Supplementary information for:
Internal structure of a Himalayan debris-covered glacier revealed by borehole optical televiewing

Table S1. Details of boreholes logged by OPTV. Borehole naming convention (e.g., BH17-01) consists of the year drilled, followed by the borehole number for that year. OPTV log depths are depths below the surface and were limited by the winch capacity of 150 m. The uppermost ~2 m of each borehole was not logged as this is the length of probe above the camera.

Borehole details				OPTV details					
Borehole ID	**Site**	**Length (m)**	**Date drilled**	**Log date**	**Log direction**	**Top depth (m)**	**Base depth (m)**	**Lighting (%)**	**Exposure (%)**
BH17-01	1	31.2	08.05.2017	11.05.2017	Down	2.03	31.04	50	66
					Up	1.89	30.88	50	66
BH17-09	2	22.0	16.05.2017	18.05.2017	Down	2.03	22.01	50	66
					Up	1.90	21.68	50	66
BH17-13	3	155.0	21.05.2017	23.05.2017	Down	1.98	149.99	50	66
					Up	2.01	149.66	75	66
BH18-04	4	192.0	02.05.2018	05.05.2018	Down	2.03	150.78	75	66
					Up	2.13	150.65	75	100

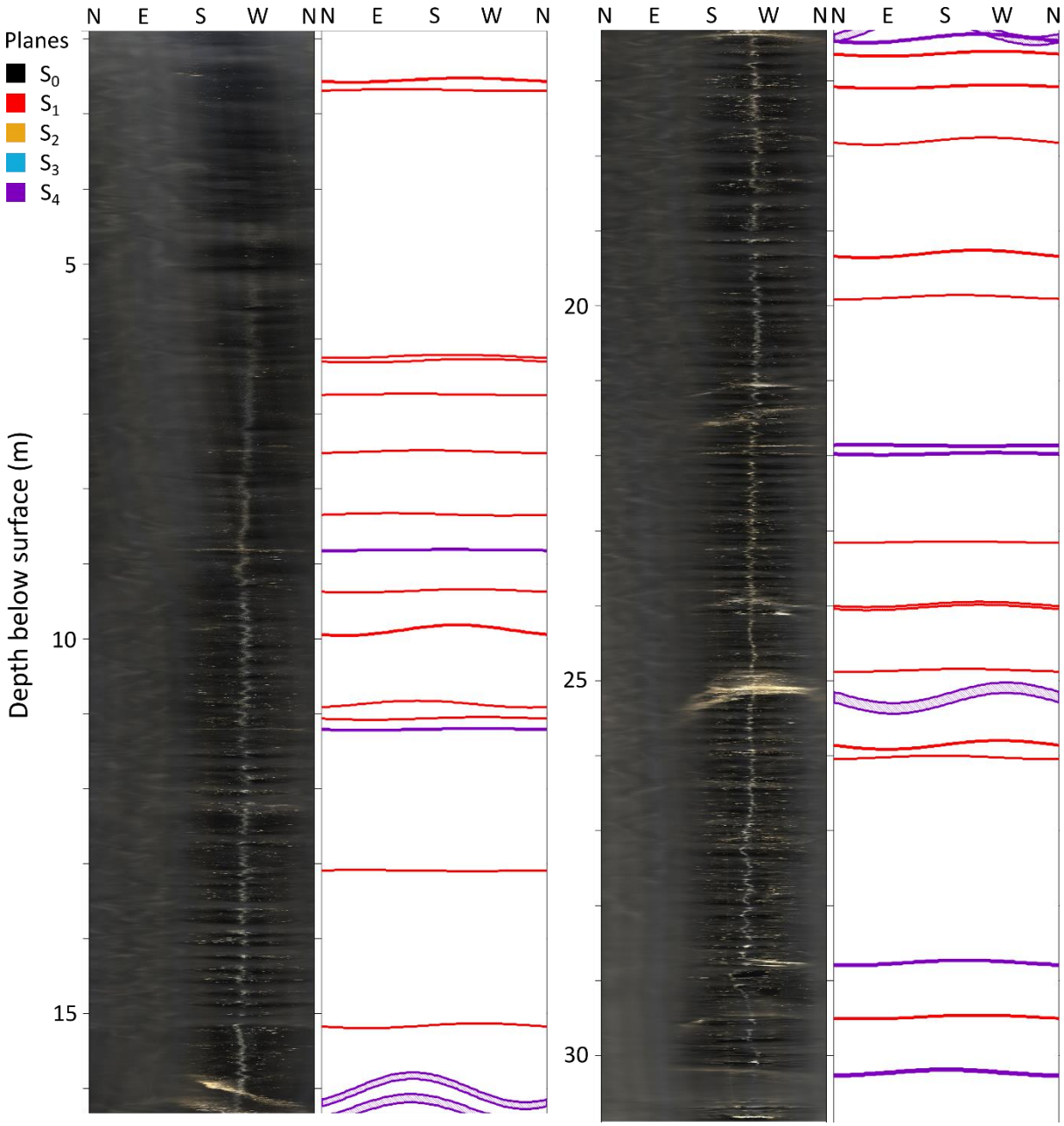

Figure S1. Raw, up-direction OPTV image log and log classifications at Site 1. Red delineated sinusoids are debris-rich layers (S_1) and purple delineated sinusoids are basally derived layers (S_4). Log sections are unrolled to progress North-East-South-West-North from left to right. The uppermost ~2 m was not logged as this is the length of probe above the camera. Saturated vertical reflections are superficial artefacts from the drilling process and obscured parts of the images (i.e., from N–S for the majority of the image log length) are due to turbid water in the borehole. This turbid water extends across the log where the borehole width was greater (due to variable borehole drilling rates), producing an apparent pattern of near-horizontal layering, unrelated to the ice structures on the borehole wall behind, that was omitted from all analysis.

