Giant offshore pumice deposit records a shallow submarine explosive eruption of ancestral Santorini

Supplementary Information

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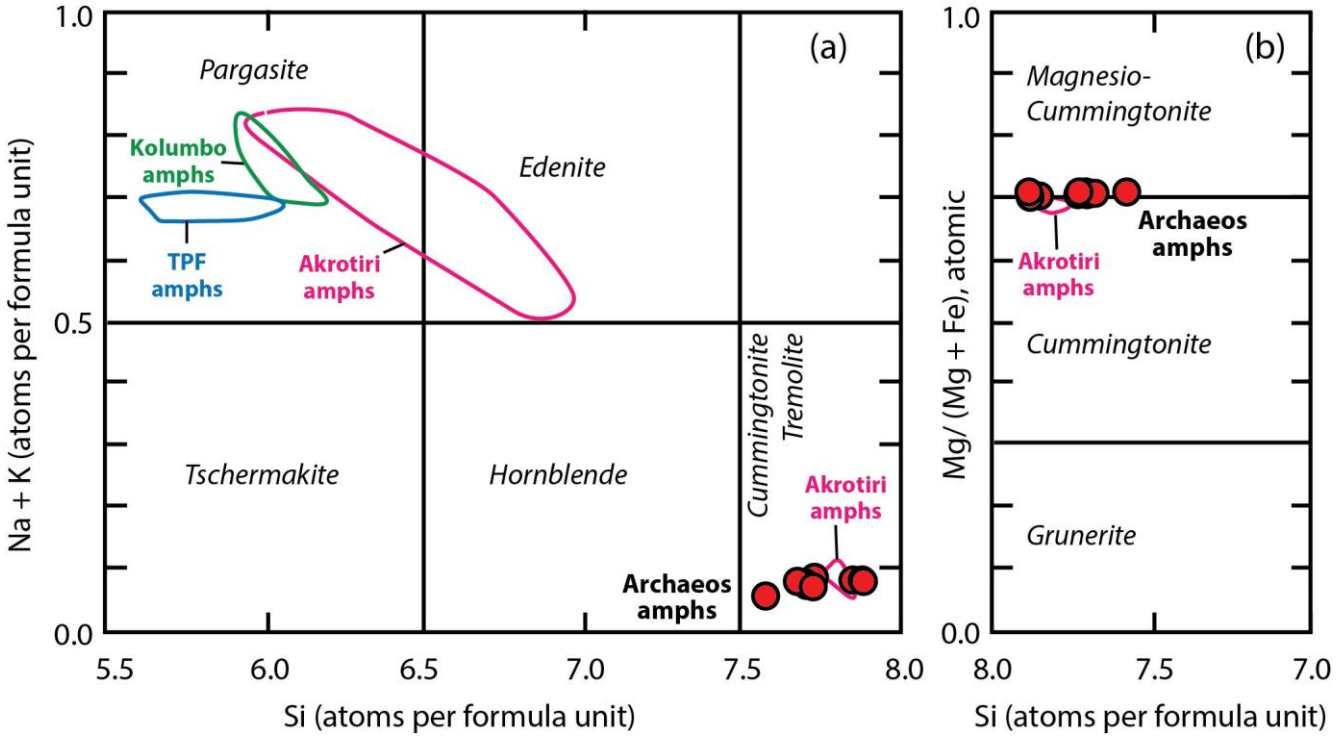
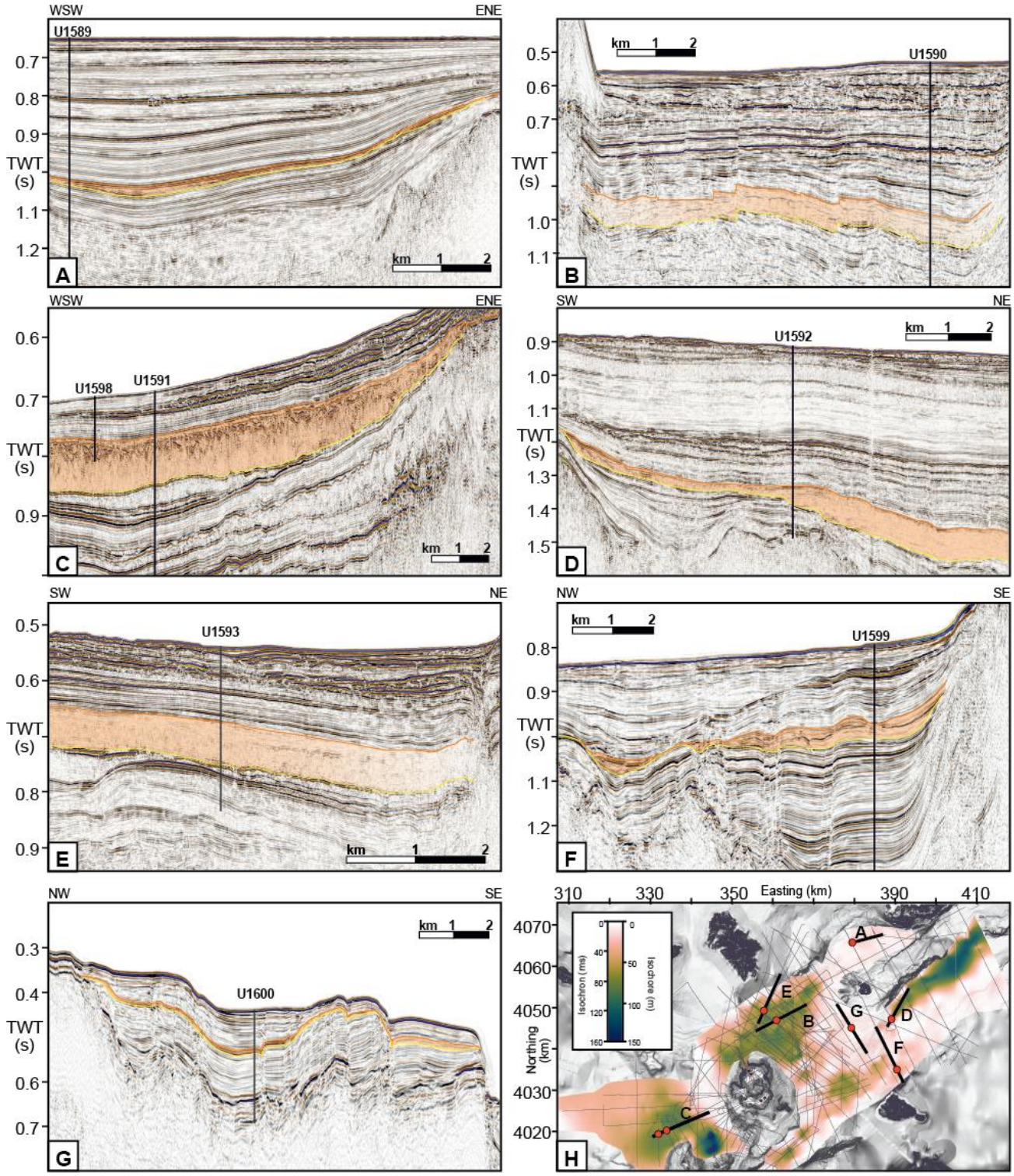
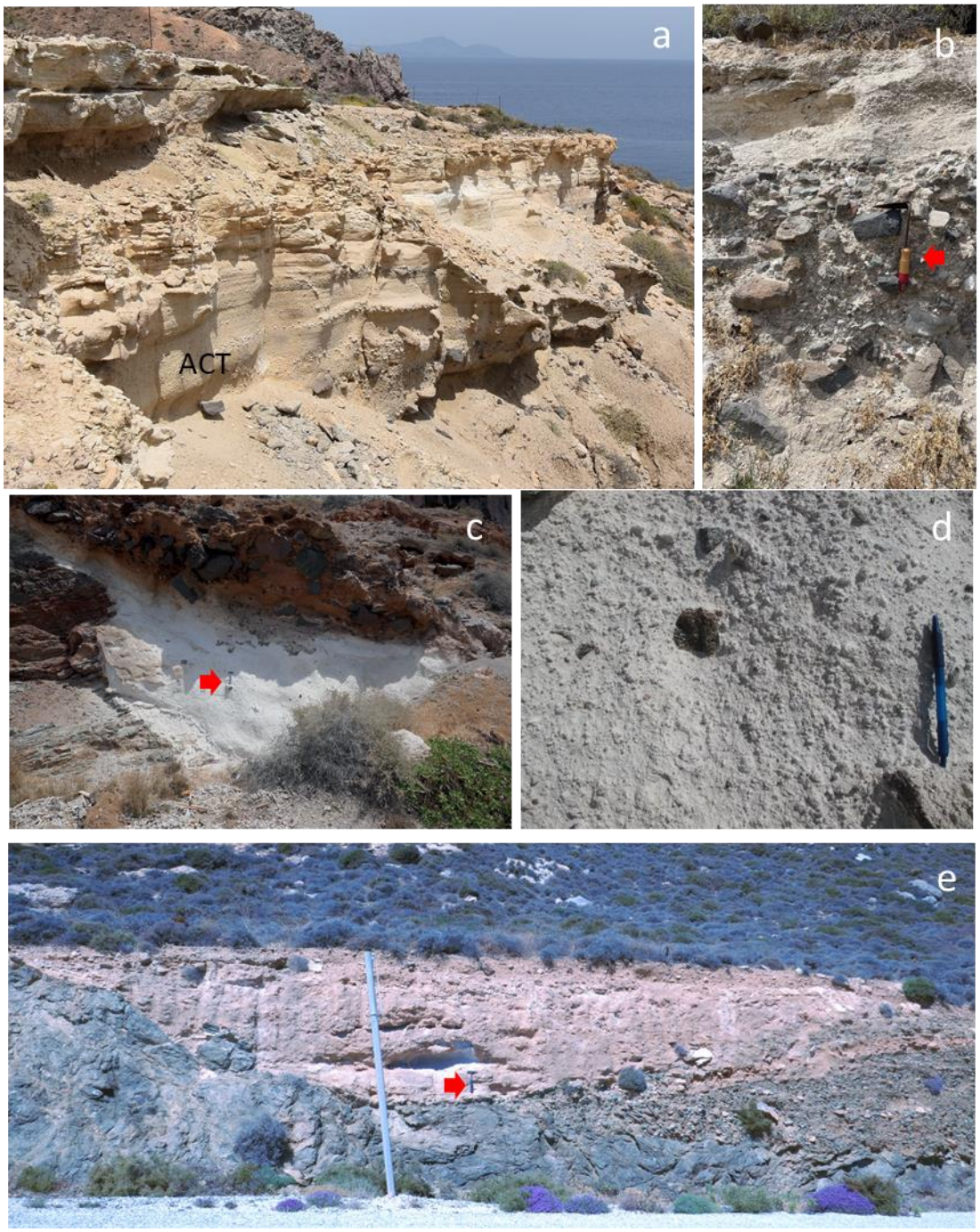
Supplementary figures and tables



