Appendix DR1

Analytical Methods.

Rock powders and chips were prepared from the least altered inner parts of the samples. Trace element and isotope data for the samples along with background information are shown in Appendix DR2, Table DR1. Trace element concentrations were determined with an AGILENT 7500cs inductively coupled plasma mass spectrometer at the Institute of Geosciences at the Christian-Albrechts University of Kiel. International reference material BIR-1, BHVO-2 and BCR-2 were digested and measured along with the samples. Results for the standards together with an evaluation of accuracy and precision are provided in Appendix DR2, Tables DR2-DR5.

Sr-Nd-Pb isotope analyses were carried out by thermal ionization mass spectrometry at GEOMAR. Prior to dissolution, the rock chips were leached in warm 2N HCl at 70 °C for 1 hour and thereafter repeatedly rinsed in ELGA water. Sr-Pb analyses were carried out on a Finnigan MAT 262 RPQ^{2+} and Nd on a Thermo Fisher TRITON, both operating in static multi-collection mode. Sr and Nd isotopic ratios were normalized within run to $^{86}Sr/^{88}Sr = 0.1194$ and $^{146}Nd/^{144}Nd = 0.7219$ respectively and all errors are reported as 2 sigma of the mean. Reference material measured along with the samples were normalized for each sample tourret and gave $^{87}Sr/^{86}Sr = 0.710250 \pm 0.000014$ (n=23; 2σ external reproducibility) for NBS987 and $^{143}Nd/^{144}Nd = 0.511850 \pm 0.000008$ (n=18; 2σ external reproducibility) for La Jolla. Pb isotope ratios were determined using a Pb double-spike (DS) technique described in Hoernle et al. (2011). Double spike corrected NBS981 values over the course of the study are $^{206}Pb/^{204}Pb = 16.9413 \pm 0.0019$, $^{207}Pb/^{204}Pb = 15.4995 \pm 0.0019$, $^{208}Pb/^{204}Pb = 36.7241 \pm 0.0048$ (n=30; 2σ external reproducibility). Total Pb chemistry blanks were 10-20pg and thus considered negligible. Hf isotopes were determined on a VG

Axiom multi-collector ICPMS (MC-ICPMS) at GEOMAR operating in static mode. Our in-house SPEX Hf ICP standard solution (Lot #9) yields an averaged, JMC475-normalized value of $^{176}Hf/^{177}Hf = 0.282173 \pm 0.000008$ (n=132). Additional references on the details of the geochemical methods are provided in Appendix DR5.

We plot the measured, rather than the initial, isotopic ratios for the following reasons: 1) The samples display an age range of ~100 Ma and are thus difficult to compare at a common age without making additional assumptions, such as parent/daughter ratios of the source. 2) Parent and daughter element concentrations or ratios are not available for most of the published data and would need to be assumed to make age corrections. 3) The relatively low parent/daughter ratios (e.g. U/Pb; see Appendix DR2) result in negligible radiogenic ingrowth (e.g. Fig. 2A), and thus the Gough and Tristan subtracks still form distinct fields on isotope correlation diagrams when initial isotopic ratios are plotted.

Appendix DR2

Trace element and isotope data.

Table DR1: Trace element data and Sr-Nd-Pb-Hf isotope data of samples from the Guyot Province and the Walvis Ridge

	Tristan Track					
Sample	**AII-93-3-1B**	**AII-93-3-25**	**AII-93-3-25***	**AII-93-5-3**	**AII-93-6-1**	**PS69/435-1-DR 27-1**
Rock Type	Alkali Basalt	Alkali Basalt	Alkali Basalt	Alkali Basalt	Tephrite	Alkali Basalt
Ar/Ar Age (Ma)	27	27	27	36	33	
Lat. (˚)	-37.10	-37.10	-37.10	-34.29	-34.35	-32.9
Long. (˚)	-7.78	-7.78	-7.78	-5.03	-4.98	-5.15
Depth (m.b.s.l.)	2600-2000	2600-2000	2600-2000	3100-3000	2360-2460	2400-2290
Cruise	R/V Atlantis II (AII-93)	R/V Atlantis II (AII-93)	R/V Atlantis II (AII-93)	R/V Atlantis II (AII-93)	R/V Atlantis II (AII-93)	R/V Polarstern ANT-XXIII/5
Li (ppm)	32.0	36.7	37.4	25.9	37.5	28.2
Sc (ppm)	33.7	33.2	33.5	25.5	22.7	35.6
V (ppm)	291	291	288	279	222	236
Cr (ppm)	56.8	56.6	56.0	20.0	29.9	237
Co (ppm)	45.5	40.4	40.0	24.1	17.5	42.7
Ni (ppm)	41.2	41.6	41.7	19.3	20.9	136
Cu (ppm)	46.7	44.8	44.6	47.8	23.3	62.8
Zn (ppm)	118	129	128	124	124	102
Ga (ppm)	21.3	21.4	21.1	22.8	17.9	19.8
Rb (ppm)	22.9	35.7	35.8	19.5	28.7	9.29
Sr (ppm)	441	434	430	571	587	334
Y (ppm)	27.4	26.5	26.5	58.8	55.9	34.5
Zr (ppm)	170	167	164	237	240	168
Nb (ppm)	25.8	24.8	24.8	42.5	41.7	17.9
Cs (ppm)	1.98	3.34	3.37	0.441	0.469	0.249
Ba (ppm)	351	347	344	433	396	146
La (ppm)	26.2	25.6	26.0	65.3	52.3	15.5
Ce (ppm)	54.9	53.7	53.9	81.7	84.6	35.2
Pr (ppm)	6.83	6.68	6.76	12.9	10.8	4.81

Sample	AII-93-3-1B	AII-93-3-25	AII-93-3-25*	AII-93-5-3	AII-93-6-1	PS69/435-1-DR 27-1
Nd (ppm)	28.6	27.9	28.4	51.9	43.6	21.1
Sm (ppm)	6.49	6.35	6.41	10.1	8.95	5.35
Eu (ppm)	2.38	2.33	2.34	3.20	2.90	1.85
Gd (ppm)	6.56	6.37	6.48	10.5	8.97	5.97
Tb (ppm)	0.990	0.962	0.979	1.54	1.31	0.990
Dy (ppm)	5.71	5.53	5.66	9.04	7.70	6.29
Ho (ppm)	1.09	1.05	1.07	1.83	1.56	1.29
Er (ppm)	2.80	2.72	2.74	4.88	4.25	3.58
Tm (ppm)	0.386	0.373	0.381	0.690	0.603	0.531
Yb (ppm)	2.41	2.34	2.38	4.33	3.87	3.45
Lu (ppm)	0.348	0.336	0.344	0.658	0.591	0.523
Hf (ppm)	4.18	4.01	4.09	5.94	5.68	3.76
Ta (ppm)	1.63	1.57	1.62	2.71	2.63	1.12
Pb (ppm)	1.98	1.91	1.95	3.20	3.11	1.47
Th (ppm)	2.76	2.65	2.73	4.48	4.25	1.59
U (ppm)	0.626	0.478	0.487	1.00	1.16	0.468
$^{87}Sr/^{86}Sr_m$	0.704480	0.704486		0.704951	0.705032	0.704396
±2σ	5	5		5	5	5
$^{87}Rb/^{86}Sr$	0.150	0.238		0.099	0.141	0.080
$^{87}Sr/^{86}Sr_{in}$	0.704416	0.704385		0.704896	0.704954	0.704346
$^{143}Nd/^{144}Nd_m$	0.512637	0.512633		0.512616	0.512619	0.512752
±2σ	3	3		3	3	3
εNd	-0.02	-0.09		-0.43	-0.38	2.22
$^{147}Sm/^{144}Nd$	0.137	0.137		0.118	0.123	0.152
$^{143}Nd/^{144}Nd_{in}$	0.512610	0.512606		0.512586	0.512587	0.512708
$εNd_{in}$	0.21	0.13		-0.04	-0.01	2.47
$^{206}Pb/^{204}Pb_m$	18.1835	18.1691		18.6339	18.6823	18.6531
±2σ	14	9		10	12	9

