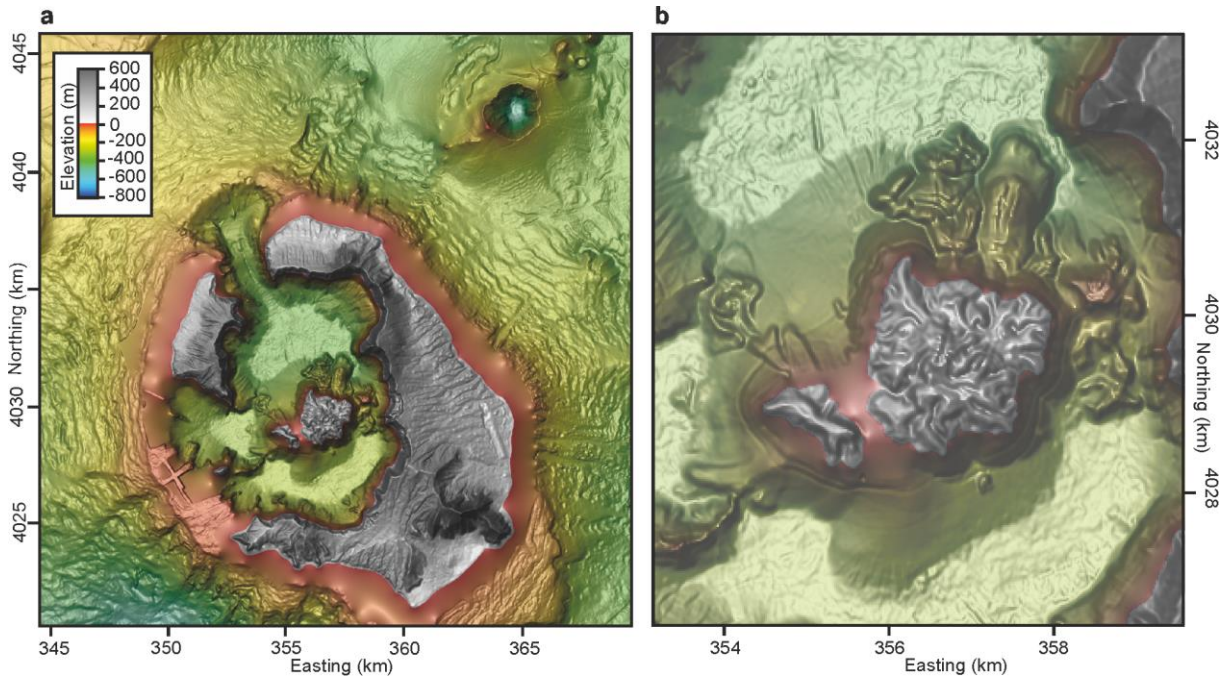


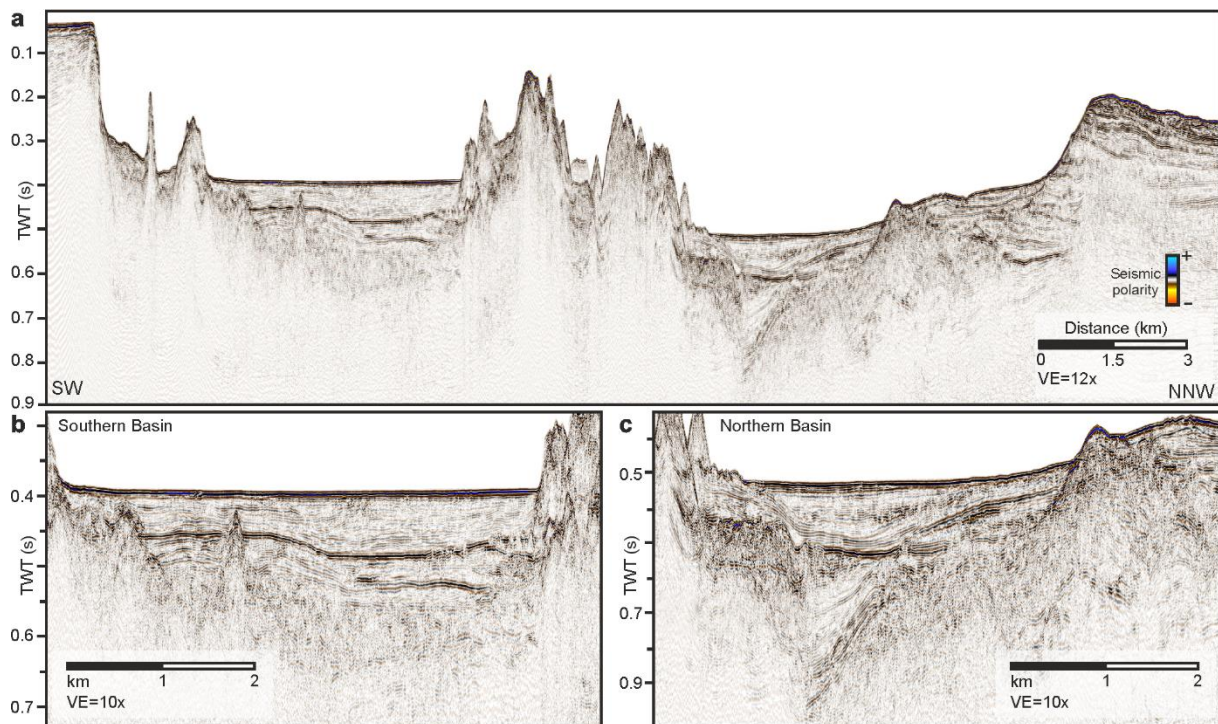


Hazardous explosive eruptions of a recharging