

GSA DATA REPOSITORY 2010153

Electronic Appendix 1 – Data and Analytical Methods

The analytical techniques used in this study are summarized below; full details of the microsampling technique are given in Charlier et al., (2006). Microsampling for determination of $^{87}\text{Sr}/^{86}\text{Sr}$ isotopic ratios was performed on 100 μm polished thin sections, using a New Wave Micromill. The core regions of single plagioclase crystals were milled, generating a powder which was captured in a Milli-Q water droplet. Samples were then collected with a micropipette and transferred to 3 ml Savillex beakers, where they were dried, before following a sequence of dissolution and evaporation steps (concentrated HF + HNO₃, 6M HCl, concentrated HNO₃). To obtain fresh, crystal-free, glass samples, hand-specimens were crushed, and fragments were hand-picked using a binocular microscope. The fragments were then dissolved using the same procedure as for the milled samples. Following a final evaporation step, samples were dissolved in 3M HNO₃, before being passed through micro-columns filled with ~50 μl of Sr-spec resin to separate the Sr fraction.

Samples were loaded onto single outgassed Re filaments for analysis by thermal ionisation mass spectrometry (TIMS). Sr isotope ratios were measured using a Thermo-Finnigan Triton TIMS instrument at Durham University. Long-term external reproducibility was determined by analysis of NBS987 of a similar load size to the micromilled sample (~3 ng), and averaged over the duration of each period of analysis. Due to data collection over several analysis periods,

sample data have been normalised to an NBS987 value of 0.710240. Standard values for the different analysis periods are given in Table A1 below. No blank corrections were applied, as total procedural blanks were in the range 4 – 35 pg of Sr, with an average of 14 pg, which is negligible compared to the sample loads.

TABLE A1. NBS987 3mg STANDARD VALUES

	Apr-06	Aug-Sep-07	Nov-07	Jun-08
Average 87/86 Sr	0.710264	0.710245	0.710235	0.710239
	± 15 ppm	± 23 ppm	± 14 ppm	± 23 ppm
	n = 10	n = 21	n = 10	n = 26
Samples analysed				
Apr-06	Plagioclase from Minoan scoria blebs			
Aug-Sep-07	All Plagioclase except Minoan scoria blebs and crystal-rich pumice			
Nov-07	All glass except Minoan crystal-rich pumice			
Jun-08	Plagioclase and glass from Minoan crystal-rich pumice			

TABLE A2a. PLAGIOCLASE CORES

Deposit	Component	Sample batch no	87/86 Sr uncorrected	NBS987 for analysis period	87/86 Sr corrected *	2SE
Minoan						
	crystal-rich pumice	M62-18	0.705424	0.710239	0.705425	0.000017
	crystal-rich pumice	M62-20	0.705417	0.710239	0.705418	0.000018
	crystal-rich pumice	M62-21	0.705416	0.710239	0.705417	0.000015
	crystal-rich pumice	M62-22	0.705400	0.710239	0.705401	0.000019
	crystal-rich pumice	M62-23	0.705399	0.710239	0.705400	0.000020
	grey scoria bleb	M25-1	0.705747	0.710260	0.705727	0.000024
	grey scoria bleb	M25-3	0.705688	0.710260	0.705668	0.000038
	grey scoria bleb	M25-5	0.705598	0.710260	0.705578	0.000016
	grey scoria bleb	M25-8	0.704979	0.710260	0.704959	0.000018
	grey scoria bleb	M25-10	0.705825	0.710260	0.705805	0.000018
	white pumice	M32-2	0.705009	0.710245	0.705004	0.000026
	white pumice	M32-5	0.705019	0.710245	0.705014	0.000030
	white pumice	M32-6	0.704964	0.710245	0.704959	0.000036
	white pumice	M32-9	0.705053	0.710245	0.705048	0.000028
	white pumice	M32-10	0.704952	0.710245	0.704947	0.000032
	white pumice	M32-7	0.704897	0.710245	0.704892	0.000078
	white pumice	M32-17	0.704969	0.710245	0.704964	0.000034
	white pumice	M32-18	0.705018	0.710245	0.705013	0.000072
Cape Riva						
	grey scoria	M36-11	0.704453	0.710245	0.704448	0.000034
	grey scoria	M36-7	0.704613	0.710245	0.704608	0.000110
	grey scoria	M36-8	0.704493	0.710245	0.704488	0.000098
	grey scoria	M36-2	0.704812	0.710245	0.704807	0.000040
	grey scoria	M36-4	0.704823	0.710245	0.704818	0.000024
	grey scoria	M36-5	0.704819	0.710245	0.704814	0.000024
	grey scoria	M36-6	0.704778	0.710245	0.704773	0.000024
	grey scoria	M36-9	0.704825	0.710245	0.704820	0.000028
	grey scoria	M36-10	0.704802	0.710245	0.704797	0.000038
	grey scoria	M36-14	0.704802	0.710245	0.704797	0.000020
	grey scoria	M36-15	0.704781	0.710245	0.704776	0.000020
	white pumice	M34-2	0.704823	0.710245	0.704818	0.000019