Sample	AII-93-3-1B	AII-93-3-25	AII-93-3-25*	AII-93-5-3	AII-93-6-1	PS69/435-1-DR 27-1
$^{207}Pb/^{204}Pb_m$	15.5256	15.5248		15.5862	15.5879	15.5602
±2σ	12	8		10	11	9
$^{208}Pb/^{204}Pb_m$	38.5721	38.5632		39.0848	39.1117	38.8756
±2σ	32	19		28	28	26
$^{207}Pb/^{206}Pb_m$	0.85383	0.85446		0.83645	0.83437	0.83419
±2σ	1	1		2	1	1
$^{208}Pb/^{206}Pb_m$	2.12127	2.12246		2.09752	2.09352	2.08414
±2σ	3	3		6	4	6
$^{238}U/^{204}Pb$	20.00	15.83		20.11	24.03	20.42
$^{235}U/^{204}Pb$	0.15	0.11		0.15	0.17	0.15
$^{232}Th/^{204}Pb$	91.14	90.52		92.91	90.73	71.56
$^{232}Th/^{238}U$	4.56	5.72		4.62	3.78	3.50
$^{206}Pb/^{204}Pb_{in}$	18.090	18.095		18.512	18.536	18.513
$^{207}Pb/^{204}Pb_{in}$	15.521	15.521		15.581	15.581	15.554
$^{208}Pb/^{204}Pb_{in}$	38.437	38.429		38.905	38.936	38.720
$^{207}Pb/^{206}Pb_{in}$	0.858	0.858		0.842	0.841	0.840
$^{208}Pb/^{206}Pb_{in}$	2.125	2.124		2.102	2.101	2.091
delta 7/4	6.3	6.4		7.5	7.2	4.7
delta 8/4	96.1	97.0		92.9	89.8	69.7
$^{208}Pb^*/^{206}Pb^*$	1.02	1.03		1.03	1.03	1.01
$^{176}Hf/^{177}Hf_m$	-	0.282848		0.282812	0.282805	0.282957
±2σ	-	6		3	3	7
εHf	-	2.67		1.40	1.15	6.55
$^{176}Lu/^{177}Hf$	-	0.012012		0.015901	0.014919	0.019929
$^{176}Hf/^{177}Hf_{in}$	-	0.282841		0.282800	0.282793	0.282940
$εHf_{in}$	-	3.11		1.87	1.64	6.95

	Gough Track					
Sample	**AII-93-10-11**	**AII-93-14-1**	**AII-93-14-19**	**PS69/419-1-DR 20-1**	**PS69/419-1-DR 20-1****	**PS69/421-2-DR 23-1**
Rock Type	Alkali Basalt	Mugearite	Mugearite	Alkali Basalt	Alkali Basalt	Tephrite
Ar/Ar Age (Ma)	49					
Lat. (˚)	-34.34	-31.99	-31.99	-31.53	-31.53	-33.35
Long. (˚)	-1.57	2.39	2.39	2.02	2.02	2.12
Depth (m.b.s.l.)	2300-2000	2300-1600	2300-1600	2600-2240	2600-2240	1970-1660
Cruise	R/V Atlantis II (AII-93)	R/V Atlantis II (AII-93)	R/V Atlantis II (AII-93)	R/V Polarstern ANT-XXIII/5	R/V Polarstern ANT-XXIII/5	R/V Polarstern ANT-XXIII/5
Li (ppm)	11.6	19.9	38.2	54.0		8.38
Sc (ppm)	28.8	21.3	20.6	23.6		21.0
V (ppm)	368	165	159	215		263
Cr (ppm)	28.0	123	124	121		163
Co (ppm)	40.5	30.1	52.8	18.7		28.5
Ni (ppm)	31.0	63.5	156	44.1		88.1
Cu (ppm)	113	35.0	33.1	51.6		35.7
Zn (ppm)	133	144	118	251		129
Ga (ppm)	24.0	24.4	23.7	24.7		25.2
Rb (ppm)	32.0	31.8	37.7	15.8		55.1
Sr (ppm)	494	437	446	375		827
Y (ppm)	30.4	30.8	29.9	31.0		33.0
Zr (ppm)	261	213	215	342		349
Nb (ppm)	29.6	31.1	31.1	42.3		54.8
Cs (ppm)	1.30	0.409	1.45	0.421		0.221
Ba (ppm)	350	1229	1278	371		827
La (ppm)	37.6	36.5	36.2	39.5		59.0
Ce (ppm)	80.8	77.1	75.2	79.3		114
Pr (ppm)	9.81	9.51	9.32	11.4		13.5
Nd (ppm)	40.1	39.8	38.6	45.4		51.9

