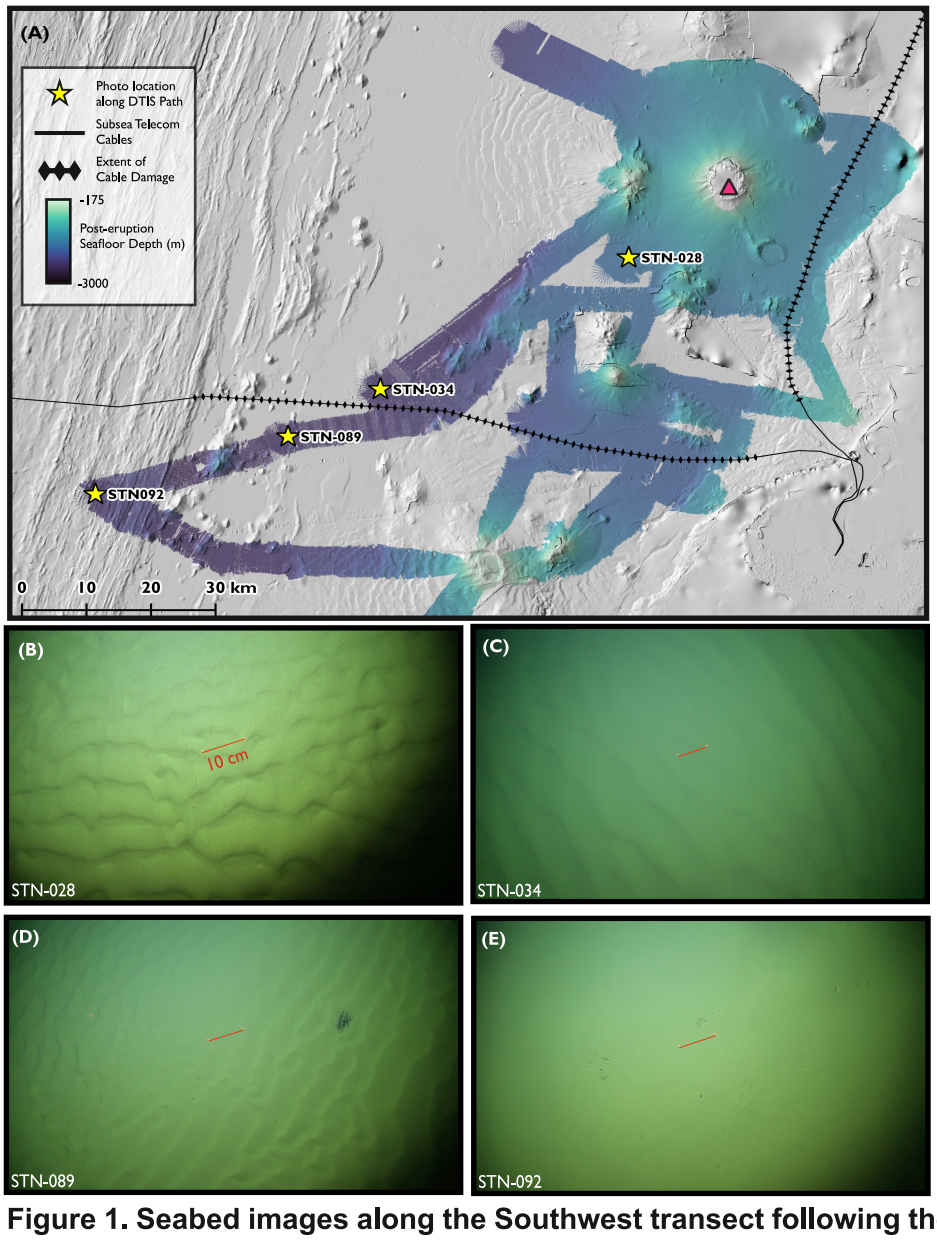
Supplementary Material

Supplementary Discussion

Pre-eruption Deposits

The base of the 2022 deposit is defined by a visually sharp grain-size break, distinct colour change, and infrequent soft-sediment deformation (Figure 1 and 2). Beneath are clays containing abundant volcanic glass and evidence of tractional structures. These sediments are not considered part of the 2022 deposits due to a differing geochemical signature (high *K/Ti* and low *Fe*/*Ti* ratios), abundant biological material (e.g., shell fragments and foraminifera), and intense weathering, oxidation, and bioturbation (Figure 2). Rather we suggest this sediment comprised the seafloor prior to the 2022 eruption and is sourced from pelagic fallout or previous volcanic eruptions, hence the low *Cl* intensity and high *K/Ti* ratios indicative of an older, compacted and clay-rich deposit.