Supplementary Figure 1. Amphiboles in the Archaeos Tuff. (a) Compositions of amphiboles (amph) from the Archaeos Tuff, and distinction from those of the Early Centres of Akrotiri[1,2], the Thera Pyroclastic Formation (TPF) of Santorini[3], and the 1650 CE eruption of Kolumbo[4]. Cummingtonite similar compositionally to that of the Archaeos Tuff occurs in some tuffs of the Akrotiri centres. Note that the Akrotiri tuffs contain coexisting calcic amphiboles and cummingtonite. (b) Classification of the Archaeos amphiboles as cummingtonite to magnesio-cummingtonite, with comparison with those from the Akrotiri centres.



Supplementary Figure 2. Compilation of seismic profiles showing the Archaeos Tuff in orange. Based on published seismic profiles[5]. Note that the unit was not recovered at Site U1590, but its presence is inferred based on the seismic stratigraphy and biostratigraphic age-depth data.



Supplementary Figure 3. Onland outcrops of the Archaeos Tuff. (a) Christiani Island (36°14.74' N / 25°12.53' E). The Archaeos Tuff (marked ACT) is 4 m thick and is overlain by other minor pumice and ash layers. Santorini lies in the distance. (b) A lithic breccia lens within the Archaeos Tuff on Christiani Island, with scraper for scale (red arrow). (c) The Archaeos Tuff on Santorini. The outcrop occurs near sea level at the base of the caldera wall (36°22.34’ N / 25°25.38’ E). The tuff directly overlies basement schists and is in turn overlain by a blocky regolith. The outcrop stratigraphically underlies the entire Thera Pyroclastic Formation of Santorini. Hammer for scale (red arrow). (d) Close-up of the outcrop in Figure c, showing the relatively fine grained and poorly sorted nature of the ignimbrite. (e) Outcrop of the Archaeos Tuff on Anafi Island, where it forms a thin lens directly atop basement schists (36°21.39’ N / 25°48.26’E). Hammer for scale (red arrow). The vertical grey line is a metal pole.

Supplementary Table 1: Description of the submarine facies of the Archaeos Tuff

Thickness	In the cores: thickest (75 m) at Site U1593 and thinnest (6 m) at Site U1600. On seismic images: up to 150 m thick between Santorini and Christiana and in the Anafi Basin.
Grain size	At Sites U1591 and U1598, it is composed of well sorted, clast-supported lapilli tuff poor in fine ash, with pumice lapilli to several cm in diameter. At Site U1589, the deposit is mostly of ash grade.
Texture	Massive to diffusely bedded lapilli-tuff and tuff (terminology of ref 6), with a top that grades up into overlying muds and oozes. Bedding within the deposit reflects variations in grain size and component proportions. Normally graded intervals in some cores may be attributable to sorting within submarine gravity flows, or may be artifacts due to ash liquefaction during drilling and core recovery. Ash liquefaction and other disturbance effects during core recovery (ref 7) overprinted finer-scale sedimentary structures and caused artificial grading within core sections, resulting in loss of sedimentological information.
Consolidation	Totally unconsolidated. The terms lapilli tuff and tuff are used even though the deposit is unconsolidated.
Components	Pumice lapilli, glass shards, lithic fragments and free crystals, with bioclasts picked up from the sea floor
Pumice	The pumice lapilli are highly vesicular and are mostly white, although a subordinate grey variety and white/grey banded varieties are also present. Vesicles in the pumces range from spherical to tubular or fibrous. The pumice lapilli range from angular to rounded.
Lithics	Lithic clasts are systematically smaller than pumice clasts, and occur scattered uniformly throughout the deposit or concentrated in clast-supported lithic-rich layers. Lithic components are mainly lavas, but greenschists, limestone and microgranitoids also occur.

Supplementary Table 2. Grain size analyses of offshore and onshore facies of the Archaeos Tuff

Drill site		**Core U1599A**	**Core U1599A**	**Core U1599A**	**Core U1591B**	**Core U1591B**	**Core U1599A**	**Core U1593A**	**Core U1593A**	**Core U1598A**	**Core U1593A**	**Core U1593B**
Core and section		**27F 2**	**29F 3**	**29F 2**	**10F 1**	**10F 1**	**28F 3**	**16H 2**	**18F 2**	**09F 2**	**17F 2**	**27F 2**
Depth in section (cm)		**46-53**	**55-63**	**26-33**	**89-100**	**128-138**	**63-70**	**95-100**	**35-40**	**97-106**	**30-35**	**82-92**
64 to 32 mm	-5 phi											
32 to 16 mm	-4 phi											
16 to 8 mm	-3 phi	6.96	6.29	10.34	11.78	7.15	5.38	10.08	2.48	13.12	5.47	0.08
8 to 4 mm	-2 phi	20.45	5.82	21.00	16.54	15.99	6.10	30.59	14.54	28.22	13.12	2.20
4 to 2 mm	-1 phi	27.00	11.68	24.97	18.07	30.24	10.48	29.22	22.21	26.98	21.31	7.98
2 to 1 mm	0 phi	14.56	14.17	17.71	17.47	20.64	13.87	13.46	18.54	14.85	25.41	21.01
1 mm to 500 µm	1 phi	7.57	15.56	14.26	16.30	13.70	15.49	8.09	16.84	9.53	21.84	23.53
500 to 250 µm	2 phi	7.55	17.15	8.37	11.92	7.71	20.27	4.94	13.44	5.69	6.75	24.92
250 to 125 µm	3 phi	7.11	13.82	2.34	5.35	2.50	17.91	2.48	7.31	1.24	3.36	19.54
125 to 63 µm	4 phi	4.47	7.78	0.72	1.37	1.14	6.63	0.74	3.26	0.25	1.36	0.65
<63 µm	>4 phi	4.32	7.72	0.30	1.21	0.94	3.86	0.41	1.38	0.12	1.39	0.08
Inman median (phi units)8		-1.20	0.80	-1.30	-0.80	-1.10	0.90	-1.70	-0.45	-1.70	-0.60	0.80
Inman sorting (phi units)8		2.28	2.30	1.70	2.03	1.55	2.08	1.45	1.88	1.50	1.50	1.44
Wt % < 1 mm		31.03	62.03	25.99	36.14	25.98	64.17	16.66	42.22	16.83	34.69	68.73
Wt % < 63 µm		4.32	7.72	0.30	1.21	0.94	3.86	0.41	1.38	0.12	1.39	0.08
Wt % 16-8 mm lithics		0	0	0	19	0	0	0	0	0	0	
Wt % 8-4 mm lithics		0	0	0	15	2	0	0	0	0	0	0
Wt % 4-2 mm lithics		0	0	0	0	1	0	0	2	0	8	0