Sample	AII-93-10-11	AII-93-14-1	AII-93-14-19	PS69/419-1-DR 20-1	PS69/419-1-DR 20-1**	PS69/421-2-DR 23-1
Sm (ppm)	8.60	8.69	8.45	9.57		10.3
Eu (ppm)	2.78	4.07	3.98	2.97		3.15
Gd (ppm)	8.15	8.46	8.07	8.81		9.22
Tb (ppm)	1.19	1.22	1.18	1.31		1.30
Dy (ppm)	6.62	6.72	6.52	7.20		6.85
Ho (ppm)	1.21	1.23	1.19	1.29		1.22
Er (ppm)	3.03	3.04	2.95	3.21		2.99
Tm (ppm)	0.411	0.407	0.396	0.431		0.396
Yb (ppm)	2.47	2.46	2.41	2.63		2.36
Lu (ppm)	0.347	0.354	0.343	0.369		0.334
Hf (ppm)	6.46	4.95	4.95	7.46		7.92
Ta (ppm)	1.93	1.92	1.87	2.55		3.29
Pb (ppm)	3.43	3.38	3.35	4.33		5.28
Th (ppm)	3.61	3.33	3.30	5.17		6.93
U (ppm)	0.762	0.765	0.705	0.684		1.37
$^{87}Sr/^{86}Sr_m$	0.705143	0.705345	0.705411	0.705289		0.705558
±2σ	4	4	5	4		5
$^{87}Rb/^{86}Sr$	0.187	0.211	0.245	0.122		0.193
$^{87}Sr/^{86}Sr_{in}$	0.705004	0.705163	0.705199	0.705182		0.705397
$^{143}Nd/^{144}Nd_m$	0.512458	0.512513	0.512498	0.512498		0.512454
±2σ	3	3	3	3		3
εNd	-3.50	-2.43	-2.73	-2.74		-3.60
$^{147}Sm/^{144}Nd$	0.129	0.132	0.132	0.127		0.120
$^{143}Nd/^{144}Nd_{in}$	0.512414	0.512461	0.512446	0.512446		0.512407
εNd_{in}	-3.06	-1.93	-2.22	-2.19		-3.02
$^{206}Pb/^{204}Pb_m$	17.8006	18.2603	18.2621	18.3314		18.1975
±2σ	11	11	7	9		8
$^{207}Pb/^{204}Pb_m$	15.5234	15.5758	15.5752	15.5875		15.5644

Sample	AII-93-10-11	AII-93-14-1	AII-93-14-19	PS69/419-1-DR 20-1	PS69/419-1-DR 20-1**	PS69/421-2-DR 23-1
±2σ	10	13	7	11		9
$^{208}Pb/^{204}Pb_m$	38.2917	38.8708	38.9081	39.0642		38.9756
±2σ	27	43	22	34		28
$^{207}Pb/^{206}Pb_m$	0.87207	0.85299	0.85287	0.85032		0.85530
±2σ	1	2	1	2		2
$^{208}Pb/^{206}Pb_m$	2.15114	2.12871	2.13054	2.13100		2.14180
±2σ	5	12	5	9		7
$^{238}U/^{204}Pb$	13.95	14.40	13.43	10.10		16.54
$^{235}U/^{204}Pb$	0.10	0.10	0.10	0.07		0.12
$^{232}Th/^{204}Pb$	68.33	64.83	64.88	78.82		86.53
$^{232}Th/^{238}U$	4.90	4.50	4.83	7.81		5.23
$^{206}Pb/^{204}Pb_{in}$	17.688	18.123	18.134	18.234		18.045
$^{207}Pb/^{204}Pb_{in}$	15.518	15.569	15.569	15.583		15.557
$^{208}Pb/^{204}Pb_{in}$	38.116	38.675	38.712	38.822		38.723
$^{207}Pb/^{206}Pb_{in}$	0.877	0.859	0.859	0.855		0.862
$^{208}Pb/^{206}Pb_{in}$	2.155	2.134	2.135	2.129		2.146
delta 7/4	10.3	10.5	10.5	10.9		10.1
delta 8/4	114.4	116.7	120.2	127.5		134.8
$^{208}Pb^*/^{206}Pb^*$	1.04	1.05	1.05	1.06		1.07
$^{176}Hf/^{177}Hf_m$	0.282708	0.282720	0.282718	0.282716	0.282727	0.282681
±2σ	3	6	8	3	6	3
εHf	-2.25	-1.85	-1.93	-1.97	-1.59	-3.21
$^{176}Lu/^{177}Hf$	0.007704	0.010249	0.009937	0.007090	0.007090	0.006051
$^{176}Hf/^{177}Hf_{in}$	0.282701	0.282708	0.282706	0.282708	0.282719	0.282674
$εHf_{in}$	-1.35	-0.89	-0.96	-0.87	-0.48	-2.12

	Gough Track				
Sample	**PS69/421-2-DR 23-1***	**PS69/422-1-DR 24-1**	**PS69/423-1-DR 25-1a**	**PS69/423-1-DR 25-2**	**PS69/440-1-DR 32-2**
Rock Type	Tephrite	Nephelinite	Alkali Basalt	Hawaiite	Alkali Basalt
Ar/Ar Age (Ma)					37
Lat. (˚)	-33.35	-34.01	-34.92	-34.92	-37.48
Long. (˚)	2.12	0.96	0.55	0.55	-2.43
Depth (m.b.s.l.)	1970-1660	2040-1940	2075-1900	2075-1900	1890-1390
Cruise	R/V Polarstern ANT-XXIII/5	R/V Polarstern ANT-XXIII/5	R/V Polarstern ANT-XXIII/5	R/V Polarstern ANT-XXIII/5	R/V Polarstern ANT-XXIII/5
Li (ppm)	8.43	45.5	31.4	22.2	27.4
Sc (ppm)	21.3	21.0	24.6	24.0	20.8
V (ppm)	265	221	227	230	268
Cr (ppm)	164	324	360	337	186
Co (ppm)	28.6	34.5	29.5	28.4	35.2
Ni (ppm)	89.7	91.0	85.8	109	111
Cu (ppm)	36.0	72.0	32.6	37.2	35.6
Zn (ppm)	131	155	142	154	131
Ga (ppm)	25.4	16.0	19.9	19.8	23.8
Rb (ppm)	55.7	22.1	29.6	41.4	20.0
Sr (ppm)	840	361	898	844	919
Y (ppm)	33.2	37.4	47.8	55.8	27.5
Zr (ppm)	353	236	330	309	265
Nb (ppm)	55.4	53.0	62.4	62.0	43.5
Cs (ppm)	0.223	0.549	0.642	0.790	0.229
Ba (ppm)	833	709	854	861	623
La (ppm)	59.4	67.5	71.6	74.2	42.9
Ce (ppm)	115	105	124	120	90.9
Pr (ppm)	13.6	12.4	15.1	15.4	11.0
Nd (ppm)	52.5	47.2	58.3	60.1	44.7

Sample	PS69/421-2-DR 23-1*	PS69/422-1-DR 24-1	PS69/423-1-DR 25-1a	PS69/423-1-DR 25-2	PS69/440-1-DR 32-2
Sm (ppm)	10.4	8.74	10.8	11.2	9.32
Eu (ppm)	3.19	2.63	3.32	3.37	3.03
Gd (ppm)	9.34	8.19	10.0	10.5	8.32
Tb (ppm)	1.30	1.12	1.40	1.46	1.14
Dy (ppm)	6.92	5.95	7.65	8.12	6.00
Ho (ppm)	1.24	1.11	1.46	1.59	1.06
Er (ppm)	3.02	2.79	3.81	4.09	2.56
Tm (ppm)	0.400	0.361	0.516	0.549	0.331
Yb (ppm)	2.42	2.16	3.18	3.30	1.98
Lu (ppm)	0.336	0.313	0.467	0.481	0.276
Hf (ppm)	8.07	5.52	7.69	7.29	6.12
Ta (ppm)	3.37	3.13	3.76	3.73	2.72
Pb (ppm)	5.42	4.85	4.23	5.31	3.95
Th (ppm)	7.03	6.11	6.96	7.03	4.26
U (ppm)	1.42	1.66	2.03	1.51	0.953
$^{87}Sr/^{86}Sr_m$		0.705409	0.705337	0.705357	0.705519
±2σ		5	5	5	5
$^{87}Rb/^{86}Sr$		0.177	0.095	0.142	0.063
$^{87}Sr/^{86}Sr_{in}$		0.705268	0.705264	0.705248	0.705485
$^{143}Nd/^{144}Nd_m$		0.512504	0.512476	0.512476	0.512495
±2σ		3	2	3	3
εNd		-2.61	-3.16	-3.15	-2.80
$^{147}Sm/^{144}Nd$		0.111	0.112	0.112	0.125
$^{143}Nd/^{144}Nd_{in}$		0.512464	0.512436	0.512437	0.512463
$εNd_{in}$		-2.00	-2.58	-2.57	-2.45
$^{206}Pb/^{204}Pb_m$		18.1401	18.3236	18.3711	18.3079
±2σ		9	7	8	5
$^{207}Pb/^{204}Pb_m$		15.5777	15.5803	15.5883	15.6007