Supplementary Figures & Tables



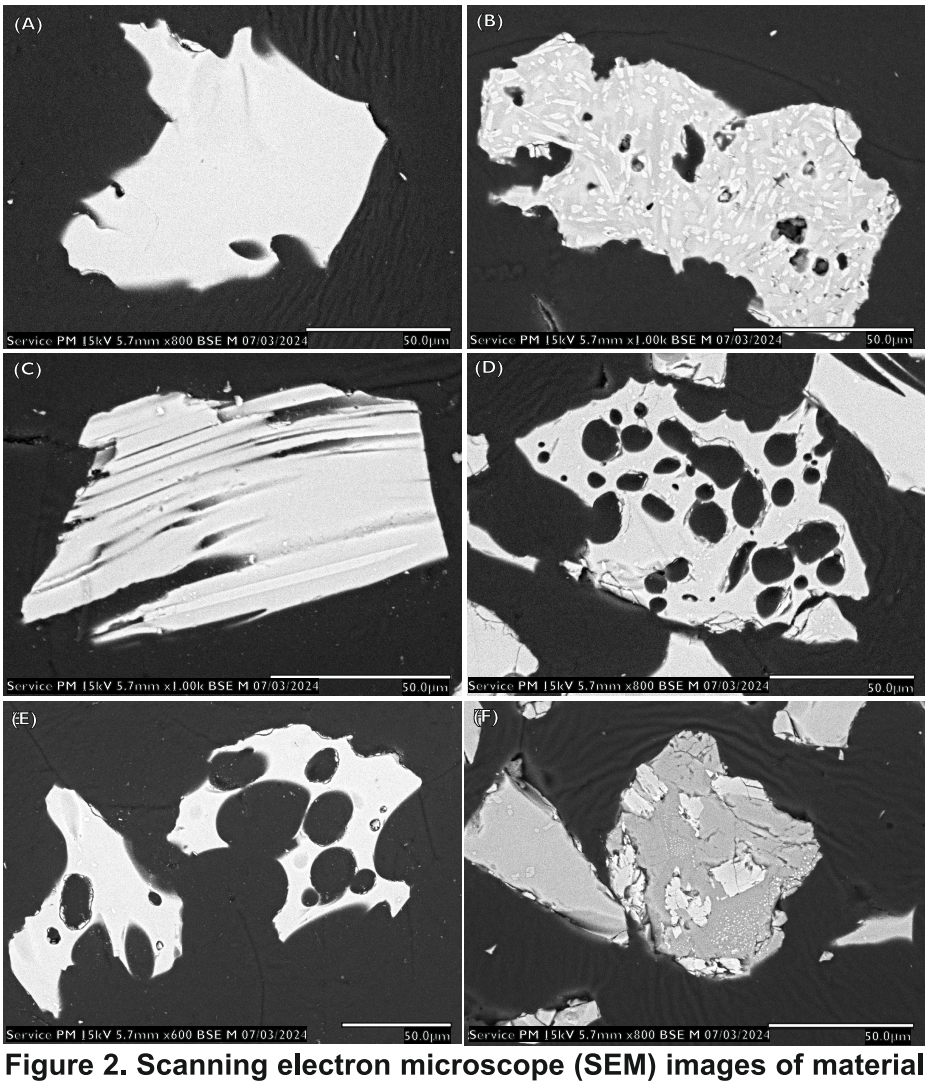
Supplementary Figure 1. Seabed images along the Southwest transect following the January 15th, 2022, Hunga volcano eruption. Images collected using NIWA's Deep Towed Instrument System (DTIS). (**A**) Location of images taken along DTIS pathways displayed on bathymetric data collected 3 months after the eruption of the TESMaP TAN2206 research cruise. (**B-D**) Muddy sediments with well-defined ripples present over 85 km from Hunga volcano. (**E**) Featureless muddy sediment images west of high-relief ridges. The red scale bar in each inset is 10 cm.

Core Name	Recovery Station	Recovery Site	Core ID	Latitude	Longitude	Distance from Hunga Caldera (km)	Core Recovery (cm)	Deposit Thickness (cm)	Water Depth (m)
SE – 19	22	16	STN22-SITE16	-20.7047	-175.2922	19.314	42.5	>42.5	1555
SW – 20	31	20	STN31-SITE20	-20.6763	-175.5322	19.982	33.8	>33.8	1718
NW – 26	65	30	STN65-SITE30	-20.3917	-175.572	26.377	32.2	>32.2	2068
SE – 31	70	17	STN70-SITE17	-20.8123	-175.267	31.096	11.2	>11.2	1376
SW – 33	87	21	STN87-SITE21	-20.7338	-175.6398	32.7	18.5	>18.5	1860
SE – 45	76	18	STN76-SITE17	-20.916	-175.1985	44.527	25.4	2.45	725
SSW – 48	83	04	STN83-SITE04	-20.9177	-175.6427	48.201	22	>22	2000
SW – 64*	36	22	STN36-SITE22	-20.8772	-175.8988	63.886	62	38	2330
SW – 80*	90	23	STN90-SITE23	-20.9525	-176.0388	80.620	69.5	30.5	2412
SW – 100*	96	31	STN96-SITE31	-21.1357	-176.131	100.369	61.5	48.5	2411
SW – 111*	95	24	STN95-SITE24	-21.0385	-176.323	110.883	31.4	6.5	2449