multi-cyclic island arc caldera

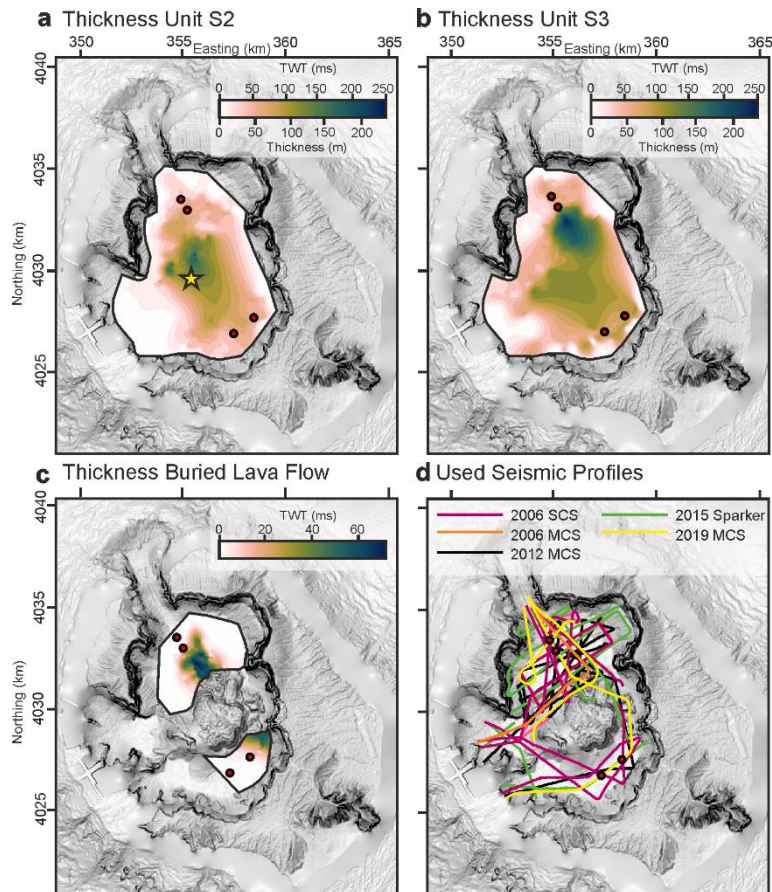
In the format provided by the authors and unedited