Sample	PS69/421-2-DR 23-1*	PS69/422-1-DR 24-1	PS69/423-1-DR 25-1a	PS69/423-1-DR 25-2	PS69/440-1-DR 32-2
±2σ		8	8	9	5
$^{208}Pb/^{204}Pb_m$		38.9557	39.1268	39.0655	38.9339
±2σ		19	26	26	13
$^{207}Pb/^{206}Pb_m$		0.85875	0.85029	0.84853	0.85213
±2σ		1	1	1	1
$^{208}Pb/^{206}Pb_m$		2.14749	2.13532	2.12647	2.12662
±2σ		2	6	5	3
$^{238}U/^{204}Pb$		21.83	30.69	18.20	15.42
$^{235}U/^{204}Pb$		0.16	0.22	0.13	0.11
$^{232}Th/^{204}Pb$		82.80	108.76	87.51	71.16
$^{232}Th/^{238}U$		3.79	3.54	4.81	4.62
$^{206}Pb/^{204}Pb_{in}$		17.950	18.065	18.218	18.217
$^{207}Pb/^{204}Pb_{in}$		15.569	15.568	15.581	15.596
$^{208}Pb/^{204}Pb_{in}$		38.726	38.836	38.831	38.800
$^{207}Pb/^{206}Pb_{in}$		0.867	0.862	0.855	0.856
$^{208}Pb/^{206}Pb_{in}$		2.157	2.150	2.131	2.130
delta 7/4		12.0	10.3	10.6	12.5
delta 8/4		139.7	134.7	122.8	117.3
$^{208}Pb^*/^{206}Pb^*$		1.07	1.07	1.06	1.05
$^{176}Hf/^{177}Hf_m$		0.282752	0.282700	0.282720	0.282709
±2σ		4	5	5	8
εHf		-0.72	-2.54	-1.83	-2.24
$^{176}Lu/^{177}Hf$		0.008146	0.008721	0.009446	0.006459
$^{176}Hf/^{177}Hf_{in}$		0.282743	0.282691	0.282710	0.282704
$εHf_{in}$		0.23	-1.64	-0.96	-1.55

	Gough Track	Walvis Ridge
Sample	**PS69/440-1-DR 32-5b**	**AII-93-21-1**
Rock Type	Tephrite	Alkali Basalt
Ar/Ar Age (Ma)	37	
Lat. (˚)	-37.48	-25.44
37	-2.43	6.70
Depth (m.b.s.l.)	1890-1390	3200-2600
Cruise	R/V Polarstern ANT-XXIII/5	R/V Atlantis II (AII-93)
Li (ppm)	30.3	17.0
Sc (ppm)	22.1	43.7
V (ppm)	294	362
Cr (ppm)	139	24.5
Co (ppm)	34.1	25.1
Ni (ppm)	94.8	44.5
Cu (ppm)	34.7	209
Zn (ppm)	161	146
Ga (ppm)	23.9	22.8
Rb (ppm)	31.4	36.0
Sr (ppm)	935	388
Y (ppm)	30.2	32.5
Zr (ppm)	235	189
Nb (ppm)	38.6	16.6
Cs (ppm)	1.18	1.31
Ba (ppm)	656	169
La (ppm)	39.2	18.8
Ce (ppm)	79.2	41.7
Pr (ppm)	9.91	5.75
Nd (ppm)	41.1	25.4

Sample	PS69/440-1-DR 32-5b	AII-93-21-1
Sm (ppm)	8.81	6.16
Eu (ppm)	2.98	2.10
Gd (ppm)	8.11	6.56
Tb (ppm)	1.12	1.05
Dy (ppm)	5.99	6.31
Ho (ppm)	1.07	1.22
Er (ppm)	2.63	3.25
Tm (ppm)	0.343	0.458
Yb (ppm)	2.05	2.89
Lu (ppm)	0.292	0.416
Hf (ppm)	5.58	4.25
Ta (ppm)	2.40	1.12
Pb (ppm)	3.96	1.97
Th (ppm)	3.47	1.69
U (ppm)	1.39	0.556
$^{87}Sr/^{86}Sr_m$	0.705519	0.705262
±2σ	4	5
$^{87}Rb/^{86}Sr$	0.097	0.269
$^{87}Sr/^{86}Sr_{in}$	0.705467	0.704995
$^{143}Nd/^{144}Nd_m$	0.512501	0.512631
±2σ	2	3
εNd	-2.67	-0.14
$^{147}Sm/^{144}Nd$	0.129	0.146
$^{143}Nd/^{144}Nd_{in}$	0.512469	0.512564
$εNd_{in}$	-2.35	0.31
$^{206}Pb/^{204}Pb_m$	18.3953	18.0632
±2σ	6	9
$^{207}Pb/^{204}Pb_m$	15.6186	15.5888

Sample	PS69/440-1-DR 32-5b	AII-93-21-1
±2σ	5	9
$^{208}Pb/^{204}Pb_m$	38.8704	38.5971
±2σ	13	25
$^{207}Pb/^{206}Pb_m$	0.84905	0.86301
±2σ	1	2
$^{208}Pb/^{206}Pb_m$	2.11306	2.13678
±2σ	2	7
$^{238}U/^{204}Pb$	22.48	17.88
$^{235}U/^{204}Pb$	0.16	0.13
$^{232}Th/^{204}Pb$	57.77	56.30
$^{232}Th/^{238}U$	2.57	3.15
$^{206}Pb/^{204}Pb_{in}$	18.262	17.869
$^{207}Pb/^{204}Pb_{in}$	15.612	15.580
$^{208}Pb/^{204}Pb_{in}$	38.762	38.402
$^{207}Pb/^{206}Pb_{in}$	0.855	0.872
$^{208}Pb/^{206}Pb_{in}$	2.122	2.149
delta 7/4	13.4	14.0
delta 8/4	100.3	113.2
$^{208}Pb^*/^{206}Pb^*$	1.03	1.04
$^{176}Hf/^{177}Hf_m$	0.282683	-
±2σ	4	-
εHf	-3.16	-
$^{176}Lu/^{177}Hf$	0.007500	-
$^{176}Hf/^{177}Hf_{in}$	0.282677	-
εHf$_{in}$	-2.50	-