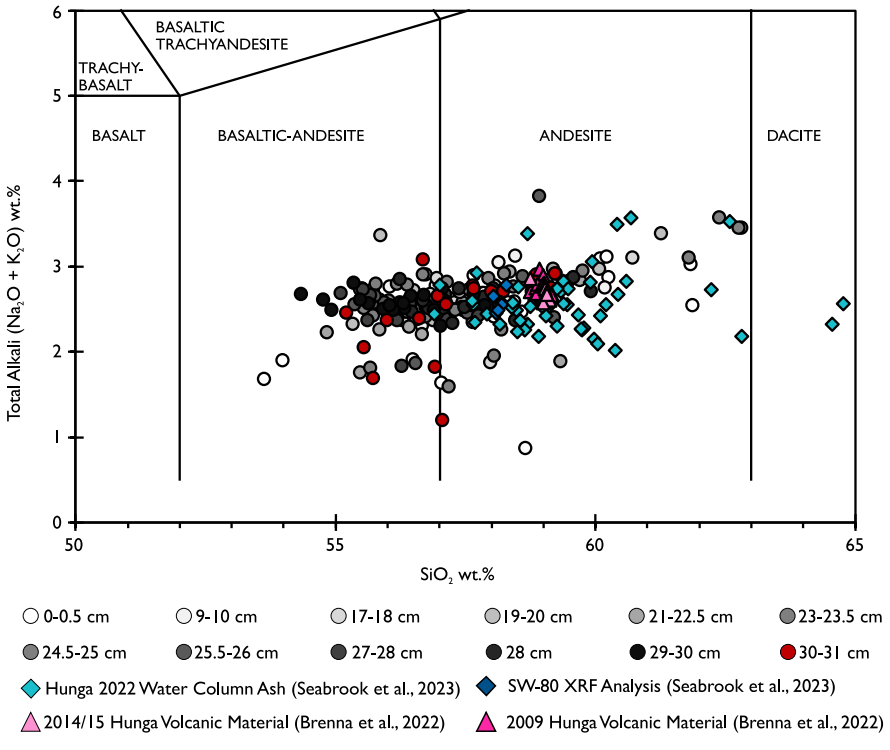
Supplementary Table 1 – Summary of sediment cores collected during the TESMaP TAN2206 Research Cruise. Samples recovered using the Ocean Instruments MC-800 multicorer systems. Core recovery location, water depth, and recovered core thickness are detailed. Core name is a combination of the direction (e.g., SE) and distance in km (e.g. 20) from the centre of the Hunga volcano caldera the core was recovered. The thickness of the density current deposit attributed to the 2022 Hunga eruption in the sediment cores is noted. For sediment cores where the base of the deposit was unrecovered thickness is given as > X cm. Sediment cores comprising the SW transect detailed in this report are noted with an asterisk (*).

Sample #	Core Name	Core Depth (cm)	Material	Grains Counted (n)	Massive Glass (n)	Crystal-Rich Glass (n)	Crystals (n)	Pumice (n)	Lithics (n)	Organic (n)	Massive Glass (%)	Crystal-rich Glass (%)	Crystals (%)	Pumice (%)	Lithics (%)	Bio/Fora (%)
1	SW-64	10-11	2022 Deposit	308	263	16	4	8	16	1	85.4	5.2	1.3	2.6	5.2	0.3
2	SW-64	22 - 23	2022 Deposit	300	202	37	13	17	28	3	67.3	12.3	4.3	5.7	9.3	1.0
3	SW-64	28 - 29	2022 Deposit	315	193	65	20	12	25	0	61.3	20.6	6.3	3.8	7.9	0.0
4	SW-64	34 - 35	2022 Deposit	305	168	71	23	19	23	1	55.1	23.3	7.5	6.2	7.5	0.3
5	SW-64	41 - 42	Pre-2022	300	100	34	9	16	21	120	33.3	11.3	3.0	5.3	7.0	40.0