Drill site		**Core U1593B**	**Core U1591B**	**Core U1593A**	**Core U1600A**	**Core U1589B**	**Core U1598B**	**Core U1593A**	**Core U1589B**	**Core U1589B**	**Onland Santorini**	**Onland Anafi**
Core and section		**10F 2**	**17F 1**	**14H 2**	**06F 1**	**60F 1**	**03F 1**	**20F 2**	**59F 1**	**60F 1**		
Depth in section (cm)		**55-65**	**90-100**	**50-55**	**20-30**	**15-25**	**91-101**	**55-65**	**70-80**	**5-10**		
64 to 32 mm	-5 phi										2.61	4.24
32 to 16 mm	-4 phi										9.33	6.50
16 to 8 mm	-3 phi	9.45	0.12	0.04	0.10	5.84	0.13	0.10	0.02	0.04	13.81	12.71
8 to 4 mm	-2 phi	36.44	20.98	6.54	0.10	19.25	4.50	18.03	7.33	0.04	14.93	14.41
4 to 2 mm	-1 phi	23.62	13.35	6.18	4.33	16.71	15.63	18.95	10.57	2.40	8.17	7.06
2 to 1 mm	0 phi	12.01	12.16	4.49	9.38	9.57	17.62	16.11	6.93	5.61	6.87	7.03
1 mm to 500 µm	1 phi	10.26	7.87	2.87	23.51	8.67	24.24	15.60	4.30	9.02	5.67	7.77
500 to 250 µm	2 phi	5.80	18.00	3.34	23.20	8.08	22.78	15.81	5.34	21.16	5.63	8.99
250 to 125 µm	3 phi	2.43	26.34	17.06	34.43	15.37	13.11	10.23	17.94	27.91	7.21	10.88
125 to 63 µm	4 phi	0.00	1.19	43.00	3.51	11.84	1.85	3.34	27.20	13.70	8.30	2.03
<63 µm	>4 phi	0.00	0.00	16.49	1.44	4.67	0.13	1.82	20.39	20.11	17.47	18.37
Inman median (phi units)8		-1.86	0.48	3.26	1.46	-0.17	0.50	-0.20	2.90	2.30	-0.85	-0.30
Inman sorting (phi units)8		1.53	2.34	2.15	1.38	2.77	1.60	2.05	2.65	1.85	3.89	4.17
Wt % < 1 mm		18.49	53.40	82.76	86.08	48.63	62.12	46.81	75.15	91.91	44.28	48.05
Wt % < 63 µm		0.00	0.00	16.49	1.44	4.67	0.13	1.82	20.39	20.11	17.47	18.37
Wt % 16-8 mm lithics		0	0	0	0	0	0	0	0	0		
Wt % 8-4 mm lithics		0	0	0	0	0	0	0	0	0		
Wt % 4-2 mm lithics		9	0	0	0	0	0	0	0	0		

Supplementary Table 3. Pumice vesicularities

Sample	% Total	% Connected	% Isolated
398 U1599A 28F 1 W 100/140 a	75.3	65.6	9.7
398 U1599A 28F 1 W 100/140 b	75.3	64.3	11.0
398 U1599A 28F 1 W 100/140 c	67.9	49.5	18.4
398 U1599A 27F CC 10/15 a	80.1	72.0	8.1
398 U1599A 27F CC 10/15 b	80.5	71.1	9.3
398 U1599A 27F CC 10/15 c	83.5	74.9	8.7
398 U1599A 29F 3 W 20/75 a	68.5	55.5	13.0
398 U1599A 29F 3 W 20/75 b	73.2	63.4	9.9
398 U1599A 29F 3 W 20/75 c	77.6	68.4	9.3
398 U1591B 10F 2 W 97/104 a	72.4	57.9	14.5
398 U1591B 10F 2 W 97/104 b	78.7	62.7	16.0
398 U1591B 10F 2 W 97/104 c	75.9	64.7	11.2
398 U1599A 25F CC 14/18 a	73.7	60.4	13.2
398 U1599A 25F CC 14/18 b	77.1	63.1	14.1
398 U1599A 25F CC 14/18 c	78.4	64.5	13.9
398 U1599A 26F 1 W 50/90 a	81.7	75.0	6.7
398 U1599A 26F 1 W 50/90 b	69.8	48.2	21.6
398 U1599A 26F 1 W 50/90 c	75.9	61.0	14.9
Mean	75.9	63.5	12.4
1 Standard deviation	4.4	7.5	3.8

