6	14.6
Ta	µg/g	ICP-MS	9.71	5.48	8.73	13.6	11.4
Pb	µg/g	ICP-MS	5.19	6.12	9.20	7.77	5.92
Th	µg/g	ICP-MS	20.8	11.1	14.8	25.3	21.4
U	µg/g	ICP-MS	0.94	1.29	0.79	22.7	6.44
							9.25
							0.392

Note that the low sums of the analyses reflect high concentrations of barite SO₄ that has not been analyzed. XRF, X-ray fluorescence; IR, infrared spectrometry; ICP-MS: inductively-coupled plasma mass spectrometry; n/a, not analyzed or below detection limit.

Table DR1. B) Whole-rock analyses of trachytes normalized on a H₂O-, CO₂- and barite-free basis

	Method	Sample				
		395-1	395-2	395-3	395-4	395-7
SiO ₂	wt.%	XRF	64.13	63.91	64.16	63.22
TiO ₂	wt.%	XRF	0.36	0.51	0.43	0.37
Al ₂ O ₃	wt.%	XRF	18.54	19.04	18.93	18.52
Fe ₂ O ₃ tot	wt.%	XRF	2.40	1.83	2.03	3.17
MnO	wt.%	XRF	0.09	0.05	0.06	0.09
MgO	wt.%	XRF	0.47	0.41	0.36	0.41
CaO	wt.%	XRF	0.80	0.83	0.78	0.97
Na ₂ O	wt.%	XRF	6.47	6.69	6.49	6.40
K ₂ O	wt.%	XRF	6.23	6.19	6.22	6.18
P ₂ O ₅	wt.%	XRF	0.08	0.12	0.08	0.23
Sum	wt.%		100.0	100.0	100.0	100.0
Sr (corr.)	µg/g	XRF	429	192	444	117
					414	172