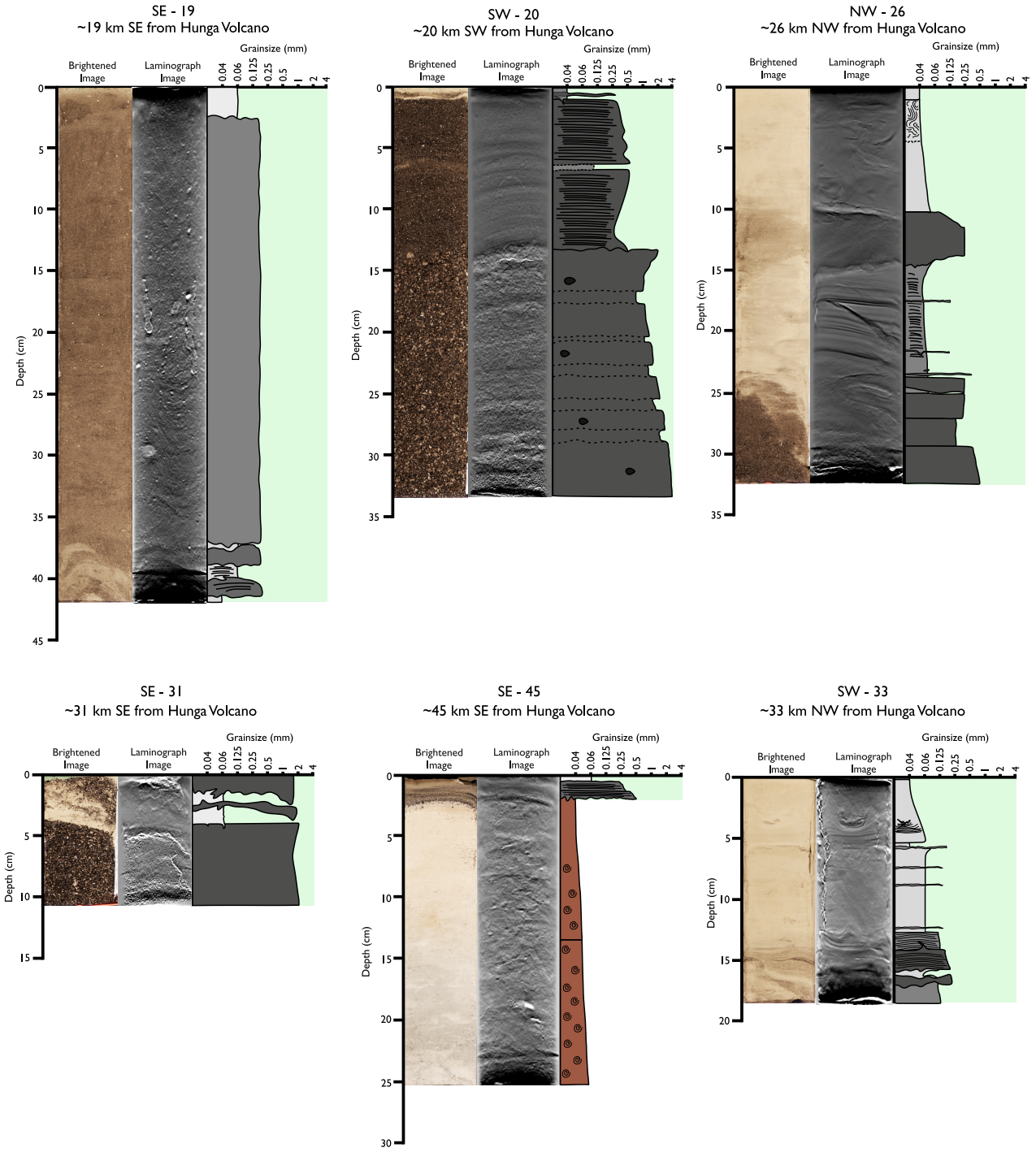
Supplementary Table 2. Componentry of sediment core SW-64