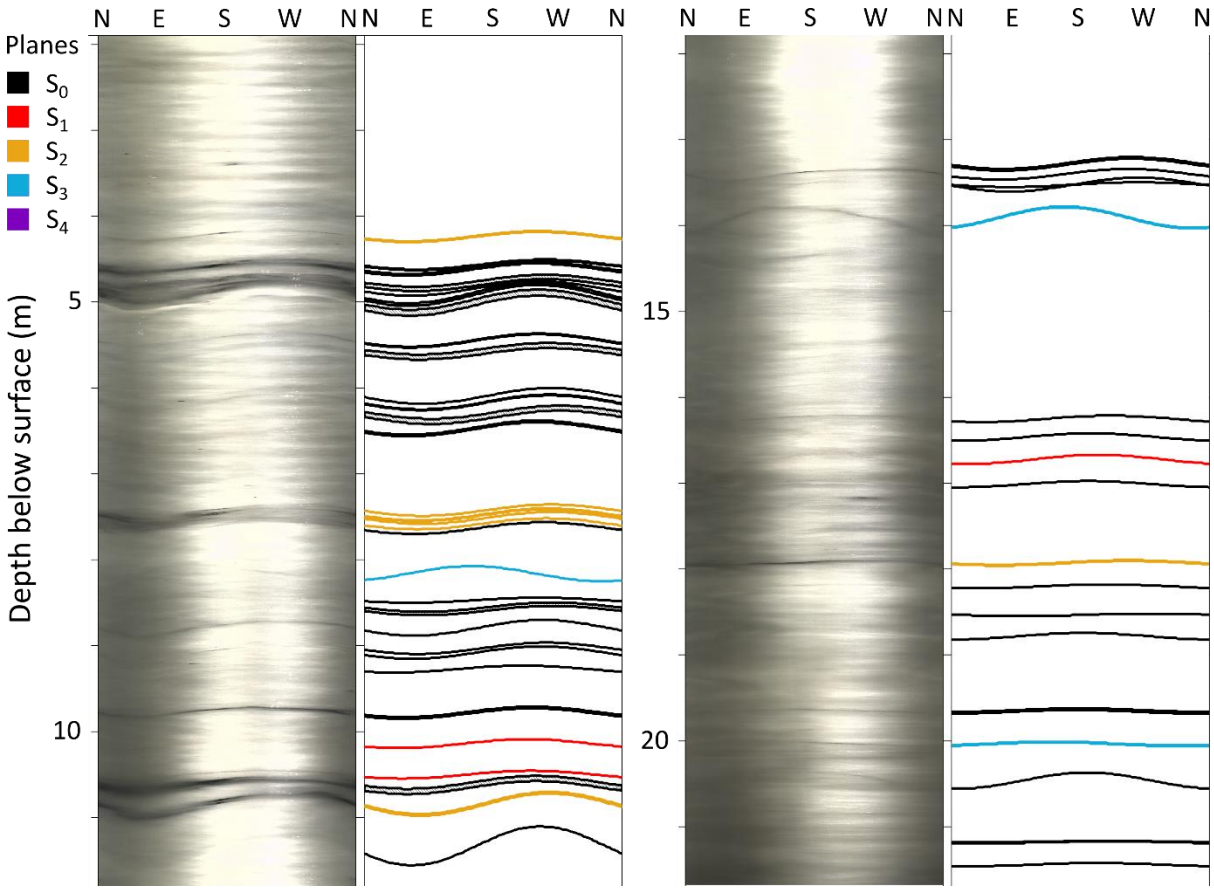

Figure S2. Raw, up-direction OPTV image log and log classifications at Site 2. Black delineated sinusoids are primary stratification (S_0), red delineated sinusoids are debris-rich layers (S_1), gold delineated sinusoids are water-healed crevasse traces (S_2), and blue delineated sinusoids are healed crevasse traces (S_3). Log sections are unrolled to progress North-East-South-West-North from left to right. The uppermost ~2 m was not logged as this is the length of probe above the camera. Saturated vertical reflections are superficial artefacts from the drilling process and obscured parts of the images are due to turbid water in the borehole. This turbid water extends across the log (e.g., the uppermost 8 m) where the borehole width was greater (due to variable borehole drilling rates), producing an apparent pattern of near-horizontal layering, unrelated to the ice structures on the borehole wall behind, that was omitted from all analysis.