US2	white pumice	M34-4	0.704844	0.710245	0.704839	0.000022
	white pumice	M34-5	0.704829	0.710245	0.704824	0.000022
	white pumice	M34-6	0.704825	0.710245	0.704820	0.000024
	white pumice	M34-7	0.704824	0.710245	0.704819	0.000019
	white pumice	M34-8	0.704822	0.710245	0.704817	0.000013
	white pumice	M34-9	0.704838	0.710245	0.704833	0.000016
	white pumice	M34-16	0.704757	0.710245	0.704752	0.000046
US1	pumice	M40-10	0.704940	0.710245	0.704935	0.000017
	pumice	M40-11	0.704909	0.710245	0.704904	0.000016
	pumice	M40-17	0.704882	0.710245	0.704877	0.000039
	pumice	M40-15	0.704726	0.710245	0.704721	0.000024
	pumice	M40-16	0.704512	0.710245	0.704507	0.000026
	pumice	M40-18	0.704553	0.710245	0.704548	0.000020
Vourvoulous	pumice	M38-14	0.704472	0.710245	0.704467	0.000027
	pumice	M38-15	0.704526	0.710245	0.704521	0.000027
	pumice	M38-16	0.704481	0.710245	0.704476	0.000032
	pumice	M38-17	0.704576	0.710245	0.704571	0.000056
	pumice	M38-18	0.704481	0.710245	0.704476	0.000065
	pumice	M38-11	0.704477	0.710245	0.704472	0.000032
Middle Pumice	white pumice	M38-20	0.704686	0.710245	0.704681	0.000017
	white pumice	M38-21	0.704723	0.710245	0.704718	0.000021
	white pumice	M38-22	0.704772	0.710245	0.704767	0.000047
	white pumice	M38-23	0.704687	0.710245	0.704682	0.000040
	white pumice	M38-26	0.704643	0.710245	0.704638	0.000025
	white pumice	M38-26	0.704675	0.710245	0.704670	0.000022
† grey scoria 1	† grey scoria 1	M40-2	0.704487	0.710245	0.704482	0.000022
	† grey scoria 1	M40-3	0.704595	0.710245	0.704590	0.000036
	† grey scoria 1	M40-4	0.704486	0.710245	0.704481	0.000029
	† grey scoria 1	M40-5	0.704549	0.710245	0.704544	0.000033
	† grey scoria 1	M40-6	0.704530	0.710245	0.704525	0.000031
	§ grey scoria 2	M38-27	0.704462	0.710245	0.704457	0.000029
	§ grey scoria 2	M38-28	0.704411	0.710245	0.704406	0.000034
	§ grey scoria 2	M38-29	0.704416	0.710245	0.704411	0.000026
	§ grey scoria 2	M38-30	0.704373	0.710245	0.704368	0.000038

Martin et al., Magma dynamics from Sr isotope microsampling					
		0.704489	0.710245	0.704484	0.000023
white pumice	M38-2	0.704492	0.710245	0.704487	0.000035
white pumice	M38-4	0.704486	0.710245	0.704481	0.000024
white pumice	M38-5	0.704486	0.710245	0.704481	0.000030
white pumice	M38-6	0.704492	0.710245	0.704487	0.000028
white pumice	M38-7	0.704485	0.710245	0.704480	0.000032
white pumice	M38-8	0.704487	0.710245	0.704482	0.000030
white pumice	M38-9	0.704577	0.710245	0.704572	0.000036

* Data normalised to an NBS987 value of
0.710240.

† Grey scoria 1 refers to large scoria blocks from the top of the Middle Pumice deposit (see text for details).

§ Grey scoria 2 refers to small scoria clasts dispersed throughout the Middle Pumice deposit (see text for details).

TABLE A2b. GLASS

Deposit	Component	Sample batch no	87/86 Sr uncorrected	NBS987 for analysis period	87/86 Sr corrected *	2SE
Minoan						
	crystal-rich pumice	M64-17	0.705630	0.710239	0.705631	0.000094
	crystal-rich pumice	M64-18	0.705516	0.710239	0.705517	0.000100
	crystal-rich pumice	M64-19	0.705434	0.710239	0.705435	0.000061
	crystal-rich pumice	M64-20	0.705477	0.710239	0.705478	0.000051
	grey scoria bleb	M25-9	0.705400	0.710255	0.705385	0.000003
	grey scoria bleb	M25-12	0.705442	0.710255	0.705427	0.000016
	white pumice	M47-26	0.705206	0.710235	0.705211	0.000036
	white pumice	M47-27	0.705138	0.710235	0.705143	0.000020
	white pumice	M47-29	0.705363	0.710235	0.705368	0.000024
Cape Riva						
	grey scoria	M47-6	0.704575	0.710235	0.704580	0.000015
	grey scoria	M47-7	0.704579	0.710235	0.704584	0.000008
	grey scoria	M47-8	0.704564	0.710235	0.704569	0.000008