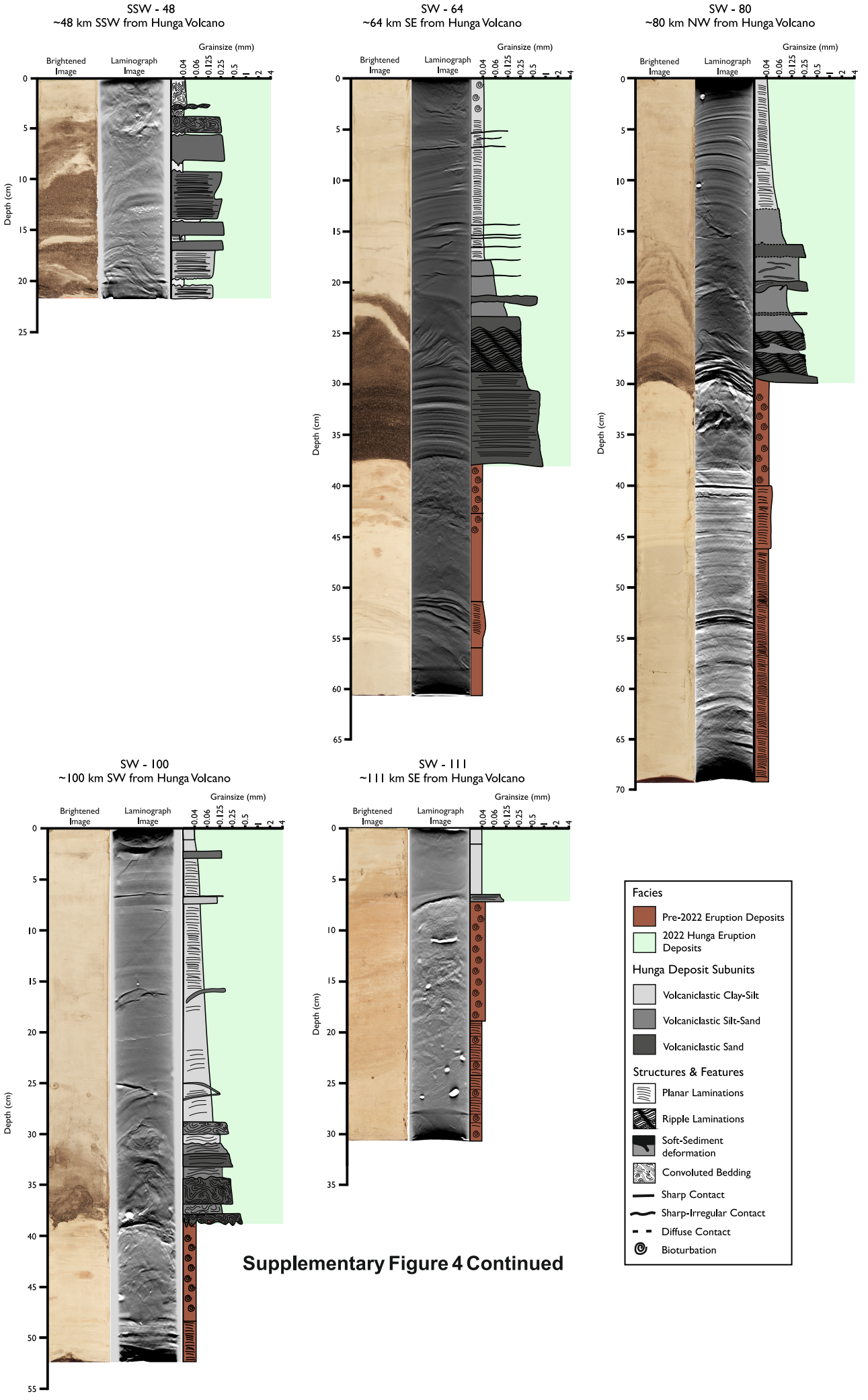
Supplementary Figure 2. Scanning electron microscope (SEM) images of material within the 2022 Hunga volcano eruption deposits from sediment core SW-80. (A) Massive and blocky glass. (B) Microlite rich glass. (C) Tube pumice. (D) Bubble rich glass. (E) Irregular and bubbly glass. (F) Lithic.



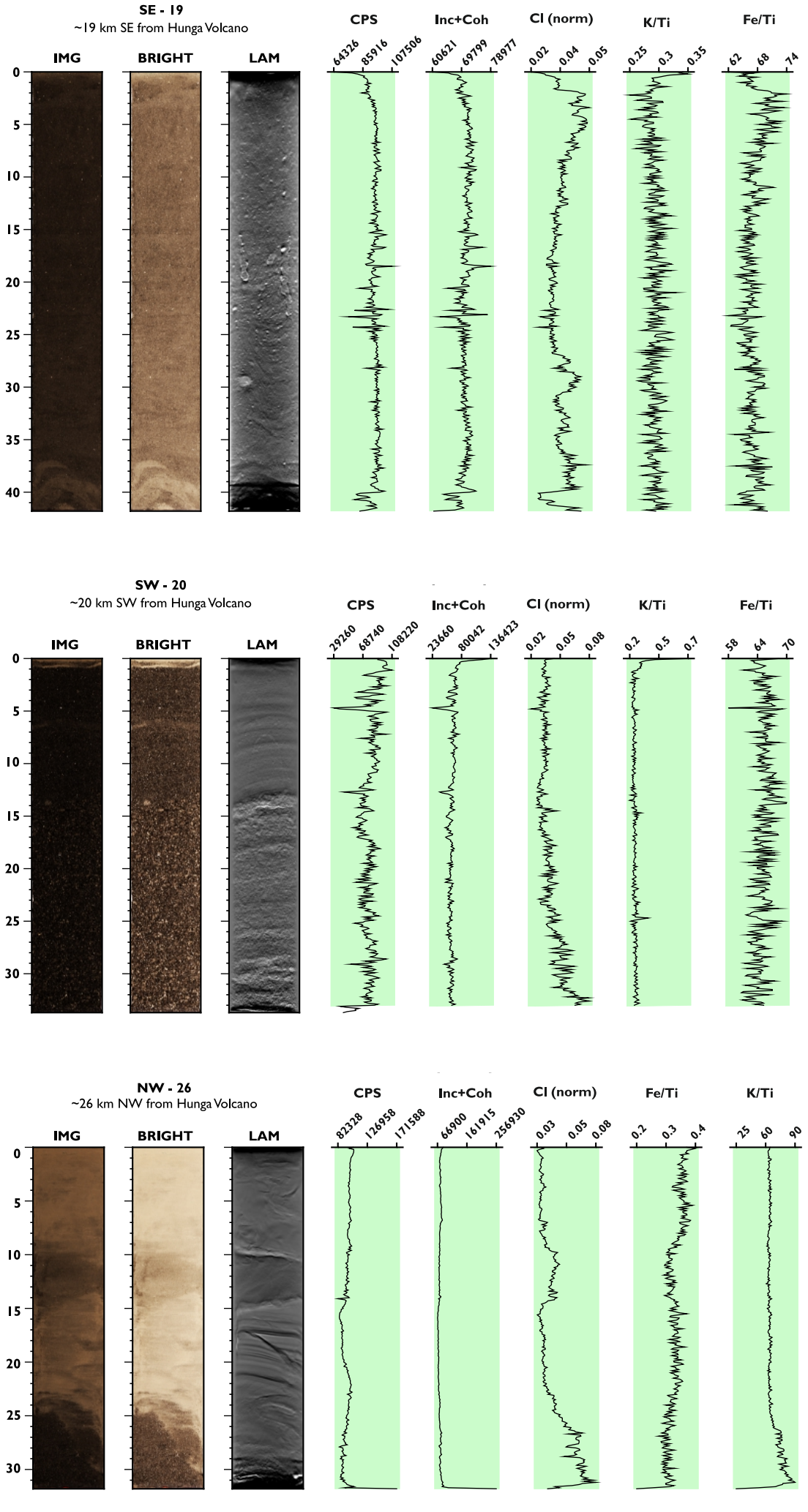
Supplementary Figure 3. Volcanic glass composition of the 2022 Hunga submarine eruption deposits. Total Alkali Silica (TAS) diagram plotting electron probe micro-analyses (EPMA) measurements of density current deposit samples taken from core SW-80 (circles). Also plotted are XRF analyses of SW-80 (dark blue diamonds)[15], submarine ash-samples (light blue diamonds)[1] collected 3 months after the eruption, and tuffs from the 2009 (light pink triangles) and 2014/15 (dark pink triangles) events at Hunga volcano[2].