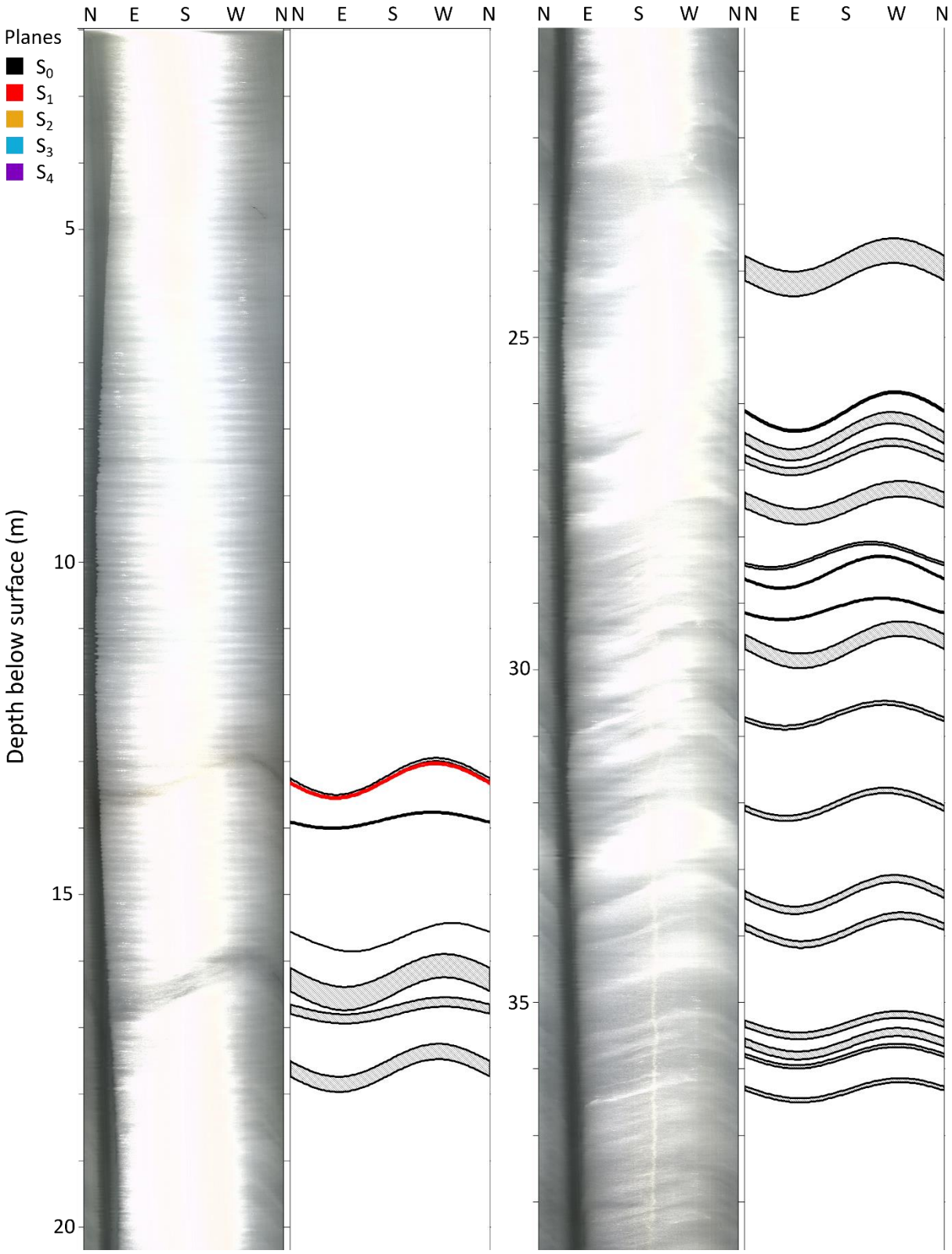

Figure S3. Raw, up-direction OPTV image log and log classifications at Site 3. Black delineated sinusoids are primary stratification (S_0), red delineated sinusoids are debris layers (S_1), and gold delineated sinusoids are water-healed crevasse traces (S_2). Log sections are unrolled to progress North-East-South-West-North from left to right. The uppermost ~2 m was not logged as this is the length of probe above the camera. Saturated vertical reflections and dark vertical traces are superficial artefacts from the drilling process. This turbid water extends across the log (e.g., the uppermost 33 m

and between 47–55 m depth) where the borehole width was greater (due to variable borehole drilling rates), producing an apparent pattern of near-horizontal layering, unrelated to the ice structures on the borehole wall behind, that was omitted from all analysis.