Supplementary Table 4. Representative glass analyses

	Christiani	Santorini	Anafi	U1589	U1591	U1592	U1593	U1598	U1599	U1600
Levels	3	3	1	3	4	2	4	8	15	2
Analyses	21	20	13	43	62	28	54	122	223	23
	Mean *(±1SD)*	Mean *(±1SD)*	Mean *(±1SD)*	Mean *(±1SD)*	Mean *(±1SD)*	Mean *(±1SD)*	Mean *(±1SD)*	Mean *(±1SD)*	Mean *(±1SD)*	Mean *(±1SD)*
Na_2O	4.1 *(0.2)**	3.0 *(0.3)*	4.2 *(0.3)*	4.1 *(0.2)*	4.1 *(0.2)*	4.2 *(0.2)*	4.1 *(0.2)*	4.1 *(0.2)*	4.1 *(0.2)*	4.1 *(0.4)*
K_2O	3.4 *(0.2)*	4.9 *(0.2)*	3.5 *(0.3)*	3.5 *(0.2)*	3.5 *(0.2)*	3.4 *(0.2)*	3.3 *(0.1)*	3.4 *(0.2)*	3.4 *(0.2)*	3.6 *(0.5)*
FeO	0.7 *(0.1)*	0.7 *(0.1)*	0.7 *(0.1)*	0.7 *(0.1)*	0.7 *(0.1)*	0.7 *(0.1)*	0.8 *(0.1)*	0.7 *(0.09)*	0.8 *(0.1)*	0.7 *(0.08)*
SiO_2	78.3 *(0.3)*	78.0 *(0.2)*	77.8 *(0.3)*	78.1 *(0.2)*	78.0 *(0.3)*	78.0 *(0.3)*	78.1 *(0.3)*	78.1 *(0.2)*	77.9 *(0.3)*	78.0 *(0.3)*
TiO_2	0.1 *(0.02)*	0.1 *(0.02)*	0.1 *(0.03)*	0.1 *(0.03)*	0.1 *(0.02)*	0.1 *(0.03)*	0.1 *(0.03)*	0.1 *(0.03)*	0.1 *(0.02)*	0.1 *(0.02)*
MgO	0.1 *(0.03)*	0.1 *(0.03)*	0.1 *(0.02)*	0.1 *(0.02)*	0.1 *(0.03)*	0.1 *(0.03)*	0.1 *(0.03)*	0.1 *(0.03)*	0.1 *(0.03)*	0.1 *(0.03)*
CaO	0.7 *(0.03)*	0.7 *(0.02)*	0.7 *(0.07)*	0.7 *(0.04)*	0.7 *(0.02)*	0.7 *(0.06)*	0.7 *(0.06)*	0.7 *(0.02)*	0.7 *(0.07)*	0.7 *(0.03)*
MnO	0.1 *(0.03)*	0.1 *(0.04)*	0.1 *(0.04)*	0.1 *(0.04)*	0.1 *(0.04)*	0.1 *(0.04)*	0.1 *(0.04)*	0.1 *(0.05)*	0.1 *(0.04)*	0.1 *(0.04)*
Al_2O_3	12.4 *(0.2)*	12.4 *(0.1)*	12.8 *(0.1)*	12.6 *(0.1)*	12.6 *(0.1)*	12.6 *(0.2)*	12.6 *(0.1)*	12.6 *(0.1)*	12.7 *(0.2)*	12.6 *(0.1)*
P_2O_5	0.04 *(0.02)*	0.02 *(0.03)*	0.02 *(0.02)*	0.02 *(0.02)*	0.02 *(0.02)*	0.03 *(0.02)*	0.02 *(0.02)*	0.02 *(0.02)*	0.02 *(0.02)*	0.02 *(0.03)*
Analyses	21	20	7	14	20	11	26	43	81	12
Rb	108.2 *(11.0)*	118.5 *(22.8)*	92.4 *(3.5)*	94.7 *(6.6)*	92.1 *(2.0)*	94.2 *(6.5)*	92.4 *(5.1)*	94.9 *(2.6)*	92.4 *(4.5)*	98.5 *(5.1)*
Sr	40.7 *(3.3)*	38.4 *(3.5)*	38.3 *(0.9)*	40.3 *(2.7)*	37.8 *(1.0)*	43.1 *(5.2)*	38.1 *(1.8)*	39.4 *(1.4)*	41.4 *(3.9)*	40.7 *(2.9)*
Y	17.7 *(1.3)*	16.4 *(0.9)*	16.5 *(0.5)*	16.7 *(1.2)*	16.5 *(0.4)*	17.0 *(0.7)*	16.3 *(1.0)*	16.8 *(0.6)*	16.6 *(0.8)*	17.5 *(0.9)*
Zr	65.0 *(5.2)*	61.2 *(3.7)*	60.9 *(1.7)*	62.2 *(4.1)*	60.5 *(1.5)*	64.7 *(4.4)*	59.9 *(3.5)*	62.1 *(2.2)*	62.7 *(3.8)*	64.5 *(3.1)*
Nb	9.8 *(0.7)*	9.8 *(0.8)*	8.7 *(0.2)*	8.9 *(0.6)*	8.8 *(0.2)*	9.0 *(0.5)*	8.7 *(0.5)*	9.0 *(0.3)*	8.8 *(0.4)*	9.4 *(0.4)*
Cs	1.4 *(0.1)*	1.4 *(0.1)*	1.2 *(0.03)*	1.2 *(0.09)*	1.2 *(0.03)*	1.3 *(0.07)*	1.2 *(0.07)*	1.2 *(0.04)*	1.2 *(0.08)*	1.3 *(0.06)*
Ba	809.1 *(67.1)*	732.6 *(47.0)*	743.5 *(33.3)*	767.7 *(54.6)*	746.1 *(19.1)*	775.9 *(36.5)*	744.2 *(44.4)*	765.9 *(25.5)*	754.8 *(37.8)*	799.7 (36.6)
La	24.1 *(2.3)*	20.5 *(1.2)*	22.1 *(0.8)*	22.6 *(1.6)*	22.0 *(0.6)*	23.7 *(1.5)*	21.9 *(1.3)*	22.5 *(0.8)*	22.7 *(1.4)*	23.5 *(1.1)*
Ce	43.3 *(3.4)*	39.0 *(2.5)*	38.9 *(1.6)*	40.8 *(3.0)*	39.2 *(1.1)*	41.7 *(2.5)*	39.0 *(2.5)*	40.4 *(1.4)*	40.3 *(2.3)*	41.8 *(1.9)*