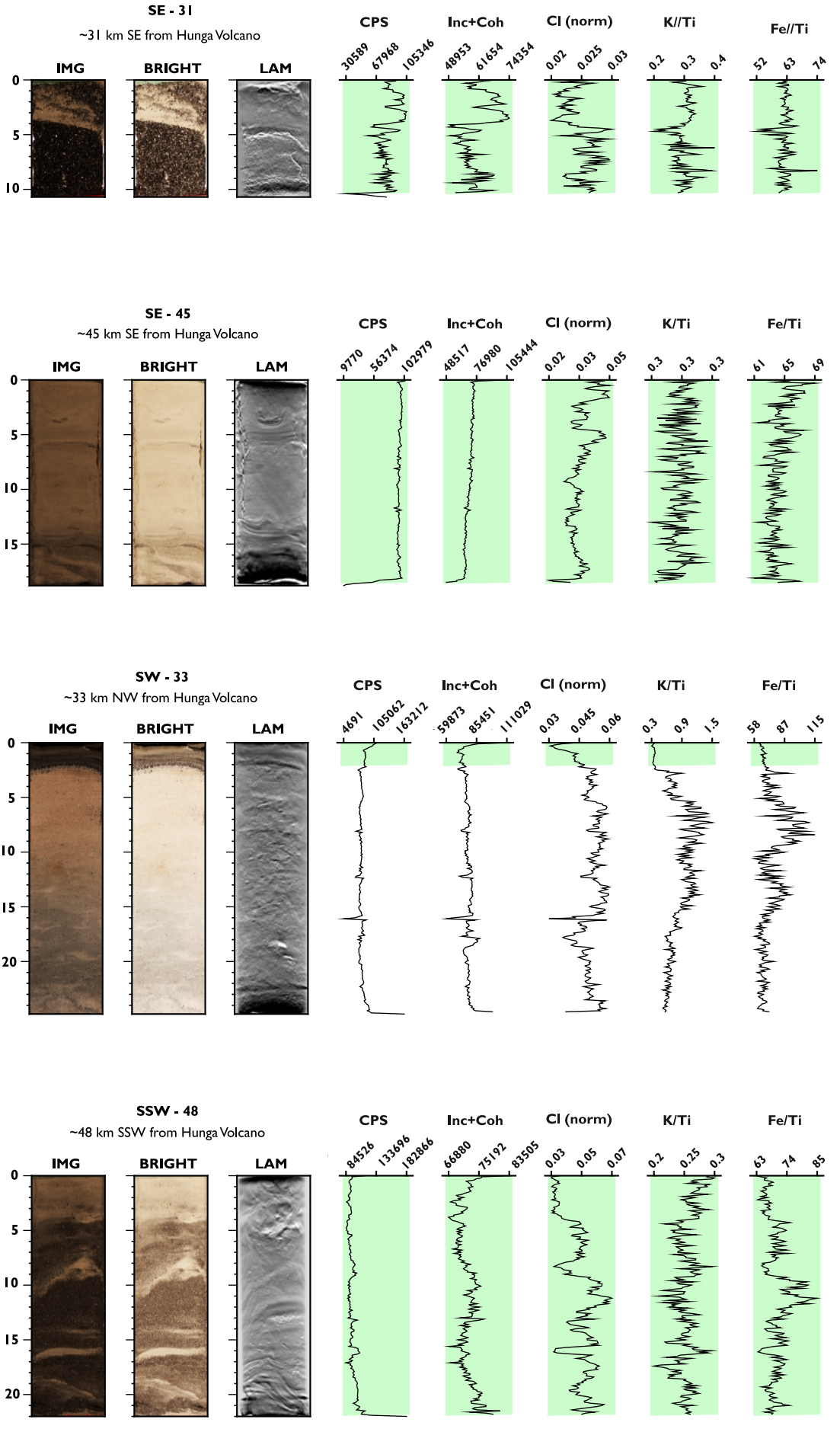
Supplementary Figure 4. 2022 Hunga eruption deposits. Brightened Images, laminographs and visual logs of all eleven sediment cores collected on the TESMaP TAN2206 Research cruise. Locations of each core relative to the other can be seen in Figure 1