white pumice	M47-2	0.704817	0.710235	0.704822	0.000017	
white pumice	M47-3	0.704832	0.710235	0.704837	0.000020	
white pumice	M47-4	0.704842	0.710235	0.704847	0.000015	
US2	pumice	M47-34	0.704489	0.710235	0.704494	0.000011
	pumice	M47-35	0.704509	0.710235	0.704514	0.000017
	pumice	M47-38	0.704490	0.710235	0.704495	0.000011
	pumice	M47-38rep	0.704499	0.710235	0.704504	0.000007
US1	pumice	M47-30	0.704540	0.710235	0.704545	0.000011
	pumice	M47-31	0.704517	0.710235	0.704522	0.000110
	pumice	M47-32	0.704529	0.710235	0.704534	0.000009
	pumice	M47-33	0.704517	0.710235	0.704522	0.000010
Vourvoulos	white pumice	M47-41	0.704408	0.710235	0.704413	0.000016
	white pumice	M47-42	0.704456	0.710235	0.704461	0.000013
	white pumice	M47-43	0.704475	0.710235	0.704480	0.000015
Middle Pumice	† grey scoria 1	M47-20	0.704785	0.710235	0.704790	0.000024
	† grey scoria 1	M47-21	0.704768	0.710235	0.704773	0.000016
	† grey scoria 1	M47-22	0.704765	0.710235	0.704770	0.000018
	§ grey scoria 2	M47-16	0.704474	0.710235	0.704479	0.000008
	§ grey scoria 2	M47-17	0.704523	0.710235	0.704528	0.000012
	§ grey scoria 2	M47-17rep	0.704530	0.710235	0.704535	0.000012
	§ grey scoria 2	M47-18	0.704500	0.710235	0.704505	0.000010
	§ grey scoria 2	M47-19	0.704486	0.710235	0.704491	0.000013
	white pumice	M47-10	0.704571	0.710235	0.704576	0.000028
	white pumice	M47-13	0.704510	0.710235	0.704515	0.000014
	white pumice	M47-14	0.704514	0.710235	0.704519	0.000014
	white pumice	M47-15	0.704566	0.710235	0.704571	0.000009

* Data normalised to an NBS987 value of 0.710240.

† Grey scoria 1 refers to large scoria blocks from the top of the Middle Pumice deposit (see text for details).

§ Grey scoria 2 refers to small scoria clasts dispersed throughout the Middle Pumice deposit (see text for details).

TABLE A3: NOTES ON FELDSPAR COMPOSITION TO COMPARE WITH FIGS 1-3

Unit	Pumice type ¹	Feldspar compositions and characteristics
Cape Thera		Euhedral, normal zoned crystals An ₄₄₋₅₅ Smaller, reverse zoned crystals An ₃₈₋₄₅ Xenocrysts with cores An ₈₉₋₉₅
Vourvoulos	WP	Reverse zoned, cores An ₄₂₋₄₄ , rims An ₄₈
	DP	Normal zoned, cores An ₆₀₋₆₃ , rims An ₅₅ Reverse zoned, cores, An ₄₂₋₄₉ (from WP) Xenocrysts' of bytownite
US1		Normally zoned, An ₄₅₋₇₀
US2	WP	An ₄₅₋₅₀
	DP	Normally zoned, An ₄₅₋₇₀ Strongly zoned xenocrysts with cores An ₈₀₋₉₅
Middle Pumice	WP	Reverse zoned crystals, cores An ₃₈₋₄₅ , rims An ₄₃₋₅₃
	DP	Normal zoned 'phenocrysts', cores An ₅₅ , rims An ₄₃₋₄₇ Glomerocrysts with ol and plag An ₇₀₋₉₀
Cape Riva	WP	Phenocrysts' An ₂₈₋₇₀ , microphenocrysts and rims An ₃₆₋₄₀ Rare 'xenocrysts' of bytownite
	DP	no info
Minoan	WP	Phenocrysts' An ₂₈₋₇₀ , microphenocrysts and rims An ₃₆₋₄₀ Rare 'xenocrysts' of bytownite
	DP	Plag in gabbro fragments An ₇₀₋₉₀ Euhedral 'phenocrysts' have cores up to An ₈₃ and rims An ₅₃₋₅₅ no crystal data, but magmas are higher in Ba with higher Ba/Rb
	CR	ratios than the Minoan WP

Details from pages 60-71 of Druitt et al. (1999), 1: Pumice types; WP = White Pumice; DP=Dark Pumice; CR = Crystal-Rich Pumice.