2. Surface Conditions of the Ice Sheet Traversed in 1974 - 1975

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The relief and slope of the ice sheet surface were observed along the routes traversed in 1974 - 1975. They are related with each other depending on the trends of the prevailing winds on the ice sheet. Similar observations were carried out in the areas traversed in 1969 - 1970 and 1970 - 1971 (Watanabe and Ageta, 1972).

2.1. Relief of the ice sheet surface

Excepting a glazed surface, almost the entire surface of the Antarctic ice sheet is covered with such relief as dunes and sastrugi, reflecting climatic conditions such as the snow accumulation rate and katabatic wind characteristics at given place.

Since the relief is formed by the depositional and/or erosional action of wind, it can be classified into two major types: dune formed by deposition of drifting snow, and sastrugi caused by erosion of pre-existing dunes. Also, the long axis of both dune and sastrugi is presumed parallel to the direction of the wind which is the cause of their formation. The mechanism of the formation of these two types of surface relief was clarified by the studies of their structures.

Morphology of the surface along the traverse routes was recorded completely by referring to stratigraphic analyses, and the observation results will be presented elsewhere.

2.2. Measurements of direction of surface relief

The directions of the long axis of the sastrugi and dune are shown in Table 1. Often two or three directions were found at a station. Same data collected along the route to the Yamato Mountains in 1973 - 1974 (Observer: Shun'ichi Kobayashi) are shown in Table 2.

In these tables, both erosional and depositional surface reliefs are classified according to the category adopted by each observer. In Table 1, the directions of sastrugi, dune and erosional pit are given with remarks showing characteristics of occurence and form. In Table 2, erosional and depositional relief are classified into six categories; sastrugi, giant sastrugi and erosional pit (erosional) and barchan, dune and drift (depositional). The directions of these surface relief are given in terms of degree in true.

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2.3. Surface slope

Measurements of surface slope of the ice sheet were carried out along Routes H, I and J at 15-20 km intervals when visibility permitted. By means of a Wild T-2 theodolite, vertical angle of the surface against the theodolite horizontal plane was read for 8 directions starting from the magnetic north. The accuracy of angle readings was one minute. The maximum and the minimum inclinations of the horizon of the ice sheet and their azimuths are given in Table 3. Multiple maximum and minimum values on inclination, and/or disagreement of the downhill axis with the uphill were obtained when the surface topography was not simple. The mean direction of the surface slope was estimated from the distribution pattern of inclination around a station. The mean direction of a surface slope in Table 3 indicates the downward direction. The distribution of slope direction is shown in Fig. 1, where data obtained in a period from 1970 to 1974 are included. According to Fig. 1 the observed area can be divided broadly into three major subareas which are related to the drainage systems of the ice sheet.

Reference

Watanabe, O. and Ageta, Y. (1972): Surface condition of the ice sheet in the Mizuho Plateau - West Enderby Land area, East Antarctica, 1969-1971. JARE Data Rep., **17** (Glaciol.), 48-76.

Table 1. Direction of surface relief along Routes Y', I and J in 1974.

*: predominant distribution, +: older formation

(Degress true)

Station number	Elevation (m)	Direction of erosional relief				Direction of depostional relief		
		Sastrugi I	Sastrugi II	Sastrugi III	Erosion pit	Dune I	Dune II	Dune III
Y 5	2263	90				65		
10	2283	85				60		
15	2310	90				70		
20	2333	85						
25	2347	89				59		
30	2375	89				59		
35	2403	89				69		
40	2420	84				69		
45	2433	94				69		
50	2456	94				79		
55	2477	99				64		
65	2505	98				68		
70	2524	98				78		
75	2539	98				68		
80	2551	100				63		
85	2572	108				73		
90	2584	98				63		
95	2596	108				78		
105	2623	100				78		
110	2640	97				67		
115	2650	97				72		
120	2664	97				77		
125	2670	97				77		
130	2683	97				77		
135	2705	97				77		
140	2716	102						
145	2736	102				77		
155	2763	107				77		
160	2768	102				77		
165	2780	108				76		