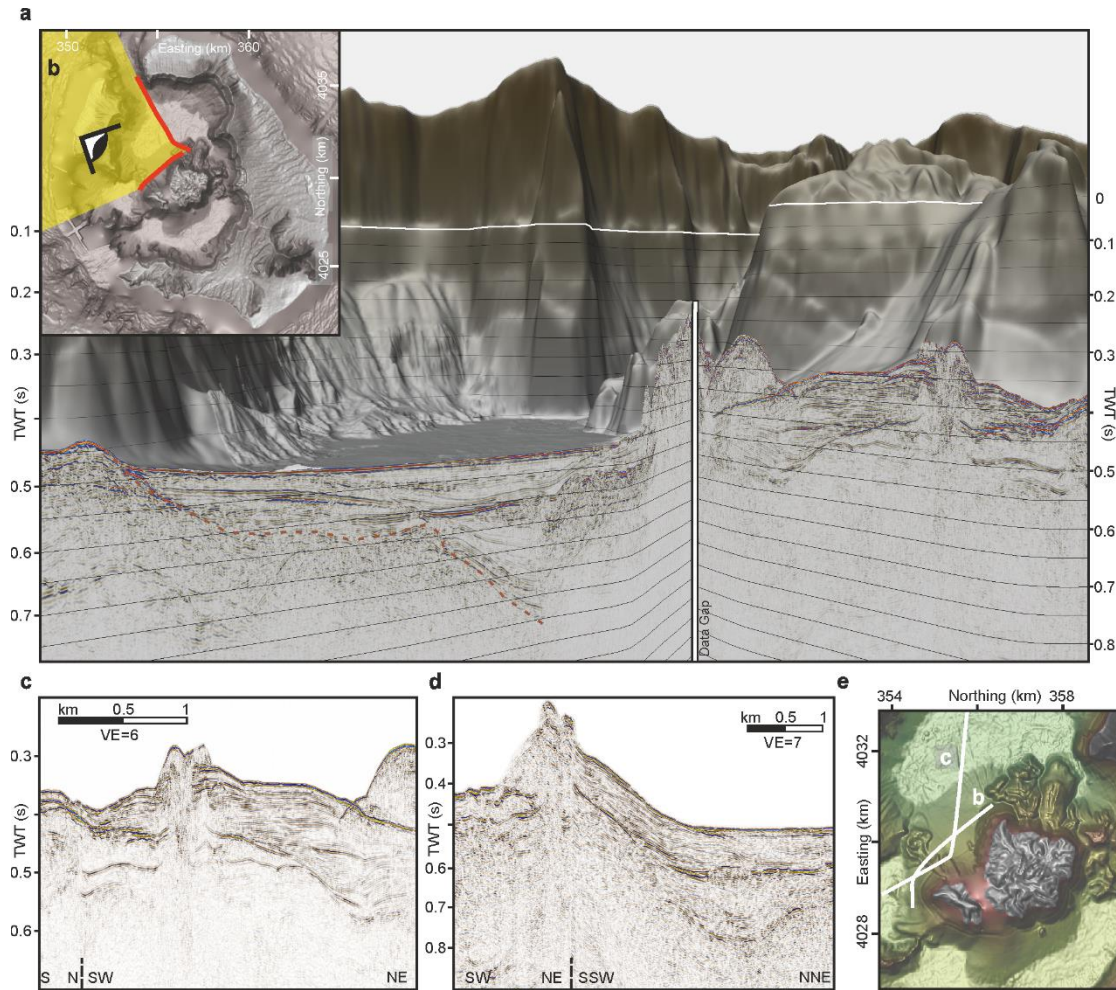
Supplementary Figure S1: Un-interpreted maps of the Morphology of Santorini Caldera and Kameni Volcano. (a) Morphological map of Santorini Caldera. **(b)** Zoom of the map shown in (a) highlighting the morphology of the Kameni Volcano.