Pr	4.1 *(0.5)*	3.6 *(0.2)*	3.8 *(0.1)*	3.9 *(0.3)*	3.8 *(0.1)*	4.0 *(0.2)*	3.7 *(0.2)*	3.9 *(0.1)*	3.9 *(0.2)*	4.0 *(0.2)*
Nd	13.0 *(1.2)*	12.0 *(0.6)*	12.3 *(0.6)*	13.0 *(1.0)*	12.5 *(0.3)*	13.1 *(0.7)*	12.4 *(0.7)*	12.8 *(0.5)*	12.7 *(0.8)*	13.5 *(0.7)*
Sm	2.4 *(0.3)*	2.2 *(0.2)*	2.3 *(0.1)*	2.4 *(0.2)*	2.3 *(0.07)*	2.4 *(0.2)*	2.3 *(0.2)*	2.3 *(0.09)*	2.3 *(0.1)*	2.4 *(0.1)*
Eu	0.4 *(0.1)*	0.4 *(0.06)*	0.4 *(0.01)*	0.4 *(0.04)*	0.4 *(0.02)*	0.4 *(0.04)*	0.4 *(0.03)*	0.4 *(0.03)*	0.4 *(0.03)*	0.4 *(0.02)*
Gd	2.2 *(0.3)*	2.1 *(0.3)*	2.1 *(0.1)*	2.1 *(0.2)*	2.1 *(0.1)*	2.2 *(0.1)*	2.0 *(0.1)*	2.1 *(0.1)*	2.1 *(0.1)*	2.2 *(0.1)*
Tb	0.4 *(0.06)*	0.3 *(0.04)*	0.4 *(0.02)*	0.4 *(0.03)*	0.3 *(0.02)*	0.4 *(0.03)*	0.3 *(0.02)*	0.4 *(0.02)*	0.4 *(0.02)*	0.4 *(0.02)*
Dy	2.6 *(0.3)*	2.3 *(0.3)*	2.5 *(0.2)*	2.5 *(0.2)*	2.5 *(0.09)*	2.5 *(0.1)*	2.4 *(0.2)*	2.5 *(0.1)*	2.4 *(0.1)*	2.6 *(0.2)*
Ho	0.6 *(0.07)*	0.5 *(0.05)*	0.6 *(0.02)*	0.6 *(0.05)*	0.5 *(0.02)*	0.6 *(0.03)*	0.5 *(0.04)*	0.6 *(0.02)*	0.5 *(0.04)*	0.6 *(0.03)*
Er	1.9 *(0.2)*	1.6 *(0.1)*	1.7 *(0.1)*	1.8 *(0.1)*	1.7 *(0.06)*	1.8 *(0.1)*	1.7 *(0.1)*	1.8 *(0.07)*	1.8 *(0.09)*	1.9 *(0.07)*
Tm	0.3 *(0.05)*	0.3 *(0.03)*	0.3 *(0.02)*	0.3 *(0.02)*	0.3 *(0.01)*	0.3 *(0.02)*	0.3 *(0.03)*	0.3 *(0.02)*	0.3 *(0.02)*	0.3 *(0.02)*
Yb	2.4 *(0.3)*	2.1 *(0.2)*	2.3 *(0.2)*	2.3 *(0.2)*	2.2 *(0.09)*	2.3 *(0.1)*	2.2 *(0.2)*	2.3 *(0.1)*	2.2 *(0.2)*	2.4 *(0.1)*
Lu	0.4 *(0.04)*	0.3 *(0.03)*	0.3 *(0.03)*	0.4 *(0.04)*	0.4 *(0.02)*	0.4 *(0.02)*	0.4 *(0.03)*	0.4 *(0.02)*	0.4 *(0.02)*	0.4 *(0.02)*
Hf	2.4 *(0.3)*	2.1 *(0.2)*	2.2 *(0.1)*	2.2 *(0.2)*	2.1 *(0.09)*	2.2 *(0.1)*	2.1 *(0.1)*	2.2 *(0.08)*	2.2 *(0.1)*	2.3 *(0.2)*
Ta	1.0 *(0.2)*	0.9 *(0.1)*	0.8 *(0.03)*	0.9 *(0.07)*	0.9 *(0.03)*	0.9 *(0.06)*	0.9 *(0.06)*	0.9 *(0.03)*	0.8 *(0.05)*	0.9 *(0.05)*
Pb	10.0 *(1.5)*	9.6 *(1.6)*	9.4 *(3.4)*	8.3 *(0.7)*	8.2 *(0.2)*	8.8 *(0.5)*	8.2 *(0.5)*	8.4 *(0.4)*	8.4 *(0.5)*	8.6 *(0.3)*
Th	17.9 *(1.5)*	16.7 *(0.9)*	16.6 *(0.8)*	17.0 *(1.4)*	16.6 *(0.5)*	17.1 *(0.9)*	16.5 *(1.0)*	16.8 *(0.6)*	16.6 *(0.9)*	17.7 *(0.9)*
U	6.3 *(0.6)*	6.4 *(0.5)*	5.5 *(0.3)*	5.9 *(0.5)*	5.7 *(0.2)*	5.8 *(0.4)*	5.7 *(0.4)*	5.8 *(0.3)*	5.7 *(0.4)*	6.1 *(0.3)*
Zr/Nb	6.6	6.3	7.0	7.0	6.9	7.2	6.9	6.9	7.2	6.9
Th/Yb	7.5	8.1	7.2	7.4	7.5	7.5	7.4	7.4	7.4	7.5
Ba/Ce	18.7	18.8	19.1	18.8	19.0	18.7	19.1	18.9	18.8	19.1
Zr/Rb	0.6	0.5	0.7	0.7	0.7	0.7	0.6	0.7	0.7	0.7
Ba/Y	45.7	44.5	45.0	45.9	45.2	45.6	45.7	45.5	45.5	45.7
Ba/Rb	7.5	6.4	8.0	8.1	8.1	8.3	8.1	8.1	8.2	8.1
Ce/Gd	20.3	18.7	18.5	20.0	19.0	19.4	19.2	19.7	19.5	18.7
Th/La	0.7	0.8	0.8	0.8	0.8	0.7	0.8	0.7	0.7	0.8
La/Sm	10.1	9.3	9.5	9.6	9.5	9.8	9.6	9.6	9.7	9.8
La/Yb	10.1	10.0	9.6	9.8	10.0	10.4	9.8	10.0	10.1	9.9
U/Th	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Rb/Sr	2.7	3.1	2.4	2.4	2.4	2.2	2.4	2.4	2.3	2.4
Ba/Zr	12.4	19.1	12.2	12.4	12.3	12.0	12.4	12.3	12.1	12.4