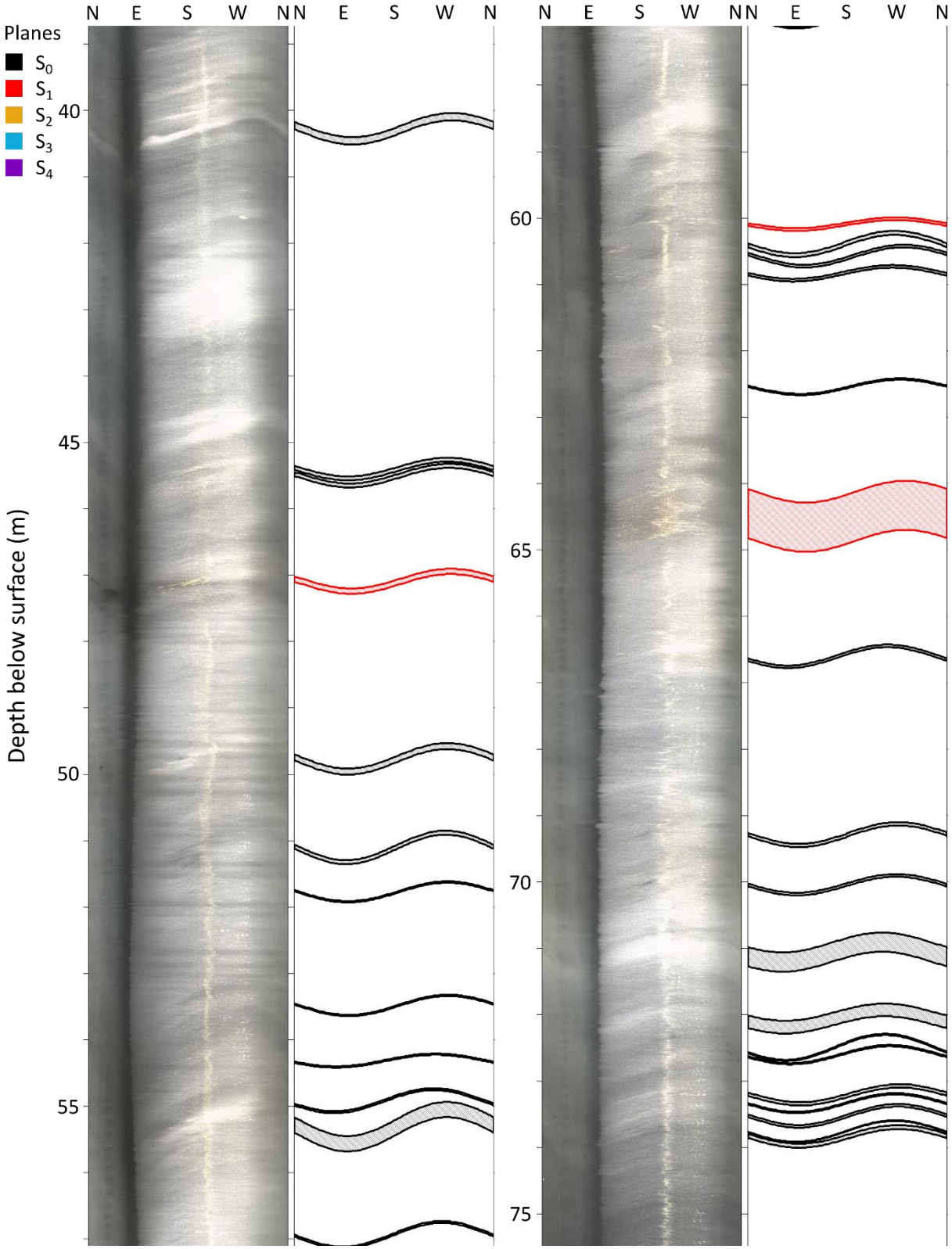

Figure S3. ***(cont.)***

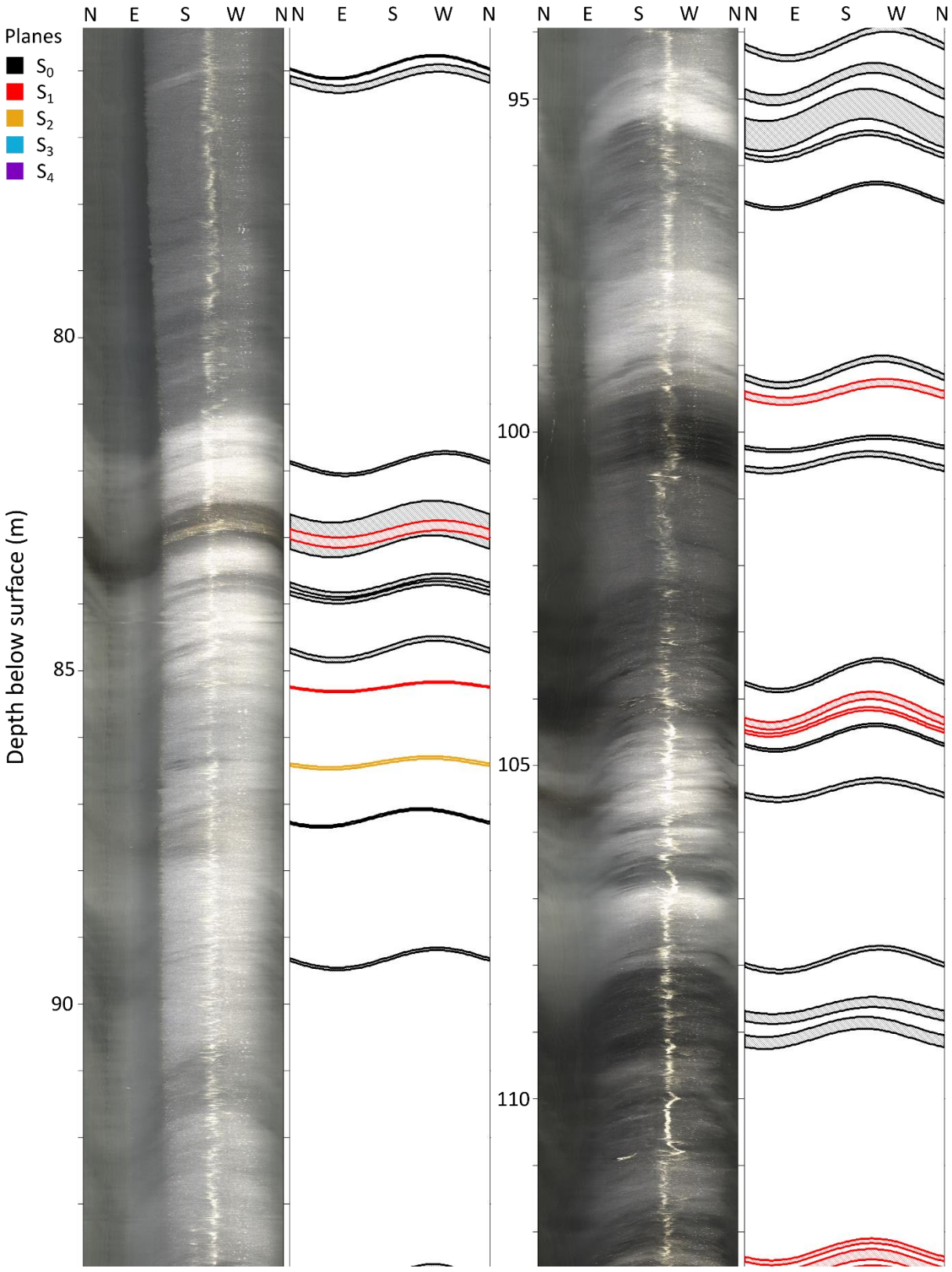

Figure S3. ***(cont.)***

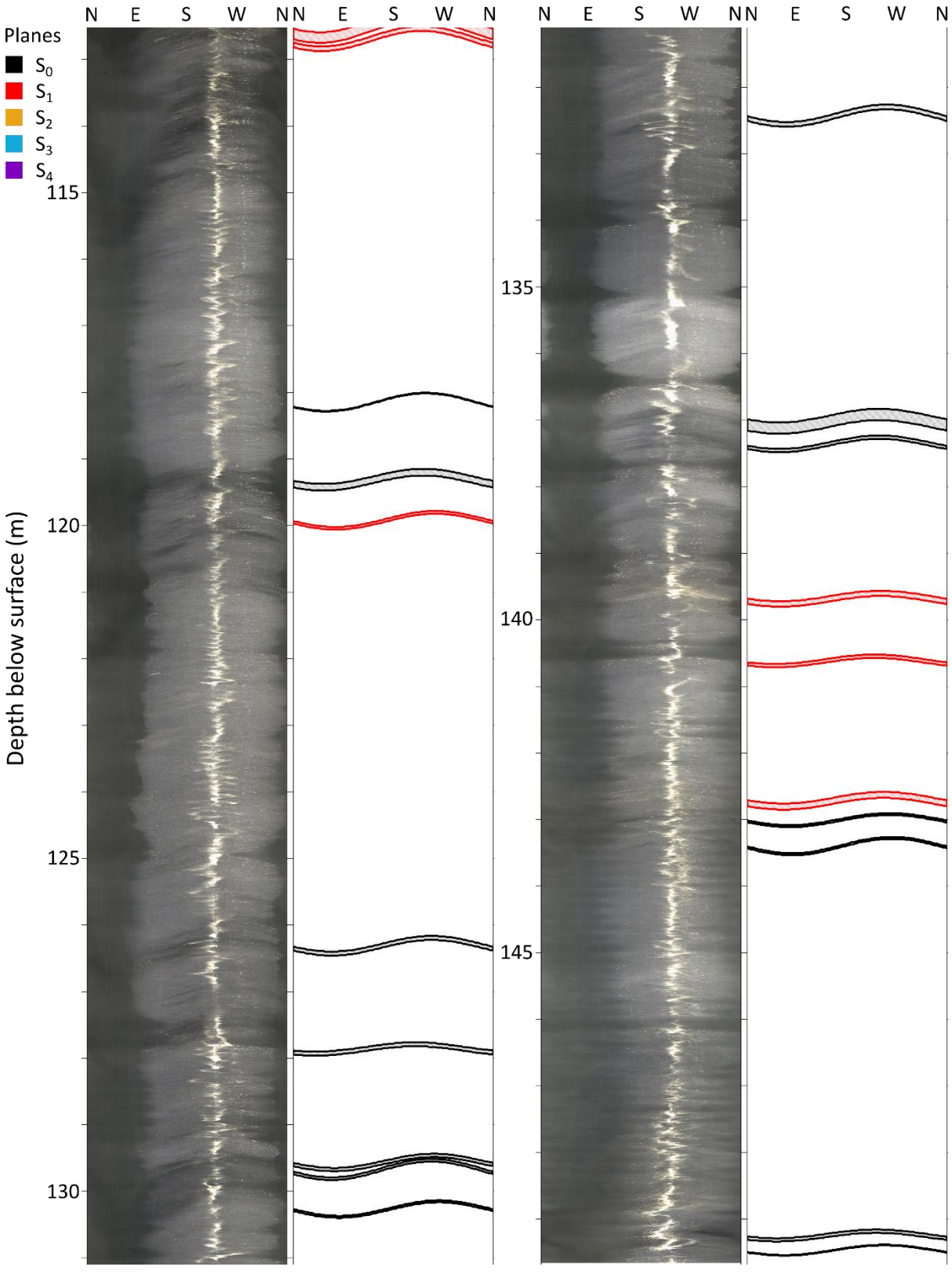

Figure S3. ***(cont.)***

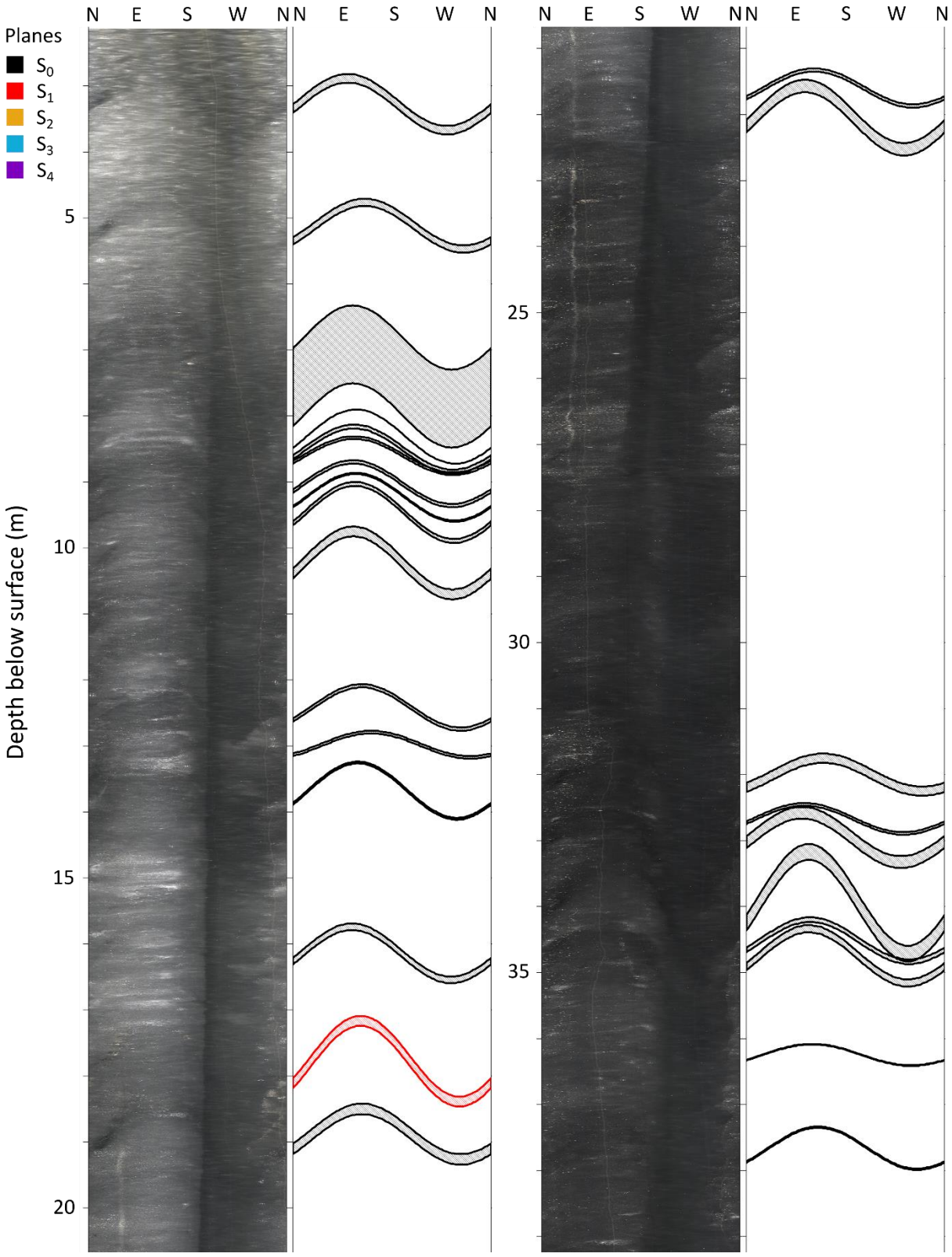

Figure S4. Raw, up-direction OPTV image log and log classifications at Site 4. Black delineated sinusoids are primary stratification (S_0) and red delineated sinusoids are debris-rich layers (S_1). Log sections are unrolled to progress North-East-South-West-North from left to right. The uppermost ~2 m was not logged as this is the length of probe above the camera. Saturated vertical reflections and dark vertical traces are superficial artefacts from the drilling process.