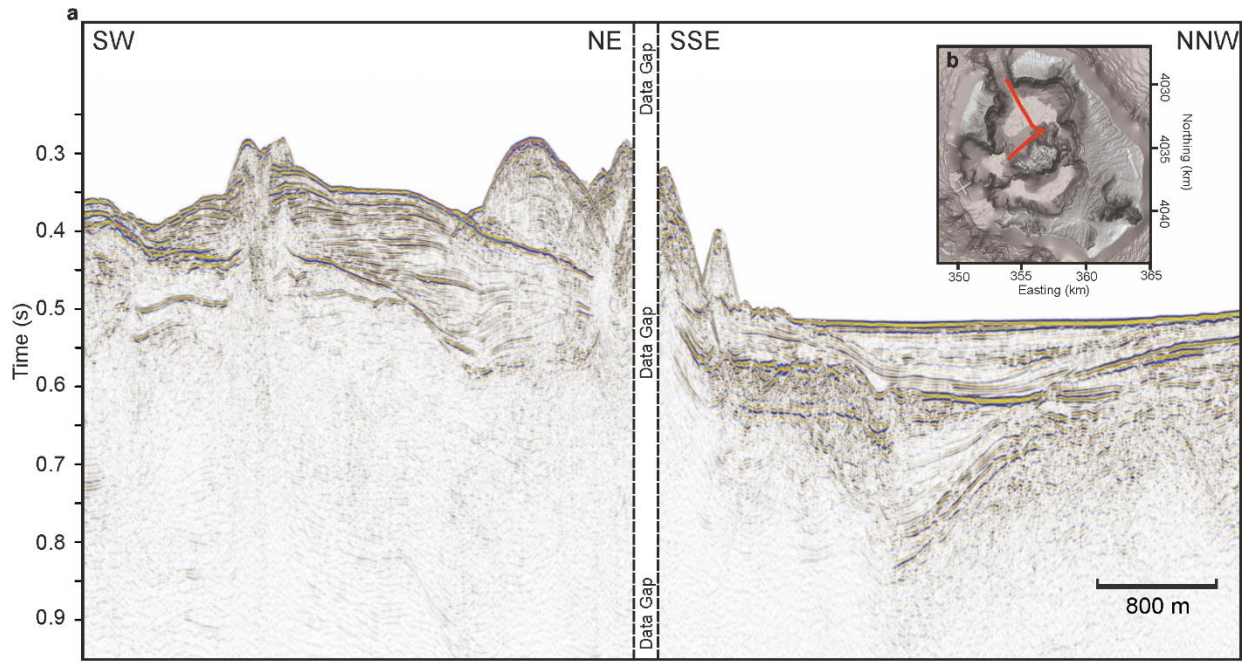
Supplementary Figure S2: Un-interpreted versions of the seismic images crossing Santorini Caldera. Un-interpreted versions of the seismic images shown in Figure 3c-e. **(a)** Seismic profile crossing the Santorini Caldera from the western breach across the southern and northern basins towards the northern breach. VE = Vertical Exaggeration. TWT = Two-way travel time. **(b)** Enlargement of the seismic image of the southern basin and **(c)** the northern basin.



Supplementary Figure S3: Interpolated Maps of Units S2 and S3 and the Interpreted 197 BCE Lava Flow. (a) Interpolation of Unit S2 (b) and S3 through Kameni edifice for estimating maximum volumes. Star marks the potential vent location of the 726 CE eruption. (c) Thickness map of the interpreted lava flow at the boundary between Unit S2 and S3. (d) All seismic profiles used for mapping.



Supplementary Figure S4: Un-interpreted 3D view of Santorini Caldera and Kameni Volcano. Un-interpreted versions of the seismic images shown in Figure 5b-d. **(a)** Two crossing seismic lines combined with a cutout of the topographic model of the Santorini Caldera and the Kameni edifice from a vantage point at Therasia (NW Santorini). **(b)** Map highlighting the viewpoint of (a). **(c)** Seismic profile crossing the northern flank of Palea Kameni and Nea Kameni. **(d)** Seismic profile crossing the northern flank of Palea Kameni. **(e)** Map of the Kameni edifice with the location of seismic lines shown in (c) and (d).