* Oxides are renormalised to 100% dry. 1 standard deviation (SD) in brackets

Supplementary Table 5. Representative amphibole analyses

	Christiani	Santorini	Anafi	U1589B	U1592B	U1593B	U1598B	U1599A	U1600A
Sample	CHR 318	SAN-G	AN 630						
Analyses	7	14	6	23	16	34	21	9	10
SiO2	54.64 (0.51)*	55.73 (0.36)	55.35	54.46 (0.43)	54.58 (0.22)	54.68 (0.36)	54.75 (0.27)	54.51 (0.43)	54.92 (0.16)
TiO2	0.24 (0.04)	0.19 (0.03)	0.19	0.24 (0.07)	0.20 (0.04)	0.20 (0.04)	0.20 (0.03)	0.21 (0.05)	0.19 (0.03)
Al2O3	1.26 (0.14)	1.28 (0.17)	1.21	1.41 (0.34)	1.27 (0.20)	1.28 (0.21)	1.21 (0.13)	1.39 (0.30)	1.17 (0.15)
FeO	16.01 (0.88)	16.17 (0.14)	15.64	16.50 (0.22)	16.45 (0.09)	16.48 (0.19)	16.39 (0.14)	16.37 (0.09)	16.33 (0.11)
MnO	2.25 (0.06)	2.28 (0.05)	2.29	2.31 (0.14)	2.39 (0.04)	2.34 (0.07)	2.35 (0.04)	2.37 (0.05)	2.34 (0.04)
MgO	20.82 (0.35)	20.93 (0.31)	21.11	21.61 (0.34)	22.01 (0.18)	21.80 (0.23)	21.94 (0.18)	21.86 (0.33)	21.89 (0.18)
CaO	1.36 (0.10)	1.41 (0.13)	1.35	1.68 (0.38)	1.31 (0.12)	1.45 (0.24)	1.40 (0.15)	1.45 (0.22)	1.48 (0.11)
Na2O	0.28 (0.04)	0.29 (0.03)	0.28	0.30 (0.07)	0.27 (0.04)	0.27 (0.05)	0.26 (0.03)	0.28 (0.09)	0.25 (0.05)
K2O	0.01 (0.01)	0.00 (0.00)	0.01	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)
Total	96.88	98.27	97.42	98.52	98.47	98.50	98.50	98.44	98.57

Amphibole formulae, recalculated

Christiani $(Na_{0.048}K_{0.002})(Fe_{1.486}Mn_{0.274}Ca_{0.21}Na_{0.03})(Mg_{4.463}Fe^{ii}_{0.439}Al_{0.071})(Si_{7.858}Al_{0.142})O_{22}((OH)_2)$

Santorini $(Na_{0.023})(Fe_{1.456}Mn_{0.273}Ca_{0.214}Na_{0.057})(Mg_{4.417}Fe^{ii}_{0.459}Al_{0.104}Ti_{0.02})(Si_{7.89}Al_{0.11})O_{22}((OH)_2)$

Anafi $(Na_{0.025}K_{0.002})(Fe_{1.465}Mn_{0.277}Ca_{0.206}Na_{0.052})(Mg_{4.486}Fe^{ii}_{0.4}Al_{0.094}Ti_{0.02})(Si_{7.891}Al_{0.109})O_{22}((OH)_2)$

U1589B $(Na_{0.083}Ca_{0.075}K_{0.002})(Fe_{1.541}Mn_{0.278}Ca_{0.181})(Mg_{4.578}Fe^{ii}_{0.42}Ti_{0.001})(Si_{7.739}Al_{0.236}Ti_{0.025})O_{22}((OH)_2)$

U1592B $(Na_{0.027}K_{0.002})(Fe_{1.532}Mn_{0.245}Ca_{0.196}Na_{0.027})(Mg_{4.536}Fe^{iii}_{0.396}Fe^{ii}_{0.068})(Si_{7.582}Fe_{0.227}Al_{0.171}Ti_{0.02})O_{22}((OH)_2)$

U1593B $(Na_{0.037}K_{0.002})(Fe_{1.465}Mn_{0.279}Ca_{0.219}Na_{0.037})(Mg_{4.581}Fe^{iii}_{0.269}Fe^{ii}_{0.15})(Si_{7.707}Al_{0.213}Fe_{0.059}Ti_{0.021})O_{22}((OH)_2)$