Isotopes: Internal errors are shown for the last significant digit(s).
Ar/Ar ages are from Rohde et al. (2012).
*ICPMS replicate analyses on separate sample dissolution
**MC-ICPMS replicate analyses on separate sample dissolution
$^{208}Pb^*/^{206}Pb^* = [(^{208}Pb/^{204}Pb)_{sample}-(^{208}Pb/^{204}Pb)_{Earth\ initial}]/[(^{206}Pb/^{204}Pb)_{sample}-(^{206}Pb/^{204}Pb)_{Earth\ initial}]$; after Galer and O`Nions, 1985.
delta 7/4 and delta 8/4 = deviation of $^{207}Pb/^{204}Pb$ and $^{208}Pb/^{204}Pb$ from the Northern Hemisphere reference line (NHRL) as defined in Hart, 1984.

Table DR2. Reproducibility and accuracy of ICP-MS trace element data for BIR-1

# Analysis/ Element	#1	#2	#3	Mean	Std. dev. (±1σ abs)	Std. dev. (±1σ %)	Ref. Value[1]	Rel. dev. (%)
Li (ppm)	3.19	3.23	2.79	3.07	0.24	7.9	3.4	9.6
Sc (ppm)	44.3	40.5	33.5	39.4	5.45	13.8	44	10.4
V (ppm)	311	308	312	310	2.30	0.7	313	0.8
Cr (ppm)	374	386	389	383	7.96	2.1	382	-0.2
Co (ppm)	51.5	51.9	52.1	51.8	0.30	0.6	51.4	-0.8
Ni (ppm)	166	159	161	162	3.24	2.0	166	2.4
Cu (ppm)	125	113	113	117	7.01	6.0	126	6.9
Zn (ppm)	70.2	66.8	67.8	68.2	1.75	2.6	71	3.9
Ga (ppm)	16.0	15.3	15.2	15.5	0.47	3.0	16	3.1
Rb (ppm)	0.233	0.157	0.120	0.170	0.06	34.0	0.212	19.8
Sr (ppm)	107	105	99	104	4.27	4.1	104	0.2
Y (ppm)	15.8	14.8	14.0	14.8	0.92	6.2	16	7.2
Zr (ppm)	14.7	13.6	13.5	13.9	0.66	4.7	14	0.5
Nb (ppm)	0.525	0.539	0.537	0.533	0.01	1.5	0.55	3.0
Cs (ppm)	0.006	0.003	0.002	0.004	0.002	57.5	0.005	26.8
Ba (ppm)	6.33	6.05	5.92	6.10	0.21	3.4	5.83	-4.6
La (ppm)	0.585	0.579	0.564	0.576	0.01	1.9	0.62	7.1
Ce (ppm)	1.86	1.87	1.83	1.85	0.02	1.1	1.95	4.9
Pr (ppm)	0.363	0.368	0.358	0.363	0.005	1.4	0.38	4.4
Nd (ppm)	2.33	2.37	2.32	2.34	0.03	1.2	2.5	6.4
Sm (ppm)	1.08	1.10	1.07	1.08	0.02	1.4	1.1	1.6
Eu (ppm)	0.513	0.517	0.501	0.510	0.01	1.6	0.54	5.5
Gd (ppm)	1.74	1.77	1.73	1.75	0.02	1.2	1.85	5.5
Tb (ppm)	0.349	0.356	0.346	0.350	0.01	1.5	0.36	2.7
Dy (ppm)	2.52	2.54	2.47	2.51	0.04	1.5	2.5	-0.4
Ho (ppm)	0.562	0.561	0.541	0.555	0.01	2.2	0.57	2.7
Er (ppm)	1.61	1.61	1.54	1.59	0.04	2.4	1.7	6.7
Tm (ppm)	0.244	0.243	0.233	0.240	0.01	2.5	0.26	7.8
Yb (ppm)	1.62	1.59	1.52	1.58	0.05	3.2	1.65	4.5
Lu (ppm)	0.244	0.241	0.229	0.238	0.01	3.5	0.26	8.5
Hf (ppm)	0.551	0.558	0.550	0.553	0.005	0.8	0.581	4.8
Ta (ppm)	0.040	0.046	0.046	0.044	0.003	7.5	0.035	-26.0
Pb (ppm)	2.98	3.00	2.91	2.97	0.05	1.6	3.08	3.7
Th (ppm)	0.029	0.030	0.028	0.029	0.001	2.6	0.03	3.2
U (ppm)	0.012	0.010	0.010	0.011	0.001	11.0	0.01	-9.0

[1]Preferred values of Hoernle et al. (2011).

Table DR3. Reproducibility and accuracy of ICP-MS trace element data for BHVO-2

# Analysis/ Element	#1	#2	#3	Mean	Std. dev. (±1σ abs)	Std. dev. (±1σ %)	Ref. value[1]	Rel. dev. (%)	Ref. Value (U.S. Geological Survey)
Li (ppm)	4.52	4.53	4.09	4.38	0.2	5.6	4.6	4.8	5
Sc (ppm)	32.7	31.8	30.4	31.6	1.2	3.6	31.8	0.5	32
V (ppm)	322	316	314	317	3.9	1.2	317*	-0.1	317
Cr (ppm)	293	295	294	294	1.2	0.4	289	-1.7	280
Co (ppm)	45.0	44.1	43.9	44.3	0.6	1.3	45*	1.6	45
Ni (ppm)	119	116	117	117	1.3	1.1	119*	1.4	119
Cu (ppm)	134	125	127	129	5.0	3.9	127*	-1.4	127
Zn (ppm)	104	104	104	104	0.3	0.3	103*	-1.0	103
Ga (ppm)	22.4	21.8	21.7	22.0	0.4	1.8	21.7*	-1.2	21.7
Rb (ppm)	9.32	9.26	8.30	8.96	0.6	6.4	9.2	2.6	9.8
Sr (ppm)	387	389	380	385	4.5	1.2	395	2.5	389
Y (ppm)	25.7	25.6	24.9	25.4	0.4	1.7	25.5	0.5	26
Zr (ppm)	170	174	175	173	2.6	1.5	174	0.4	172
Nb (ppm)	17.7	18.3	18.3	18.1	0.3	1.9	18*	-0.5	18
Cs (ppm)	0.108	0.104	0.074	0.096	0.02	19.2	0.11	13.1	
Ba (ppm)	132	132	132	132	0.5	0.4	130*	-1.6	130
La (ppm)	15.4	15.2	15.1	15.3	0.1	0.9	15.2	-0.4	15
Ce (ppm)	38.3	37.6	37.3	37.7	0.5	1.4	38*	0.7	38
Pr (ppm)	5.39	5.41	5.35	5.38	0.03	0.5	5.3	-1.5	
Nd (ppm)	24.4	24.9	24.8	24.7	0.3	1.2	25*	1.2	25
Sm (ppm)	6.13	6.19	6.15	6.16	0.03	0.5	6.2*	0.7	6.2
Eu (ppm)	2.07	2.08	2.07	2.07	0.01	0.4	2.06	-0.7	
Gd (ppm)	6.21	6.24	6.19	6.22	0.02	0.4	6.3*	1.3	6.3
Tb (ppm)	0.935	0.954	0.938	0.943	0.01	1.1	0.93	-1.4	0.9
Dy (ppm)	5.36	5.41	5.29	5.36	0.1	1.1	5.25	-2.0	
Ho (ppm)	0.983	0.984	0.974	0.98	0.01	0.6	0.99	1.0	1.04
Er (ppm)	2.44	2.46	2.43	2.44	0.02	0.7	2.5	2.2	
Tm (ppm)	0.328	0.329	0.323	0.327	0.004	1.1	0.34	4.0	
Yb (ppm)	2.00	2.00	1.96	1.98	0.02	1.1	2*	0.9	2.0
Lu (ppm)	0.280	0.278	0.272	0.276	0.004	1.5	0.28*	1.3	0.28
Hf (ppm)	4.33	4.16	4.19	4.23	0.1	2.1	4.07	-3.8	4.1
Ta (ppm)	1.10	1.13	1.13	1.12	0.02	1.6	1.13	0.5	1.4
Pb (ppm)	1.67	1.99	1.58	1.74	0.2	12.6	1.7	-2.6	
Th (ppm)	1.19	1.21	1.15	1.18	0.03	2.4	1.21	2.4	1.2
U (ppm)	0.409	0.419	0.421	0.416	0.01	1.6	0.41	-1.5	