Supplementary Figure S5: 2D representation of the two profiles used to create the 3D view. (a) Un-interpreted and two-dimensional version of the seismic profiles used to create Figures 5 and S4. **(b)** Map showing the location of both profiles.

Supplementary Table 1. P-wave velocity (v_p) measurements for seismic Units S1-3 with the corresponding number of samples. Standard error is given by the values in parentheses.

Unit	V_p (m/s)	Number of samples
S1	1635 (7)	389
S2	1854 (10)	345
S3	1810 (29)	160

Supplementary Table 2. Results of moisture and density measurements with standard errors given in parentheses. MGD: Mean grain density.

Unit	DRE Factor	Bulk Density (kg/m^3)	Porosity (%)	MGD (kg/m^3)	Number of Samples
S1	0.314 (0.008)	1484 (16)	64.9 (0.8)	2340	36
S2	0.265 (0.010)	1365 (18)	63.7 (1.3)	1940	31
S3	0.492 (0.035)	1839 (63)	48.0 (3.2)	2540	18

Supplementary Table 3: Chemical compositions of marine tephras including the raw data for major elements from gravity core POS513/15 from cruise POS513^{1,2}.

Sample ID	Na2O	K2O	FeO	SiO2	TiO2	MgO	CaO	MnO	Al2O3	P2O5	Total
POS513/15_9-11-3°	5.01	2.31	3.32	68.56	0.58	0.73	2.70	0.15	15.02	0.15	98.53
POS513/15_9-11-4°	4.77	2.23	3.81	68.63	0.63	0.76	2.62	0.25	14.80	0.11	98.61
POS513/15_9-11-5°	5.05	2.38	3.55	69.64	0.62	0.77	2.70	0.08	14.83	0.13	99.75
POS513/15_9-11-6	5.11	2.24	3.77	69.39	0.63	0.75	2.66	0.18	14.88	0.12	99.74
POS513/15_9-11-7	4.98	2.25	3.82	69.18	0.61	0.76	2.72	0.20	14.99	0.15	99.65
POS513/15_9-11-8	4.93	2.24	3.80	68.42	0.59	0.76	2.72	0.14	14.96	0.13	98.68
POS513/15_9-11-9	5.12	2.27	3.55	68.42	0.61	0.76	2.75	0.12	15.19	0.11	98.91
POS513/15_9-11-10	4.92	2.28	3.79	69.44	0.63	0.78	2.66	0.18	14.91	0.11	99.70
POS513/15_9-11-12	4.82	2.24	3.60	69.32	0.60	0.69	2.72	0.21	15.14	0.13	99.47
POS513/15_9-11-13	5.07	2.23	4.12	67.42	0.58	1.11	2.97	0.17	14.53	0.12	98.31
POS513/15_9-11-14	5.14	2.21	4.06	67.65	0.62	0.76	2.71	0.13	14.91	0.14	98.32
POS513/15_9-11_average	4.99	2.26	3.74	68.73	0.61	0.78	2.72	0.16	14.92	0.13	99.06
<i>POS513/15_9-11_stddev</i>	<i>0.12</i>	<i>0.05</i>	<i>0.23</i>	<i>0.74</i>	<i>0.02</i>	<i>0.11</i>	<i>0.09</i>	<i>0.05</i>	<i>0.18</i>	<i>0.01</i>	<i>0.60</i>
Measurements in Clermont*, Taipeh*											

Supplementary Table 4: Chemical compositions of marine tephras including the raw data for major elements from core U1595A_4H from IODP Expedition 398.