Supplementary Figure 4 Continued



Supplementary Figure 5. Geochemical signature of the 2022 Hunga eruption deposits. Core panels for all sediment cores collected on the TESMaP TAN2206 Research cruise. Core images (IMG), brightened images (BRIGHT), laminographs (LAM) and down core Itrax micro-XRF



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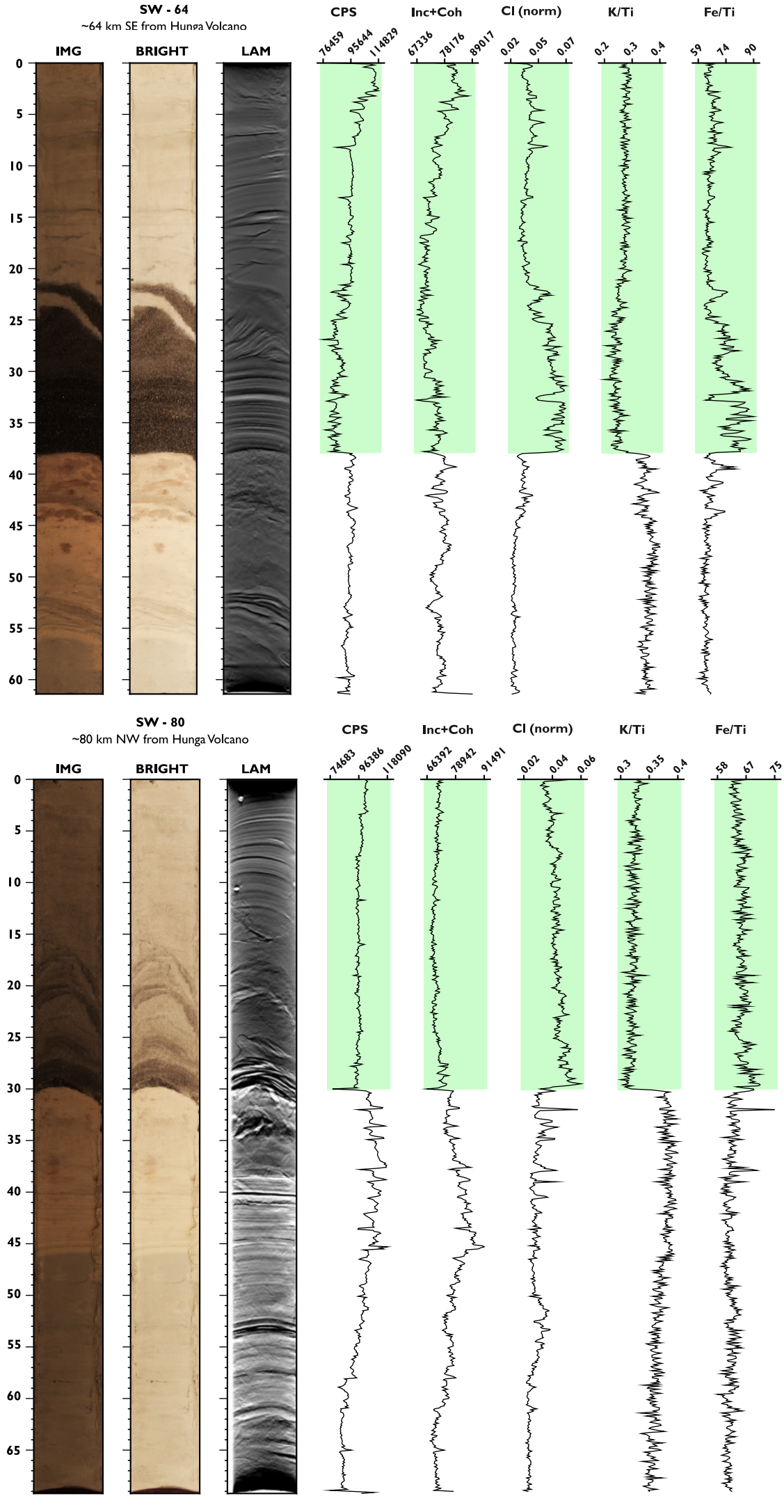