Table DR1. C) Whole-rock analyses of submarine basanites from El Hierro

	Method	Sample								
		136-2	141-1-19	142-9	148-9	149-1	151-5	178-1	178-4	
Latitude		27°47.6'N	27°52.4'N	27°51.9'N	27°43.3'N	27°42.3'N	27°46.9'N	27°37.8'N	27°37.8'N	
Longitude		17°48.3'W	17°58.3'W	18°00.8'W	18°13.7'W	18°14.6'W	18°12.5'W	18°05.0'W	18°05.0'W	
Depth	m	1950	1100	1100	1720	2030	1510	1800	1800	
SiO ₂	wt.%	XRF	41.98	42.69	42.29	41.75	42.58	41.24	41.57	41.98
TiO ₂	wt.%	XRF	4.17	3.20	3.94	4.31	4.36	4.36	4.19	4.22
Al ₂ O ₃	wt.%	XRF	13.96	12.13	9.62	11.28	13.81	11.65	14.74	14.90
Fe ₂ O ₃ tot	wt.%	XRF	14.65	13.70	15.41	15.26	14.34	14.89	13.76	13.84
MnO	wt.%	XRF	0.18	0.19	0.18	0.18	0.19	0.18	0.20	0.21
MgO	wt.%	XRF	7.20	11.95	13.47	11.70	7.29	10.03	5.32	5.36
CaO	wt.%	XRF	11.65	10.68	11.47	9.88	10.72	11.74	10.95	10.53
Na ₂ O	wt.%	XRF	3.04	2.89	1.88	2.67	3.35	3.14	3.73	3.78
K ₂ O	wt.%	XRF	0.97	1.03	0.73	1.19	1.44	1.27	1.59	1.56
P ₂ O ₅	wt.%	XRF	0.77	0.73	0.55	0.76	0.90	0.80	1.55	1.35
H ₂ O	wt.%	IR	1.31	0.71	0.77	0.84	1.19	0.60	1.27	1.47
CO ₂	wt.%	IR	0.13	0.03	0.08	0.03	0.05	0.02	0.13	0.12
Sum	wt.%		100.23	100.22	100.63	100.13	100.48	100.21	99.29	99.60
V	µg/g	XRF	380	306	332	348	362	376	329	323
Cr	µg/g	ICP-MS	124	496	488	356	168	384	31.3	16.3
Co	µg/g	ICP-MS	54	63	75	68	52	59	38.9	40.5
Ni	µg/g	ICP-MS	102	303	312	292	101	191	27.6	23.8
Cu	µg/g	ICP-MS	143	116	103	97	81	112	38.3	44.2
Zn	µg/g	ICP-MS	114	103	108	119	123	120	144	147
Rb	µg/g	ICP-MS	18	22.1	14.6	25	30	27	33.8	35.8
Sr	µg/g	XRF	805	820	525	787	941	906	1224	1198
Y	µg/g	ICP-MS	28.8	26.7	25.0	28.3	35.1	28.4	43.6	43.5
Zr	µg/g	ICP-MS	277	255	236	359	436	329	530.4	544.4
Nb	µg/g	ICP-MS	60.8	62.1	42.7	64.5	76.3	80.9	111	113
Cs	µg/g	ICP-MS	0.29	0.31	0.17	0.31	0.37	0.37	0.47	0.49
Ba	µg/g	XRF	274	368	205	309	314	359	460	458
La	µg/g	ICP-MS	43.9	59.5	37.2	55.2	57.8	57.2	77.2	78.4
Ce	µg/g	ICP-MS	97.2	116	78.7	119	126	119	170	171
Pr	µg/g	ICP-MS	12.5	13.9	10.1	15.5	15.9	14.7	21.1	21.0
Nd	µg/g	ICP-MS	54.1	56.9	45.4	67.6	68.2	62.5	90.8	89.9
Sm	µg/g	ICP-MS	12.4	11.5	10.0	14.1	15.0	12.4	18.0	18.1
Eu	µg/g	ICP-MS	3.66	3.31	3.03	4.04	4.29	3.67	5.25	5.10
Gd	µg/g	ICP-MS	10.5	9.22	8.74	10.7	11.4	10.2	14.3	13.9
Tb	µg/g	ICP-MS	1.38	1.22	1.18	1.44	1.57	1.34	1.90	1.86
Dy	µg/g	ICP-MS	7.21	6.67	6.18	7.54	8.41	7.02	9.88	9.88
Ho	µg/g	ICP-MS	1.28	1.16	1.15	1.29	1.48	1.19	1.75	1.70
Er	µg/g	ICP-MS	3.19	3.01	2.56	3.18	3.66	2.94	4.31	4.18
Tm	µg/g	ICP-MS	0.38	0.37	0.34	0.38	0.47	0.37	0.52	0.52
Yb	µg/g	ICP-MS	2.08	2.11	1.79	2.16	2.57	2.12	3.07	3.11
Lu	µg/g	ICP-MS	0.31	0.32	0.25	0.30	0.38	0.27	0.44	0.43
Hf	µg/g	ICP-MS	7.73	6.80	7.39	10.3	10.9	8.41	12.6	12.5
Ta	µg/g	ICP-MS	3.94	3.76	2.95	4.22	4.77	5.02	7.51	7.44
Pb	µg/g	ICP-MS	2.67	3.47	2.12	3.26	3.76	3.99	4.71	4.71
Th	µg/g	ICP-MS	3.69	6.64	3.73	5.75	6.00	6.16	8.09	8.05
U	µg/g	ICP-MS	1.00	1.69	1.02	1.51	1.64	1.51	2.18	2.04

Basanites from submarine volcanic cones at the flanks of El Hierro were dredged during R/V "Poseidon" cruise POS270 in 2001. The latitudes, longitudes and depths given are the average positions for each dredge haul.