[1]Preferred values of the ICP-MS laboratory at the Institute of Geosciences at the Christian-Albrechts University of Kiel

* equivalent to the certified values of the U.S. Geological Survey (http://crustal.usgs.gov/geochemical_reference_standards/)

Table DR4. Accuracy of ICP-MS trace element data for BCR-2

# Analysis/ Element	BCR-2	Ref. Value[1]	Rel. dev. (%)
Li (ppm)	8.88	9.00	1.3
Sc (ppm)	34.9	33.0	-5.7
V (ppm)	420	416	-1.0
Cr (ppm)	19.5	18.0	-8.2
Co (ppm)	37.7	37.0	-1.9
Ni (ppm)	12.1	12.3	1.7
Cu (ppm)	20.3	19.0	-6.9
Zn (ppm)	133	127	-5.1
Ga (ppm)	23.4	23.0	-1.6
Rb (ppm)	48.5	47.5	-2.2
Sr (ppm)	339	343	1.1
Y (ppm)	35.8	37.0	3.2
Zr (ppm)	189	186	-1.8
Nb (ppm)	12.0	12.6	4.4
Cs (ppm)	1.15	1.10	-4.2
Ba (ppm)	664	680	2.3
La (ppm)	25.2	25.0	-0.7
Ce (ppm)	52.9	53.0	0.2
Pr (ppm)	6.83	6.75	-1.2
Nd (ppm)	28.9	28.4	-1.8
Sm (ppm)	6.59	6.64	0.8
Eu (ppm)	1.95	1.98	1.7
Gd (ppm)	6.75	6.78	0.3
Tb (ppm)	1.05	1.07	2.2
Dy (ppm)	6.36	6.41	0.8
Ho (ppm)	1.28	1.31	2.1
Er (ppm)	3.48	3.66	4.8
Tm (ppm)	0.519	0.540	4.0
Yb (ppm)	3.36	3.44	2.4
Lu (ppm)	0.500	0.507	1.4
Hf (ppm)	4.71	4.85	2.8
Ta (ppm)	0.727	0.740	1.7
Pb (ppm)	10.7	11.0	2.8
Th (ppm)	5.67	5.95	4.8
U (ppm)	1.61	1.69	4.6

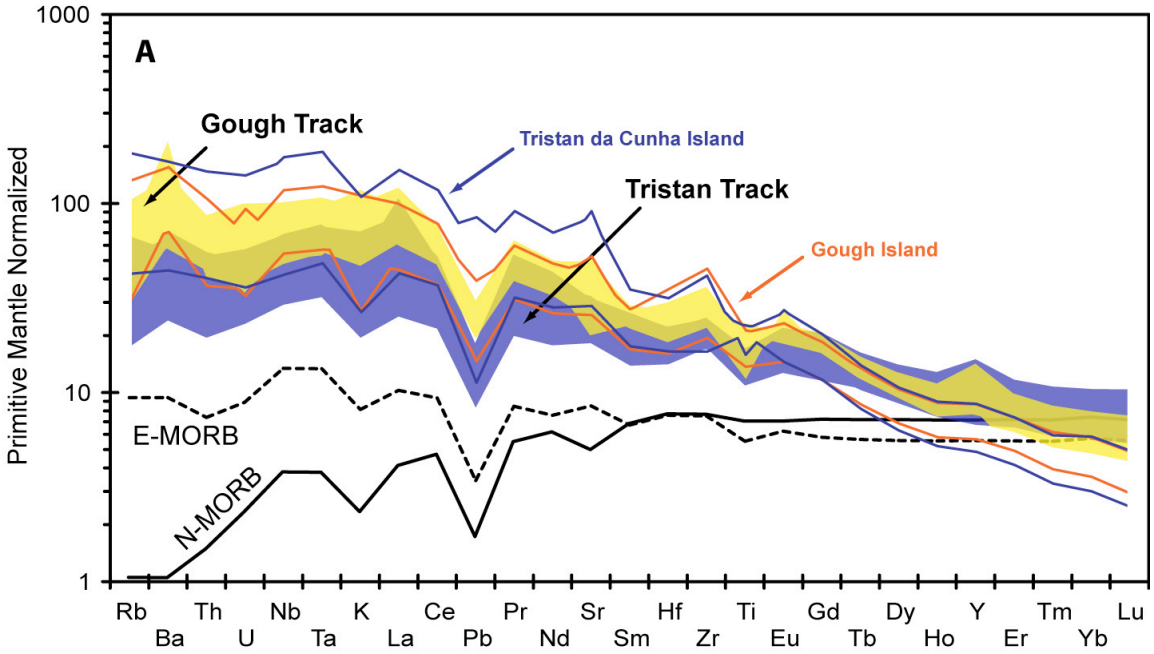
[1]Reference values are from GeoReM (http://georem.mpch-mainz.gwdg.de/)