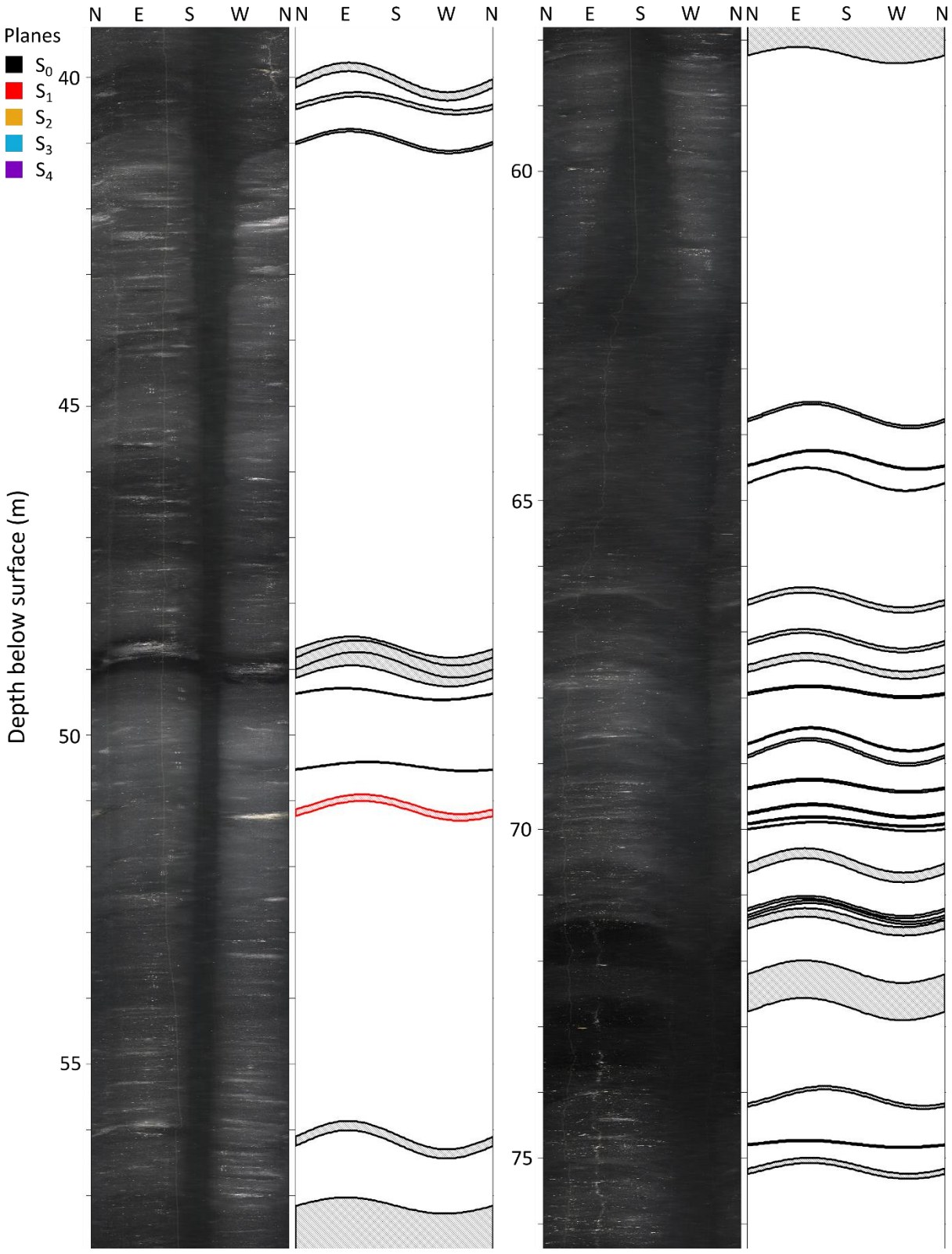

Figure S4. ***(cont.)***

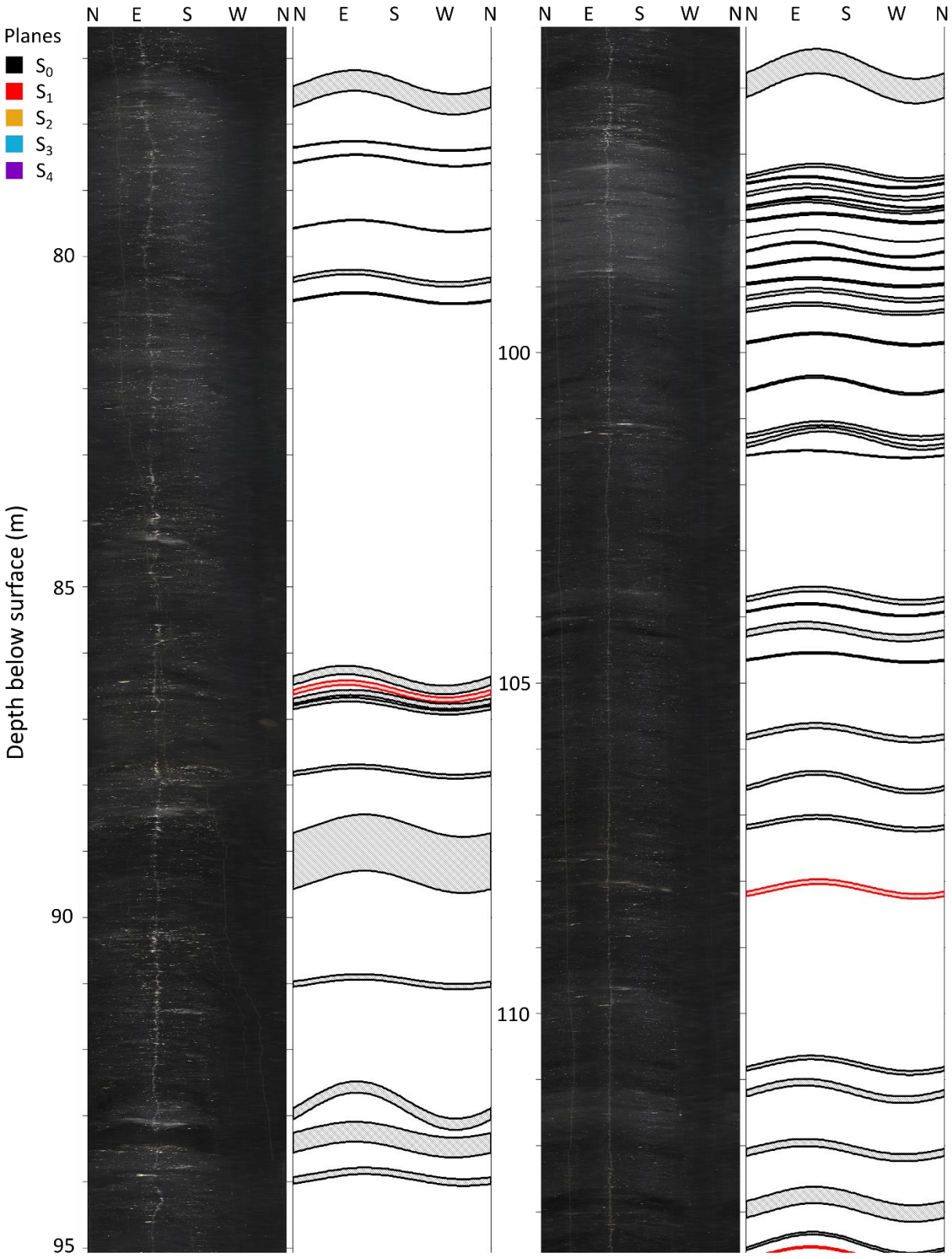

Figure S4. ***(cont.)***

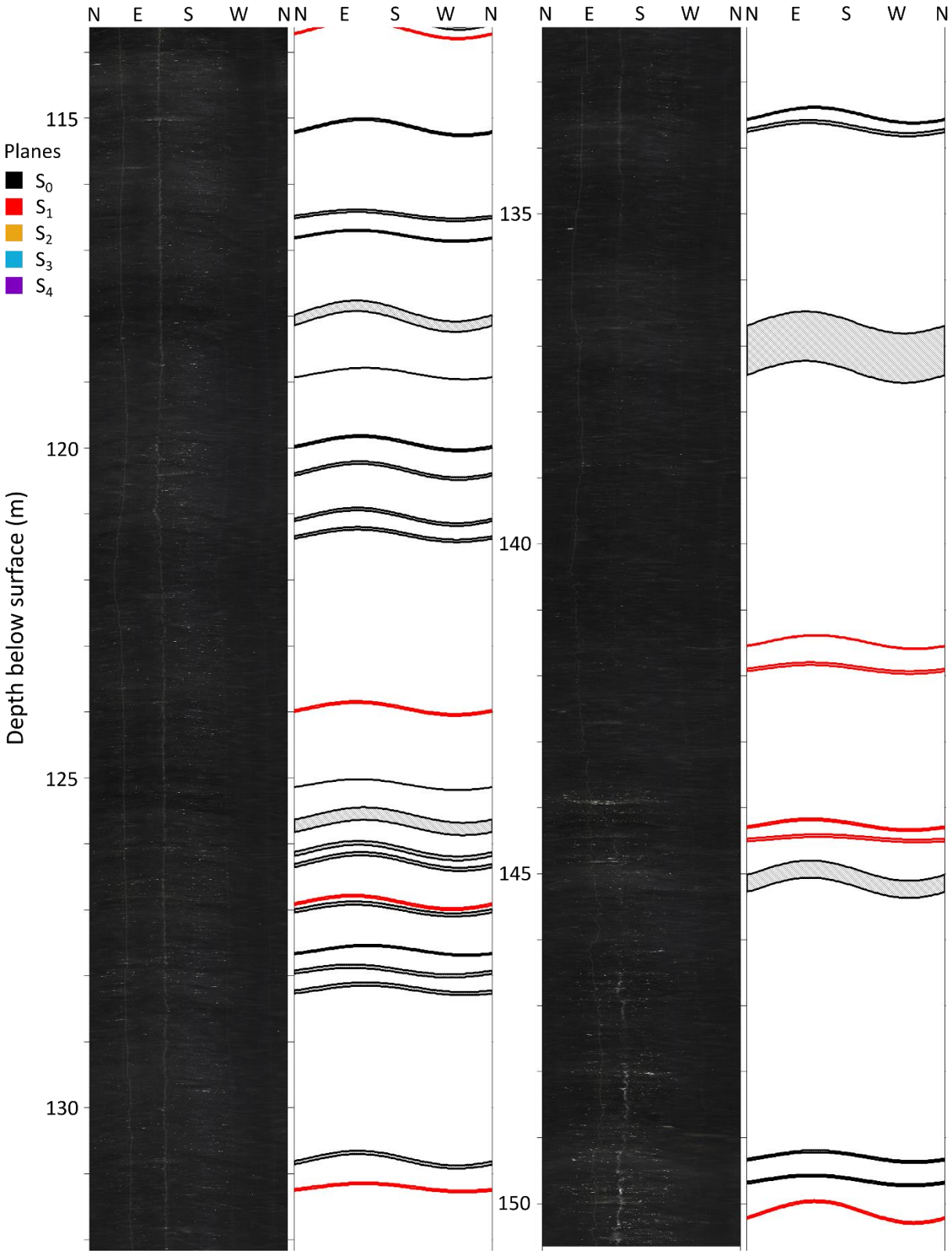

Figure S4. ***(cont.)***

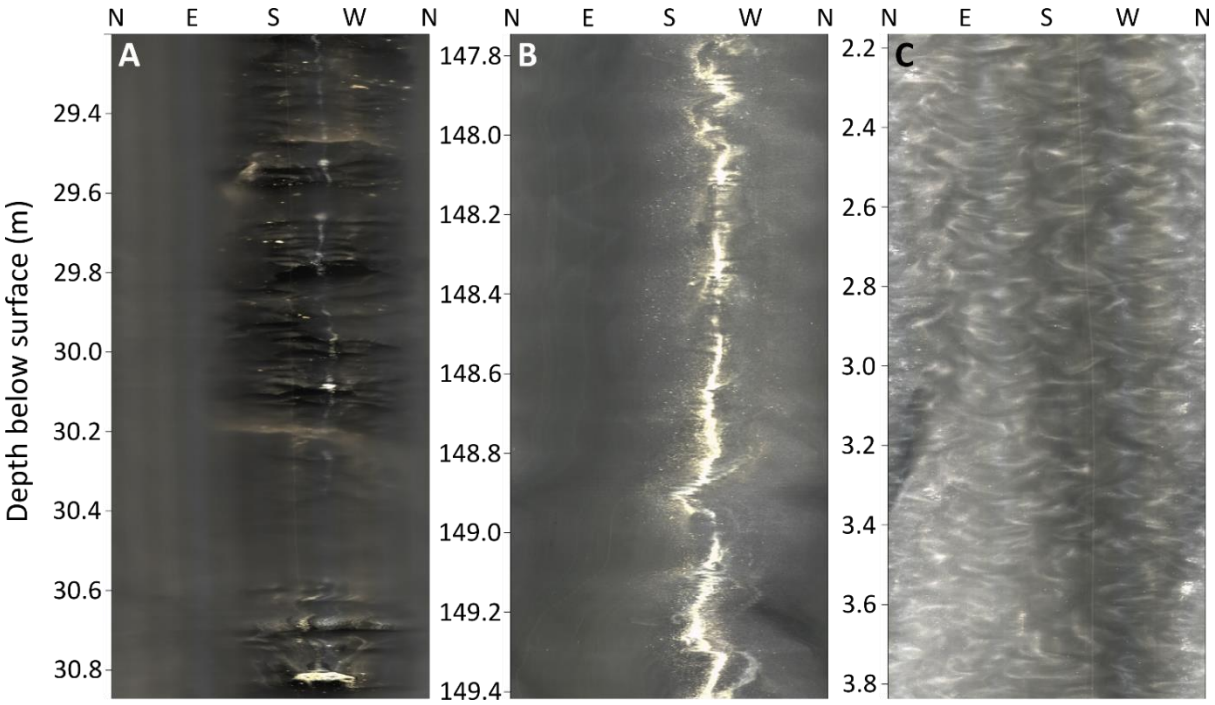

Figure S5. Example sections of image logs where turbid water obscures the borehole walls. A) Site 1, with borehole walls obscured from N-SE for the whole section, and across the full image width in thin layers throughout and completely from 30.2–30.6 m, thought to be a result of variable borehole width from slow drilling rates (Miles and others, 2019); **B)** Site 3, with borehole walls obscured from N-SE and NW-N, again in pulses due to variable drilling; and **C)** Site 4, with the full image width obscured by cloudy, patterned turbid water. All logs are unrolled to progress North-East-South-West-North from left to right. Note the differing scales between the panels. Saturated vertical reflections and dark vertical traces are superficial artefacts from the drilling process; all other bright reflections are debris clasts.