Sample ID	Na2O	K2O	FeO	SiO2	TiO2	MgO	CaO	MnO	Al2O3	P2O5	Total
U1595A_4H-4_37-47_2*	5.50	2.24	3.91	68.28	0.58	0.74	2.88	0.16	14.95	0.10	99.33
U1595A_4H-4_37-47_3*	5.68	2.27	4.18	68.92	0.60	0.72	2.70	0.13	15.22	0.09	100.51
U1595A_4H-4_37-47_12	5.32	2.29	3.94	69.18	0.65	0.70	2.69	0.16	15.07	0.11	100.10
U1595A_4H-4_37-47_13	5.47	2.21	3.87	68.47	0.57	0.63	2.82	0.18	14.83	0.09	99.14
U1595A_4H-4_37-47_14	5.39	2.20	4.15	68.34	0.63	0.71	2.79	0.10	14.94	0.11	99.36
U1595A_4H-4_37-47_15	5.53	2.30	4.11	68.25	0.62	0.67	2.60	0.11	15.12	0.16	99.47
U1595A_4H-4_37-47_17	5.37	2.24	4.00	68.41	0.62	0.73	2.77	0.21	15.00	0.15	99.50
U1595A_4H-4_37-47_19	5.41	2.26	3.79	68.06	0.59	0.73	2.65	0.17	14.86	0.14	98.66
U1595A_4H-4_37-47_20	5.48	2.22	3.75	67.51	0.63	0.75	2.56	0.15	14.87	0.10	98.01
U1595A_4H-4_37-47_21	5.41	2.25	3.56	68.44	0.56	0.70	2.65	0.16	15.06	0.14	98.94
U1595A_4H-4_37-47_22	5.09	2.28	3.90	68.18	0.66	0.73	2.65	0.11	15.10	0.16	98.87
U1595A_4H-4_37-47_23	5.36	2.26	3.87	69.09	0.64	0.66	2.71	0.16	14.84	0.13	99.73
U1595A_4H-4_37-47_24	5.27	2.28	4.07	66.49	0.58	0.63	2.61	0.16	15.33	0.17	97.59
U1595A_4H-4_37-47_L1°	5.37	2.24	4.00	68.41	0.62	0.73	2.77	0.21	15.00	0.15	99.50
U1595A_4H-4_37-47_L2°	5.41	2.26	3.79	68.06	0.59	0.73	2.65	0.17	14.86	0.14	98.66
U1595A_4H-4_37-47_L3°	5.48	2.22	3.75	67.51	0.63	0.75	2.56	0.15	14.87	0.10	98.01
U1595A_4H-4_37-47_L4	5.41	2.25	3.56	68.44	0.56	0.70	2.65	0.16	15.06	0.14	98.94
U1595A_4H-4_37-47_L7	5.09	2.28	3.90	68.18	0.66	0.73	2.65	0.11	15.10	0.16	98.87
U1595A_4H-4_37-47_L8	5.36	2.26	3.87	69.09	0.64	0.66	2.71	0.16	14.84	0.13	99.73
U1595A_4H-4_37-47_L9	5.27	2.28	4.07	66.49	0.58	0.63	2.61	0.16	15.33	0.17	97.59
U1595A_4H-4_37-47_average	5.38	2.25	3.90	68.19	0.61	0.70	2.68	0.15	15.01	0.13	99.03
<i>U1595A_4H-4_37-47_std</i>	<i>0.14</i>	<i>0.03</i>	<i>0.17</i>	<i>0.73</i>	<i>0.03</i>	<i>0.04</i>	<i>0.09</i>	<i>0.03</i>	<i>0.16</i>	<i>0.03</i>	<i>0.78</i>
Measurements in Clermont*, Taipei°											

Supplementary Table 5: Chemical compositions of marine tephras including the raw data for major elements from core U1595A_5H from IODP Expedition 398.