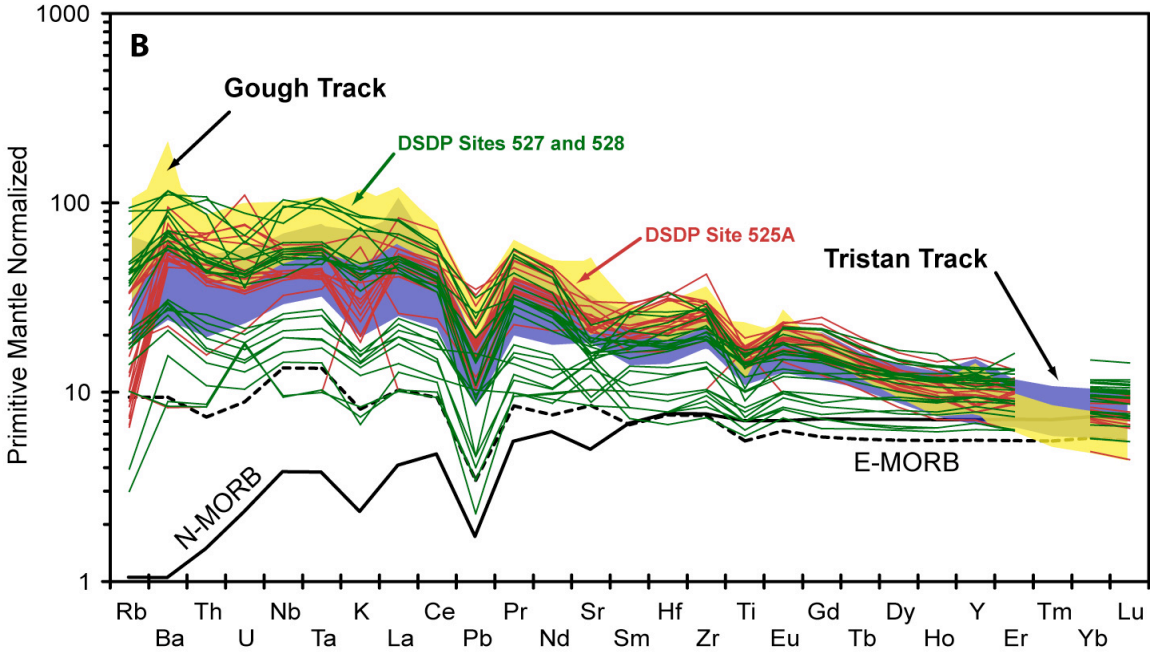
Table DR5. Reproducibility of ICP-MS trace element data based on sample replicates

# Analysis/ Element	AII-93-3-25 (1)	AII-93-3-25 (2)	Diff. (%)	PS69/421-2-DR 23-1 (1)	PS69/421-2-DR 23-1 (2)	Diff. (%)
Li (ppm)	36.7	37.4	-1.8	8.38	8.43	-0.5
Sc (ppm)	33.2	33.5	-0.8	21.0	21.3	-1.6
V (ppm)	291	288	0.8	263	265	-1.0
Cr (ppm)	56.6	56.0	0.9	163	164	-0.9
Co (ppm)	40.4	40.0	0.8	28.5	28.6	-0.4
Ni (ppm)	41.6	41.7	-0.1	88.1	89.7	-1.9
Cu (ppm)	44.8	44.6	0.5	35.7	36.0	-0.9
Zn (ppm)	129	128	0.8	129	131	-1.8
Ga (ppm)	21.4	21.1	1.3	25.2	25.4	-0.9
Rb (ppm)	35.7	35.8	-0.5	55.1	55.7	-1.1
Sr (ppm)	434	430	0.9	827	840	-1.6
Y (ppm)	26.5	26.5	-0.1	33.0	33.2	-0.4
Zr (ppm)	167	164	1.5	349	353	-1.3
Nb (ppm)	24.8	24.8	0.0	54.8	55.4	-1.1
Cs (ppm)	3.34	3.37	-0.8	0.221	0.223	-0.9
Ba (ppm)	347	344	0.9	827	833	-0.7
La (ppm)	25.6	26.0	-1.6	59.0	59.4	-0.6
Ce (ppm)	53.7	53.9	-0.4	114	115	-0.9
Pr (ppm)	6.68	6.76	-1.2	13.5	13.6	-0.9
Nd (ppm)	27.9	28.4	-2.0	51.9	52.5	-1.1
Sm (ppm)	6.35	6.41	-1.0	10.3	10.4	-0.8
Eu (ppm)	2.33	2.34	-0.4	3.15	3.19	-1.4
Gd (ppm)	6.37	6.48	-1.7	9.22	9.34	-1.3
Tb (ppm)	0.962	0.979	-1.8	1.30	1.30	-0.1
Dy (ppm)	5.53	5.66	-2.3	6.85	6.92	-1.0
Ho (ppm)	1.05	1.07	-2.3	1.22	1.24	-1.7
Er (ppm)	2.72	2.74	-0.8	2.99	3.02	-1.1
Tm (ppm)	0.373	0.381	-2.0	0.396	0.400	-1.1
Yb (ppm)	2.34	2.38	-1.9	2.36	2.42	-2.6
Lu (ppm)	0.336	0.344	-2.4	0.334	0.336	-0.6
Hf (ppm)	4.01	4.09	-2.0	7.92	8.07	-1.8
Ta (ppm)	1.57	1.62	-2.7	3.29	3.37	-2.6
Pb (ppm)	1.91	1.95	-2.2	5.28	5.42	-2.8
Th (ppm)	2.65	2.73	-3.0	6.93	7.03	-1.4
U (ppm)	0.478	0.487	-1.8	1.37	1.42	-3.7

Appendix DR3

Multi-element diagrams.