Table DR2. Sr, Nd and Pb isotope ratios from Henry Seamount samples

Sample	Type	$^{87}\text{Sr}/^{86}\text{Sr}$	2σ	$^{143}\text{Nd}/^{144}\text{Nd}$	2σ	$^{206}\text{Pb}/^{204}\text{Pb}$	2σ	$^{207}\text{Pb}/^{204}\text{Pb}$	2σ	$^{208}\text{Pb}/^{204}\text{Pb}$	2σ
395-1	Barite-impregnated trachyte	0.708987	0.000003	0.512872	0.000002	19.534	0.001	15.613	0.001	39.745	0.003
395-7	Barite-impregnated trachyte	0.708783	0.000003	0.512896	0.000003	19.590	0.001	15.609	0.001	39.865	0.002
395-1_leached	Barite-impregnated trachyte	0.708779	0.000002	n.d.		19.530	0.001	15.601	0.001	39.402	0.002
395-7_leached	Barite-impregnated trachyte	0.708568	0.000002	n.d. n.a.		19.516	0.001	15.607	0.001	39.472	0.002
397-2 Top	Barite, top	0.708176	0.000004	n.d.		n.d.		n.d.		n.d.	
397-2 Bot	Barite, bottom	0.708468	0.000003	n.d.		n.d.		n.d.		n.d.	

n.d. = not determined. 2sigma = two standard deviations uncertainty.

Table DR3. 40Ar/39Ar analysis data**Sample 395-7fss: K-feldspar step-heating analysis**

Mass = 0.938 mg

J = 3.65E-03 ± 6.18E-06 (0.169 %) (2 Sigma)

Plateau age = 126.28 ± 0.26 Ma (2 Sigma, including 83.5% of the 39Ar, steps 11 to 17, and J-error of 0.169%), MSWD = 1.5, Probability = 0.16

Heating step	Laser power (W)	Cumulative 39Ar									
		40Ar/39Ar	37Ar/39Ar	36Ar/39Ar	Mol 39Ar	Ca/K	% 40Ar(Atm)	fraction	Age [Ma]	2 sigma error	A.I.
1	0.2	8.731E+01	6.739E+00	1.658E-01	1.273E-17	13.29	55.13	7.70E-05	242.46	309.43	0.03567
2	0.3	7.635E+01	1.657E+00	1.848E-01	5.982E-17	3.25	71.27	4.39E-04	139.11	88.37	0.04032
3	0.4	4.292E+01	4.590E-01	6.710E-02	1.441E-16	0.90	46.06	1.31E-03	146.32	32.05	0.01465
5	0.5	2.343E+01	1.139E-01	6.995E-03	5.642E-16	0.22	8.76	4.72E-03	135.45	7.91	0.00152
6	0.6	2.271E+01	1.225E-01	9.118E-03	1.556E-15	0.24	11.80	1.41E-02	127.21	3.56	0.00198
7	0.7	1.993E+01	8.592E-02	6.375E-04	2.613E-15	0.17	0.89	2.99E-02	125.50	1.45	0.00013
8	0.8	2.007E+01	8.159E-02	9.623E-04	3.540E-15	0.16	1.36	5.13E-02	125.79	1.33	0.00020
9	1.0	1.999E+01	7.352E-02	5.833E-04	7.469E-15	0.14	0.81	9.65E-02	126.01	0.74	0.00012
10	1.2	2.004E+01	8.267E-02	7.204E-04	8.395E-15	0.16	1.01	1.47E-01	126.03	0.50	0.00015
11	1.4	1.992E+01	8.437E-02	2.064E-04	7.615E-15	0.17	0.25	1.93E-01	126.22	0.50	0.00004
12	1.5	1.996E+01	7.439E-02	7.992E-05	7.236E-15	0.15	0.07	2.37E-01	126.72	0.66	0.00001
13	2.0	1.999E+01	8.004E-02	4.480E-04	1.447E-14	0.16	0.61	3.25E-01	126.25	0.41	0.00009
14	3.0	1.997E+01	6.709E-02	2.929E-04	3.570E-14	0.13	0.39	5.40E-01	126.37	0.27	0.00006
15	4.0	1.998E+01	1.149E-01	2.639E-04	2.008E-14	0.23	0.32	6.62E-01	126.50	0.36	0.00005
16	6.0	1.988E+01	1.294E-01	2.435E-04	5.167E-14	0.25	0.28	9.74E-01	125.99	0.28	0.00004
17	10.0	2.014E+01	7.855E-02	1.687E-04	1.468E-15	0.15	0.20	9.83E-01	127.63	2.52	0.00003
18	12.0	2.004E+01	1.093E-01	5.885E-04	2.807E-15	0.21	0.80	1.00E+00	126.31	1.47	0.00012