Sample ID	Na2O	K2O	FeO	SiO2	TiO2	MgO	CaO	MnO	Al2O3	P2O5	Total
U1595A_5H-3_90-100_5	5.33	2.25	3.98	67.87	0.61	0.77	2.65	0.23	15.23	0.13	99.04
U1595A_5H-3_90-100_8	5.08	2.31	4.60	68.32	0.63	0.75	2.76	0.11	15.48	0.12	100.17
U1595A_5H-3_90-100_18	5.16	2.27	3.69	68.03	0.59	0.70	2.54	0.16	14.91	0.11	98.16
U1595A_5H-3_90-100_20	5.46	2.23	3.82	68.21	0.60	0.75	2.79	0.22	15.35	0.08	99.51
U1595A_5H-3_90-100_23	5.35	2.22	3.96	64.93	0.60	0.69	2.71	0.25	14.88	0.12	95.71
U1595A_5H-3_90-100_25	5.32	2.25	3.39	68.02	0.65	0.69	2.83	0.21	15.26	0.16	98.78
U1595A_5H-3_90-100_L1°	5.16	2.27	3.69	68.03	0.59	0.70	2.54	0.16	14.91	0.11	98.16
U1595A_5H-3_90-100_L2°	5.46	2.23	3.82	68.21	0.60	0.75	2.79	0.22	15.35	0.08	99.51
U1595A_5H-3_90-100_L3°	5.35	2.22	3.96	64.93	0.60	0.69	2.71	0.25	14.88	0.12	95.71
U1595A_5H-3_90-100_L4	5.32	2.25	3.39	68.02	0.65	0.69	2.83	0.21	15.26	0.16	98.78
U1595A_5H-3_90-100_L5°	5.32	2.25	3.39	68.02	0.65	0.69	2.83	0.21	15.26	0.16	98.78
U1595A_5H-3_90-100_average	5.30	2.25	3.79	67.51	0.62	0.72	2.73	0.20	15.16	0.12	98.39
<i>U1595A_5H-3_90-100_std</i>	<i>0.12</i>	<i>0.03</i>	<i>0.35</i>	<i>1.28</i>	<i>0.02</i>	<i>0.03</i>	<i>0.11</i>	<i>0.04</i>	<i>0.22</i>	<i>0.03</i>	<i>1.45</i>
Measurements in Clermont*, Taipei°											

Supplementary Table 6: Chemical compositions of marine tephras including the trace element data of individual glass shard measurements.