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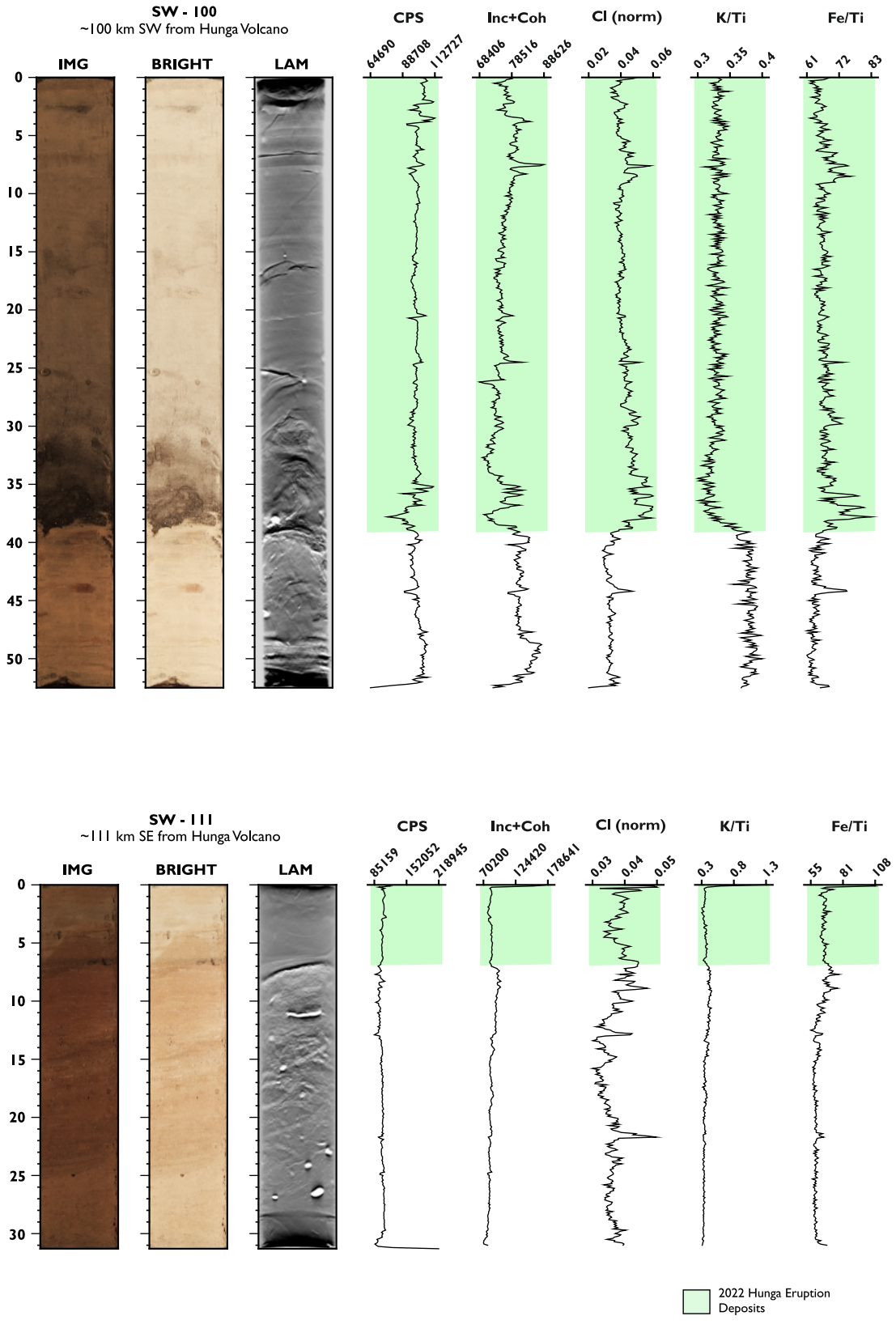

Supplementary Figure 5 Continued

Supplementary Datasets

Also available as part of the supplementary material are excel spreadsheets containing grainsize data, componentry data, XRF, and electron microprobe analysis (EPMA) data.

Supplementary References

1. Seabrook, S. *et al*. Volcaniclastic density currents explain widespread and diverse seafloor impacts of the 2022 Hunga Volcano eruption. *Nature Communications* **14**, 7881 (2023).

2. Brenna, M. *et al*. Post-caldera volcanism reveals shallow priming of an intra-ocean arc andesitic caldera: Hunga volcano, Tonga, SW Pacific. *Lithos* **412–413**, 1–21 (2022).