Sample 395-7mxs: Matrix step-heating analysis

Mass = 1.410 mg

J = 3.46E-03 ± 7.57E-06 (0.219 %) (2 Sigma)

Plateau age = 123.79 ± 0.33 Ma (2 Sigma, including 54.6% of the 39Ar, steps 6 to 16, and J-error of 0.219%), MSWD = 0.98, Probability = 0.46

Heating step	Laser power (W)	Cumulative 39Ar									
		40Ar/39Ar	37Ar/39Ar	36Ar/39Ar	Mol 39Ar	Ca/K	% 40Ar(Atm)	fraction	Age [Ma]	2 sigma error	A.I.
1	0.1	3.375E+01	4.577E-01	6.626E-02	8.251E-15	0.90	57.84	2.68E-02	86.82	5.21	0.01371
2	0.2	2.059E+01	5.250E-01	3.452E-03	1.987E-14	1.03	4.62	9.13E-02	118.72	5.54	0.00067
3	0.3	2.014E+01	1.834E-01	4.103E-04	4.959E-14	0.36	0.48	2.52E-01	121.06	0.54	0.00007
5	0.4	2.049E+01	1.208E-01	4.128E-04	5.832E-14	0.24	0.52	4.42E-01	123.08	0.44	0.00007
6	0.5	2.060E+01	9.679E-02	5.648E-04	5.535E-14	0.19	0.75	6.21E-01	123.43	0.41	0.00011
7	0.6	2.077E+01	7.489E-02	9.747E-04	4.319E-14	0.15	1.34	7.61E-01	123.69	0.35	0.00020
8	0.7	2.119E+01	7.316E-02	2.194E-03	2.487E-14	0.14	3.02	8.42E-01	124.04	0.39	0.00045
9	0.8	2.135E+01	8.634E-02	2.848E-03	1.466E-14	0.17	3.89	8.90E-01	123.84	0.58	0.00058
10	0.9	2.124E+01	1.009E-01	2.287E-03	9.889E-15	0.20	3.12	9.22E-01	124.22	0.78	0.00047
11	1.0	2.115E+01	1.801E-01	2.002E-03	6.237E-15	0.35	2.69	9.42E-01	124.23	0.73	0.00040
12	1.1	2.109E+01	3.648E-01	2.317E-03	3.514E-15	0.72	3.02	9.54E-01	123.47	1.14	0.00045
13	1.2	2.102E+01	4.069E-01	1.864E-03	2.618E-15	0.80	2.37	9.62E-01	123.88	1.54	0.00035
14	1.4	2.091E+01	2.578E-01	1.857E-03	2.379E-15	0.51	2.46	9.70E-01	123.15	1.64	0.00036
15	1.5	2.096E+01	2.251E-01	2.018E-03	1.927E-15	0.44	2.71	9.76E-01	123.16	1.72	0.00040
16	2.0	2.094E+01	1.606E-01	1.289E-03	3.617E-15	0.31	1.72	9.88E-01	124.20	1.14	0.00025
17	3.0	2.100E+01	1.233E-01	1.022E-03	2.516E-15	0.24	1.36	9.96E-01	125.00	1.16	0.00020
18	5.0	2.083E+01	1.256E-01	2.124E-03	1.245E-15	0.25	2.94	1.00E+00	122.08	2.55	0.00043

Sample 395-1fss: K-feldspar step-heating analysis

Mass = 2.198 mg

J = 3.65E-03 ± 6.18E-06 (0.169 Percent) (2 Sigma)

Plateau age = 126.02 ± 0.29 Ma (2 Sigma, including 40.6% of the 39Ar, steps 15 to 17, and J-error of 0.169%), MSWD = 0.46, Probability = 0.63