Sample ID	Rb85	Sr88	Y89	Zr90	Nb93	Cs133	Ba137	La139	Ce140	Pr141	Nd146	Sm147	Eu153	Gd157	Tb159	Dy163	Ho165	Er166	Tm169	Yb172	Lu175	Hf178	Ta181	Pb208	Th232	U238	
POSS13/15_9-11-3°	79.28	122.31	43.36	236.45	9.73	2.31	433.00	24.65	53.84	6.36	22.89	6.22	1.48	6.79	1.02	6.88	1.60	4.54	0.67	4.67	0.80	5.97	0.67	14.51	13.06	4.64	
POSS13/15_9-11-4°	79.98	124.03	44.05	241.54	8.85	2.25	441.90	25.10	50.56	6.18	23.66	5.60	1.42	6.39	1.18	7.37	1.54	4.71	0.79	5.45	0.70	6.41	0.64	13.96	13.62	4.52	
POSS13/15_9-11-5°	73.41	120.14	38.01	207.64	8.21	2.11	375.99	21.79	46.30	5.27	21.44	4.86	1.12	6.08	0.86	6.44	1.44	4.29	0.49	4.55	0.77	5.77	0.53	12.90	12.27	3.74	
POSS13/15_9-11_average	77.56	122.16	41.81	228.54	8.93	2.22	416.96	23.85	50.23	5.94	22.66	5.56	1.34	6.42	1.02	6.90	1.53	4.51	0.65	4.89	0.76	6.05	0.61	13.79	12.98	4.30	
<i>POSS13/15_9-11_stddev</i>	3.61	1.95	3.31	18.28	0.76	0.10	35.76	1.80	3.78	0.58	1.13	0.68	0.19	0.36	0.16	0.47	0.08	0.21	0.15	0.49	0.05	0.33	0.07	0.82	0.68	0.49	
U1595A_4H-4_37-47_2*	81.83	128.61	44.99	244.71	9.36	2.344	458.25	26.5	54.41	6.1	25.56	6.24	1.498	6.62	1.075	7.71	1.73	5.11	0.779	5.29	0.82	6.14	0.744	15.2	14.51	4.58	
U1595A_4H-4_37-47_3*	73.96	120.33	44.28	238.19	8.81	2.12	438.12	25.46	52.21	5.95	24.43	5.89	1.391	6.44	1.03	7.35	1.645	5.05	0.753	5.22	0.801	6.08	0.657	13.58	13.87	4.26	
U1595A_4H-4_37-47_L1*	75.72	134.81	47.97	258.99	8.66	2.5	434.55	27.2	53.02	6.21	27.1	7.57	1.35	7.31	1.19	9.04	2	5.73	0.864	6.68	0.834	7.34	0.572	17.57	15.5	4.53	
U1595A_4H-4_37-47_L2*	77.32	128.29	47.8	259.83	8.8	2.29	449.29	28.78	51.7	5.59	28.3	6.9	1.08	8.29	1.47	7.11	1.69	4.13	0.57	6.86	0.85	8	0.54	14.36	15.89	4.42	
U1595A_4H-4_37-47_L3*	90.72	127.31	48.26	263.05	10.17	2.69	455.69	27.35	54.42	6.42	26.21	7.14	1.55	7.27	1.156	7.9	1.95	4.96	0.853	5.25	0.99	7.32	0.735	20.06	15.24	5.07	
U1595A_4H-4_37-47_average	79.91	127.87	46.66	252.954	9.16	2.3888	447.18	27.058	53.152	6.054	26.32	6.748	1.3738	7.186	1.1842	7.822	1.803	4.996	0.7638	5.86	0.859	6.976	0.6496	16.154	15.002	4.572	
<i>U1595A_4H-4_37-47_std</i>	6.71	5.15	1.87	10.86	0.62	0.22	10.50	1.22	1.25	0.31	1.47	0.68	0.18	0.73	0.17	0.75	0.16	0.57	0.12	0.83	0.08	0.84	0.09	2.65	0.81	0.30	
U1595A_5H-3_90-100_L1°	76.69	120.73	46.26	254.7	8.6	2.4	424.83	26.58	50.07	6.58	24.63	5.53	1.53	6.82	1.01	7.87	1.65	5.26	0.825	5.04	0.838	7.24	0.585	13.47	15.16	4.34	
U1595A_5H-3_90-100_L2°	76.37	120.33	47.35	255.42	9.39	2.23	411.42	26.58	50.74	6.21	26.92	7.31	1.8	6.6	1.3	7.03	1.73	4.7	0.76	5.64	0.682	7.01	0.709	14.57	14.59	3.96	
U1595A_5H-3_90-100_L3°	73.94	119.37	46.37	248.54	8.91	2.38	424.86	26.32	52.11	6.11	25.8	4.99	1.55	7.17	1.11	8.65	1.6	4.87	0.859	5.66	0.822	7.29	0.702	14.15	14.09	4.27	
U1595A_5H-3_90-100_L5°	80.86	130.06	52.05	278.32	9.42	1.98	465.21	29.48	56.43	6.88	27.91	6.6	1.38	7.36	1.37	8.6	1.88	5.02	0.727	5.72	1	7.2	0.633	14.65	16.58	4.18	
U1595A_5H-3_90-100_average	76.97	122.62	48.01	259.25	9.08	2.25	431.58	27.24	52.34	6.45	26.32	6.11	1.57	6.99	1.20	8.04	1.72	4.96	0.79	5.52	0.84	7.19	0.66	14.21	15.11	4.19	
<i>U1595A_5H-3_90-100_std</i>	2.87	4.99	2.74	13.09	0.40	0.19	23.30	1.50	2.86	0.35	1.42	1.04	0.17	0.34	0.17	0.76	0.12	0.24	0.06	0.32	0.13	0.12	0.06	0.54	1.08	0.17	
Measurements in Clermont*, Taipei°																											

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