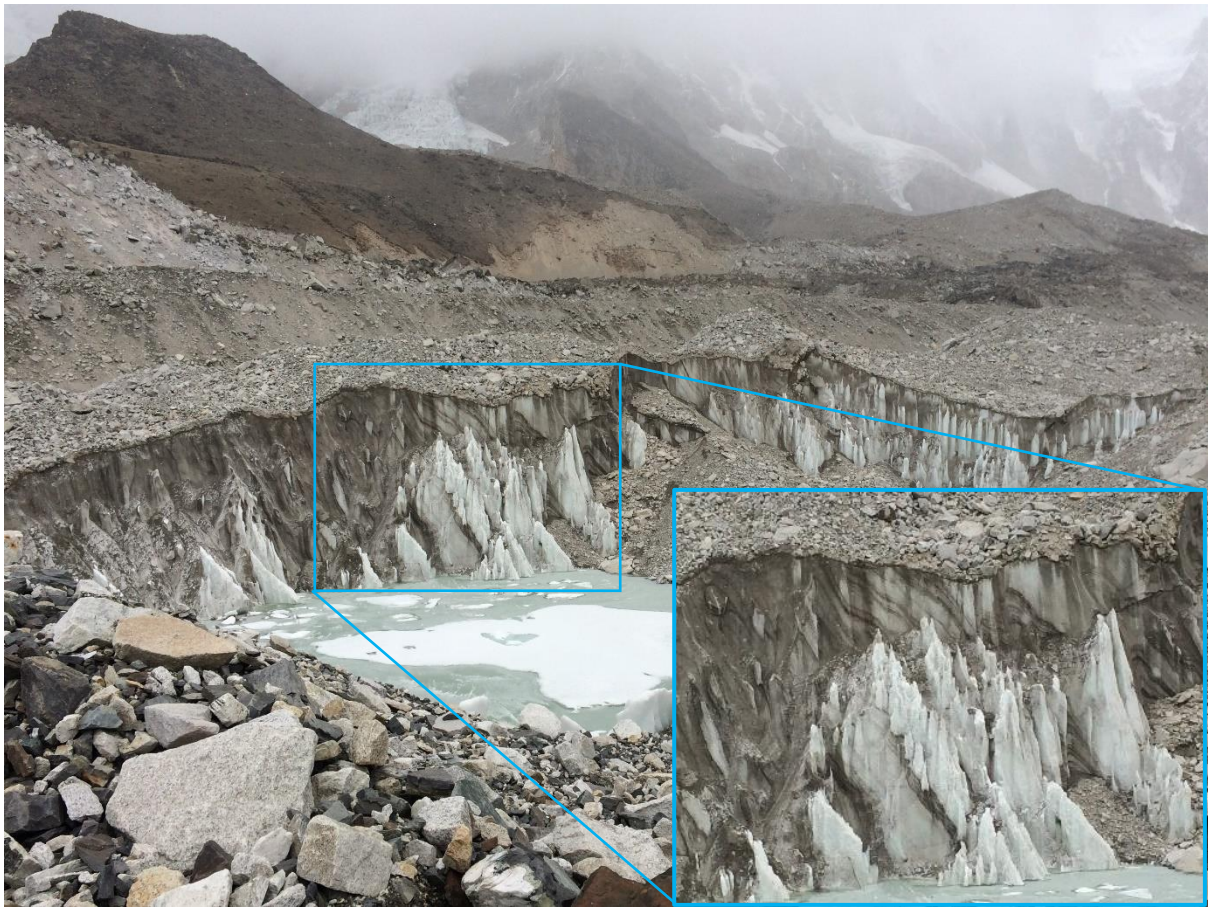

Figure S6. Image of dipping debris planes in an ice cliff face on Khumbu Glacier, Nepal, enlarged in the inset. Image was taken on the glacier close to Site 3, looking north.

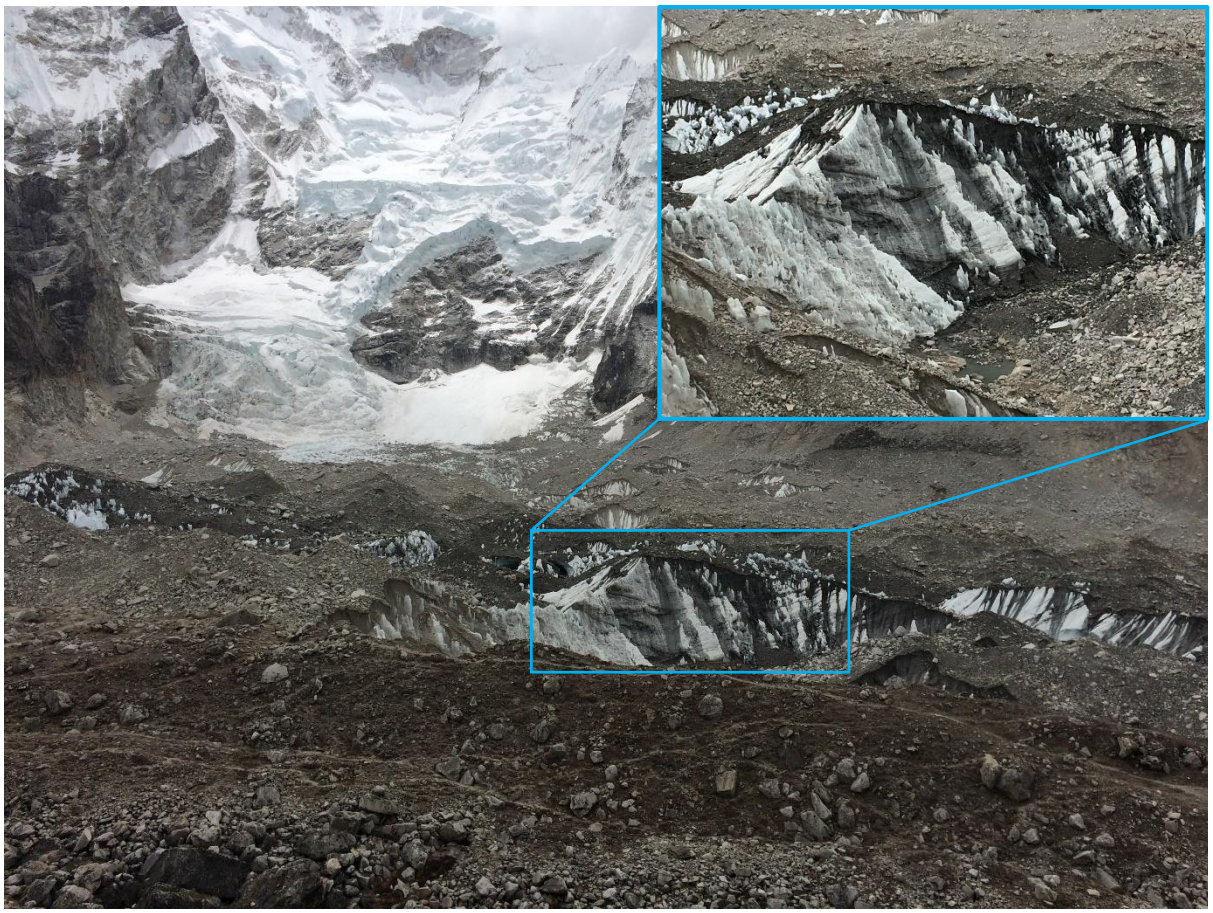

Figure S7. Image of a folded debris plane in a clean ice cliff face on Khumbu Glacier, Nepal, enlarged in the inset. Image is taken from the true-right outer moraine of Khumbu Glacier, between Sites 2 and 3, looking towards the south-east and the southern extent of the Nuptse basin flow unit.