U1598B $(Na_{0.036}K_{0.002})(Fe_{1.473}Mn_{0.28}Ca_{0.211}Na_{0.035})(Mg_{4.607}Fe^{iii}_{0.264}Fe^{ii}_{0.128})(Si_{7.713}Al_{0.201}Fe_{0.065}Ti_{0.021})O_{22}((OH)_2)$

U1599A $(Na_{0.038}K_{0.002})(Fe_{1.46}Mn_{0.283}Ca_{0.219}Na_{0.038})(Mg_{4.593}Fe^{iii}_{0.292}Fe^{ii}_{0.114})(Si_{7.683}Al_{0.231}Fe_{0.063}Ti_{0.022})O_{22}((OH)_2)$

U1600A $(Na_{0.034}K_{0.002})(Fe_{1.464}Mn_{0.279}Ca_{0.223}Na_{0.034})(Mg_{4.594}Fe^{iii}_{0.246}Fe^{ii}_{0.16})(Si_{7.732}Al_{0.194}Fe_{0.054}Ti_{0.02})O_{22}((OH)_2)$

* Wt% oxide with 1 standard deviation in brackets

Supplementary Table 6. Representative plagioclase analyses

	Santorini	Anafi	U1589B	U1592B	U1593B	U1598B	U1599A	U1600A
Sample	SAN02-25	ANA18-2						
Analyses	13	27	9	11	21	13	22	6
SiO_2	61.29 (0.39)*	61.43 (0.55)	61.95 (0.61)	61.83 (0.68)	61.49 (0.43)	61.49 (0.36)	61.79 (0.46)	61.66 (0.54)
Al2O3	23.71 (0.27)	23.61 (0.38)	24.00 (0.33)	24.13 (0.44)	24.21 (0.17)	24.24 (0.28)	24.10 (0.33)	24.29 (0.27)
CaO	5.52 (0.23)	5.50 (0.39)	5.51 (0.40)	5.67 (0.45)	5.72 (0.17)	5.72 (0.33)	5.57 (0.35)	5.80 (0.27)
FeO	0.19 (0.04)	0.21 (0.03)	0.17 (0.02)	0.17 (0.02)	0.17 (0.01)	0.18 (0.02)	0.16 (0.01)	0.17 (0.01)
Na2O	8.19 (0.15)	8.29 (0.20)	8.17 (0.27)	8.17 (0.23)	7.92 (0.16)	8.08 (0.14)	8.14 (0.17)	7.99 (0.21)
K2O	0.43 (0.03)	0.43 (0.05)	0.44 (0.03)	0.43 (0.03)	0.42 (0.02)	0.42 (0.04)	0.43 (0.04)	0.42 (0.03)
Total	99.33	99.48	100.24	100.40	99.94	100.13	100.19	100.32
An**	26.5	26.2	26.5	27.0	27.9	27.4	26.8	27.9
Ab**	71.1	71.4	71.0	70.5	69.7	70.2	70.8	69.7
Or**	2.5	2.4	2.5	2.4	2.4	2.4	2.5	2.4

* Wt% oxide with 1 standard deviation in brackets

** Percentages of anorthite An (100Ca/[Ca+Na+K]), atomic), albite Ab (100Na/[Ca+Na+K]), and orthoclase Or (100K/[Ca+Na+K]) components.

Supplementary Table 7. Paleobathymetry

Site	Before Archaeos Tuff (m)	After Archaeos Tuff (m)
U1589	200-700	
U1591	200-700	
U1592	500-1000	
U1593	200-700	
U1598	No recovery	200-700
U1599	200-700	
U1600	500-1000	

Supplementary Table 8: Description of the onland facies of the Archaeos Tuff

Christiani	
Outcrop	36°14.74' N / 25°12.53' E. Crops out for 900 m long along the cliffs; maximum 4 m thick
Previous names	Christiani Bims (ref 9) Unterer Bims von Christiani (ref 10), Christiani Ignimbrite (ref 11)
Lithology	Massive to diffusely stratified, poorly sorted lapilli tuff. Nonwelded with the features typical of subaerial ignimbrite. Complex internal stratigraphy with several depositional units. Conspicuous lithic breccia lenses with lithic diameters up to 1 m at the base of the ignimbrite.
Lithics	Perlitic obsidian, basaltic to andesitic lavas, biotite-granites, aplites, greenschists, limestones and marbles
Santorini	
Outcrop	36°22.34' N / 25°25.38' E at the base of the caldera wall near Cape Therma. Two nearby outcrops directly beneath the deposits from the Cape Therma 1 eruption and underlying M1 interplinian deposits
Previous names	Christiani Ignimbrite (ref 11)
Lithology	Massive to diffusely stratified, poorly sorted lapilli tuff. Nonwelded with the features typical of subaerial ignimbrite. Maximum pumice diameters reach 9 cm, with the long axis of the 10 largest pumice clasts ranging from 3.5 to 9.0 cm, and with an average of 5.0 cm. Lithic clasts can be larger than pumices, with the long axis of the 15 largest lithics ranging from 4 to 15 cm, with an average of 8.6 cm.
Lithics	Greenschists, marbles, granitoids, hyaloclastite and variably altered volcanic rocks.
Anafi	
Outcrop	36°21.39' N / 25°48.26'E at 135 m above sea level in the area of Megas Potamos. A single outcrop 10 m long.
Previous names	Christiani Ignimbrite (ref 11)
Lithology	Massive to diffusely stratified, poorly sorted lapilli tuff. Nonwelded with the features typical of subaerial ignimbrite. Lithic clasts are less abundant and on average smaller than in the equivalent deposits on Christiani and Santorini, ranging in size up to only 4 cm (long axis).
Lithics	Lithic clasts are less diverse than on Santorini, with volcanic rocks identified as the principal lithic component.

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