Heating step	Laser power (W)	Cumulative 39Ar									
		40Ar/39Ar	37Ar/39Ar	36Ar/39Ar	Mol 39Ar	Ca/K	% 40Ar(Atm)	fraction	Age [Ma]	2 sigma error	A.I.
1	0.5	4.462E+01	1.066E+00	9.821E-02	8.333E-17	2.09	64.74	5.15E-04	100.77	55.09	0.02140
2	0.6	3.314E+01	7.831E-01	5.167E-02	1.570E-16	1.54	45.77	1.19E-03	114.65	38.60	0.01124
3	0.7	2.438E+01	2.504E-01	1.792E-02	2.871E-16	0.49	21.59	2.43E-03	121.65	14.63	0.00390
5	0.8	2.341E+01	3.030E-01	1.402E-02	4.634E-16	0.59	17.54	4.43E-03	122.77	10.19	0.00304
6	1.0	2.066E+01	8.545E-02	3.317E-03	1.843E-15	0.17	4.69	1.24E-02	125.16	2.64	0.00072
7	1.2	2.037E+01	7.546E-02	3.179E-03	3.426E-15	0.15	4.56	2.72E-02	123.61	1.59	0.00069
8	1.4	2.101E+01	8.722E-02	4.374E-03	4.417E-15	0.17	6.10	4.63E-02	125.36	1.30	0.00095
9	1.5	1.981E+01	7.234E-02	5.262E-04	5.472E-15	0.14	0.74	6.99E-02	125.00	0.93	0.00011
10	2.0	1.990E+01	6.655E-02	2.854E-04	1.841E-14	0.13	0.38	1.49E-01	125.95	0.44	0.00006
11	3.0	1.983E+01	7.788E-02	1.895E-04	3.484E-14	0.15	0.23	3.00E-01	125.73	0.29	0.00003
12	4.0	1.995E+01	7.154E-02	5.764E-04	2.233E-14	0.14	0.81	3.96E-01	125.76	0.43	0.00012
13	6.0	2.037E+01	5.148E-02	5.489E-04	3.926E-14	0.10	0.76	5.66E-01	128.32	0.52	0.00012
14	8.0	2.004E+01	2.844E-03	1.729E-03	9.654E-16	0.01	2.55	5.70E-01	124.14	5.78	0.00038
15	10.0	1.985E+01	5.759E-02	1.376E-04	5.046E-14	0.11	0.17	7.88E-01	125.93	0.28	0.00002
16	12.0	1.990E+01	2.582E-02	3.797E-05	5.266E-16	0.05	0.07	7.90E-01	126.35	8.01	0.00001
17	15.0	1.988E+01	5.069E-02	1.224E-04	4.308E-14	0.10	0.15	9.76E-01	126.12	0.29	0.00002
18	20.0	1.994E+01	3.236E+00	1.032E-02	5.487E-15	6.36	13.18	1.00E+00	110.81	3.36	0.00195

Sample 395-1mxs: Matrix step-heating analysis

Mass = 1.526 mg

J = 3.46E-03 ± 7.57E-06 (0.219 Percent) (2 Sigma)

Plateau age = 123.77 ± 0.32 Ma (2 Sigma, including 59.5% of the 39Ar, steps 7 to 19, and J-error of 0.219%), MSWD = 0.60, Probability = 0.86