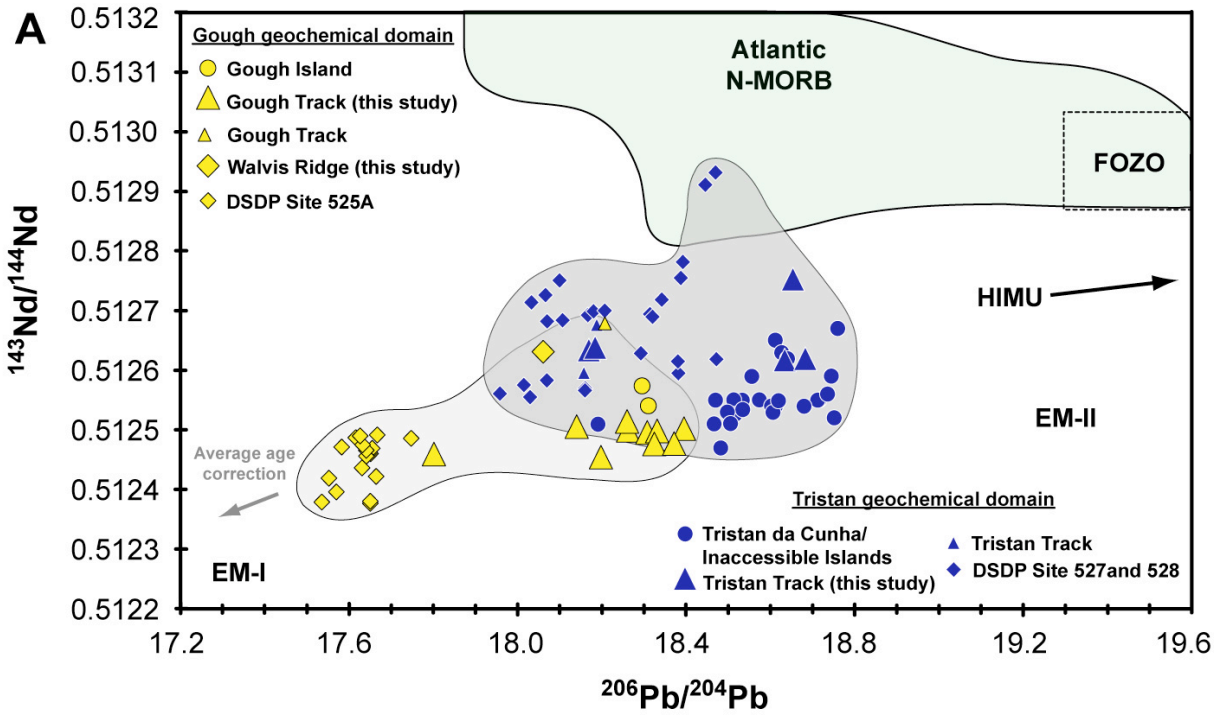




Incompatible element diagrams for Tristan and Gough subtrack samples including Tristan and Gough Islands and DSDP Sites 525A, 527 and 528. The diagrams include our data from the Guyot Province and published data for A: Tristan da Cunha and Gough Islands (Willbold and Stracke, 2006) and for B: DSDP Sites 525A, 527 and 528 (Salters and Sachi-Kocher, 2010). Values are primitive mantle normalized (Hofmann, 1988). N-MORB and E-MORB are also shown (Sun and McDonough, 1989). The incompatible element data for the Tristan and Gough subtracks do not show any systematic differences but instead largely overlap. References are provided in Appendix DR5.

Appendix DR4

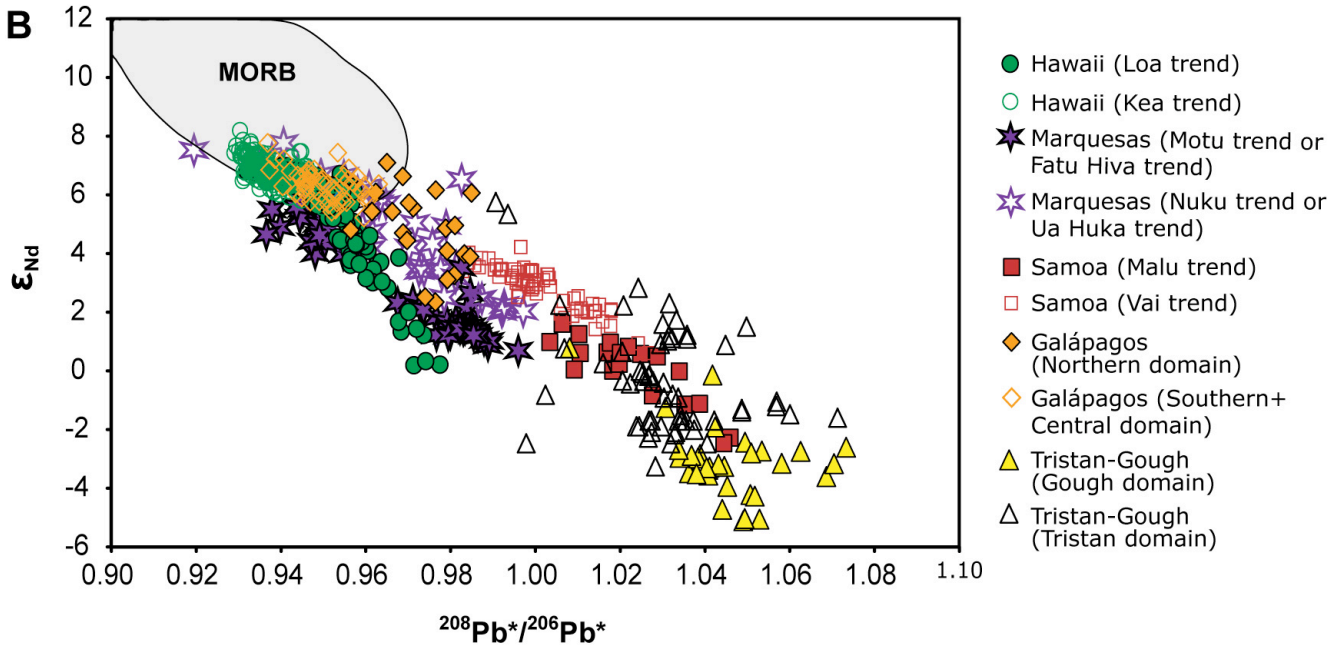
Pb-Nd isotope variation diagram.



$^{206}Pb/^{204}Pb$ versus $^{143}Nd/^{144}Nd$ demonstrating that the Gough subtrack generally has less radiogenic Pb and Nd isotopic compositions (i.e. more enriched isotopic composition) than the Tristan subtrack. The Gough domain includes data from Gough Island and seamount/ridge chain in the Guyot Province, DSDP Site 525A and one dredge site on the Walvis Ridge. The Tristan domain includes data from Tristan da Cunha and Inaccessible Islands, the Tristan seamount/ridge chain in the Guyot Province and DSDP Sites 527 and 528 on the Walvis Ridge (published data compiled from GEOROC (http://georoc.mpch-mainz.gwdg.de/georoc/)). Gray arrow shows average reduction in isotopic ratios resulting from age correction for our Tristan and Gough data. Field for FOZO (Stracke et al., 2005) is also shown. Enriched mantle (EM-I and EM-II) from (Stracke et al., 2003). Data from Atlantic N-

MORB are compiled from PetDB (http://www.petdb.org/). References are provided in Appendix DR5.

$^{208}Pb^*/^{206}Pb^*$ versus ε_{Nd} plot for the Tristan-Gough and zoned Pacific hotspots.



Base data for Hawaii, the Marquesas, Samoa and Galápagos compiled from GEOROC (http://georoc.mpch-mainz.gwdg.de/georoc/). Data for the Tristan domain include our data from the Tristan subtrack and published data (Tristan da Cunha Islands, Tristan subtrack and DSDP Sites 527 and 528) compiled from GEOROC (http://georoc.mpch-mainz.gwdg.de/georoc/). Data for the Gough domain include our data from the Gough subtrack and the Walvis Ridge and published data (Gough Island, Gough subtrack and DSDP Site 525A) compiled from GEOROC (http://georoc.mpch-mainz.gwdg.de/georoc/). MORB data are compiled from PetDB (http://www.petdb.org/). Nomenclature of the Marquesan geochemical domains is from Huang et al. (2011) and Chauvel et al. (2012), respectively. References are provided in Appendix DR5.

Appendix DR5

Additional references

References for Methods section

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