Heating step	Laser power (W)	Cumulative 39Ar									
		40Ar/39Ar	37Ar/39Ar	36Ar/39Ar	Mol 39Ar	Ca/K	% 40Ar(Atm)	fraction	Age [Ma]	2 sigma error	A.I.
1	0.1	4.563E+01	2.670E-01	1.062E-01	5.134E-15	0.52	68.71	1.82E-02	87.11	8.27	0.02202
2	0.2	2.841E+01	1.936E-01	2.877E-02	9.351E-15	0.38	29.84	5.12E-02	120.44	5.64	0.00595
3	0.3	2.077E+01	6.861E-02	2.747E-03	2.235E-14	0.13	3.87	1.30E-01	120.64	1.26	0.00056
5	0.4	2.038E+01	4.812E-02	1.002E-03	3.571E-14	0.09	1.42	2.57E-01	121.32	0.35	0.00020
6	0.5	2.054E+01	4.769E-02	5.077E-04	4.194E-14	0.09	0.70	4.05E-01	123.14	0.36	0.00010
7	0.6	2.063E+01	4.517E-02	5.546E-04	4.022E-14	0.09	0.77	5.47E-01	123.58	0.41	0.00011
8	0.7	2.073E+01	4.478E-02	7.728E-04	3.651E-14	0.09	1.07	6.77E-01	123.78	0.34	0.00016
9	0.8	2.093E+01	4.479E-02	1.287E-03	2.997E-14	0.09	1.79	7.83E-01	124.08	0.41	0.00026
10	0.9	2.108E+01	4.503E-02	1.988E-03	1.962E-14	0.09	2.76	8.52E-01	123.70	0.50	0.00041
11	1.0	2.119E+01	4.697E-02	2.324E-03	1.133E-14	0.09	3.21	8.92E-01	123.76	0.68	0.00048
12	1.1	2.128E+01	5.175E-02	2.722E-03	7.003E-15	0.10	3.75	9.17E-01	123.65	0.89	0.00056
13	1.2	2.108E+01	5.335E-02	2.399E-03	5.319E-15	0.10	3.33	9.36E-01	123.02	0.87	0.00049
14	1.4	2.110E+01	5.243E-02	2.041E-03	4.097E-15	0.10	2.83	9.50E-01	123.75	1.02	0.00042
15	1.5	2.111E+01	5.385E-02	1.435E-03	2.637E-15	0.11	1.98	9.59E-01	124.83	1.88	0.00029
16	2.0	2.113E+01	5.312E-02	2.047E-03	4.271E-15	0.10	2.83	9.75E-01	123.91	1.41	0.00042
17	3.0	2.117E+01	6.595E-02	2.230E-03	4.800E-15	0.13	3.07	9.92E-01	123.86	1.38	0.00046
18	5.0	2.133E+01	6.197E-02	2.639E-03	2.061E-15	0.12	3.62	9.99E-01	124.09	2.02	0.00054
19	8.0	2.214E+01	8.222E-02	4.994E-03	3.096E-16	0.16	6.62	1.00E+00	124.76	12.84	0.00103

A.I. = Alteration Index; MSWD = Mean Square Weighted Deviates; heating steps for plateau indicated in boldface.

Salt correction values: 37Ar/39Ar(Ca) = 1006; 36Ar/39Ar (Ca) = 0.445; 40Ar/39Ar (K) = 0.0037.

Table DR4. Sulfur and oxygen isotope ratios from Henry Seamount samples

Sample	Description	$\delta^{34}\text{S}$ (VCDT)	$\delta^{18}\text{O}$ (VSMOW)	$\delta^{34}\text{S}/\delta^{18}\text{O}$
397-2 TOP	Barite block, top	26.5	14.1	1.88
397-2 MID	Barite block, middle	30.6	16.3	1.88
397-2 BOT	Barite block, bottom	31.8	16.9	1.88
397-2A	Barite block, 3 cm from coral	25.3	13.1	1.93
397-2B	Barite block, 2.5 cm from coral	24.9	13.0	1.91
397-2C	Barite block, 2 cm from coral	25.2	12.9	1.95
397-2D	Barite block, 1.3 cm from coral	25.1	13.5	1.86
397-2E	Barite block, 0.5 cm from coral	24.7	13.6	1.81
395-1	Barite impregnation in trachyte	47.3	13.3	3.56
395-7	Barite impregnation in trachyte	45.0	13.2	3.41

VCDT = Vienna Canyon Diablo troilite; VSMOW = Vienna Standard Mean Ocean Water.

Data Repository Item

Fig. DR1: Primitive mantle-normalized (Sun and McDonough, 1989) incompatible-element diagram showing differences between trachytes from Henry Seamount and submarine basanites from El Hierro (shaded field). The barite-metasomatized trachytes are recalculated on a H₂O-, CO₂- and barite-free basis, with Sr being barite-corrected based on the observed Ba-Sr correlation of the samples.