(Degress true)

Station number	Elevation (m)	Direction of erosional relief				Direction of depostional relief		
			Sastrugi		Erosion		Dune	
		I	II	III	pit	I	II	III
Y 170	2781	108						
175	2830	106				76		
180	2838	104				76		
185	2839	111				86		
190	2870	116				86	118	
195	2876	116						
200	2880	116				86		
205	2874	106	121					
(I Route)								
I 10	2890	106*	126			81*	126	
30	2917	106	128			91*	146	
40	2934	106	116*			76+ — 86	136*	
50	2943	100	114 — 118			86	118 — 126	
60	2968	116				96*	136	
70	2977	120				90	145	
80	3000	107 — 110	127*			85*	140	
90	3009	110	120	135		85*	135 — 145	
100	3026	95	120*			75	145*	
110	3040	115*				80 — 85		
120	3058	95 — 105	125			85	135	
130	3086	120	135*			85* — 95	145+	

(Degress true)

Station number	Elevation (m)	Direction of erosional relief				Direction of depostional relief		
		Sastrugi I	Sastrugi II	Sastrugi III	Erosion pit	Dune I	Dune II	Dune III
I 140	3105	95*	135	105 × 135		115	165	
150	3121	105			135	95+	145	
160	3134	135			120	85+	125	
170	3162	130 — 135				80+	125	
180	3166	115	145			80	135	
190	3166	95	125* — 135			125		
200	3176	95	135*			95	135+	
210	3184	95	125	130		95	135‡	
220	3174	100 — 105	130+ — 135			95		
230	3197	105	125	140+ — 145	173	105	140+	
240	3203	102	110	122 — 144	134	84 — 94	134	154+
250	3211	94* — 104	134+ — 144			89 — 99	124 — 134	
260	3219	96 — 106	140+ — 149	159	154	89 — 99	134	
270	3222	119 — 124	139 — 144	149 — 154		94	144	
280	3240	134	146 — 149			99* — 104	144+	
290	3246	102 — 104	154 — 156		139	94	124	159
300	3266	104	154		124 — 139 — 144	104	119	

(Degress true)

Station number	Elevation (m)	Direction of erosional relief				Direction of depostional relief		
			Sastrugi		Erosion pit		Dune	
		I	II	III		I	II	III
I 310	3271	104 — 109	119 — 124	154	129	104	154+	
320	3284	109	154		124	104* — 109	149 — 154	
330	3284	119 — 129	139 — 149		129	124*	134	
340	3290	106	149 — 154		149	99 — 104	134 — 139	
350	3299	119	144 — 149	154	139 — 142 154	139 — 144		
360	3308	109 — 114	144 — 149		134 — 139 149	104	139+ — 144	
370	3312	119 — 124	154			119*	169+	
380	3322	123 — 128	143 — 153		135	118		
390	3328	123 — 128	158 — 163			123* — 128		
400	3329	133 — 138	143 — 148			108*	118	
410	3333	126	158 — 163			128 — 133		
420	3355	113 — 123	158		163	123 — 133	158+	
430	3362	133	163 — 168		163 — 168	123 — 133		

(Degress true)

Station number	Elevation (m)	Direction of erosional relief				Direction of depostional relief		
		Sastrugi			Erosion pit	Dune		
		I	II	III		I	II	III
I 440	3369	128 — 138	163 — 168			138*		
450	3362	123 — 133	163			133	163	
460	3369	133	158			128	138	
470	3365	137	157 — 162			137 — 142		
480	3380	137 — 142	152* — 162	172	182	137*	177 — 182	
500	3385	157	182	192 — 197	147	142 — 147	187 — 192	
515		147 — 152	177 — 182		190	147 — 152	192 — 197	
530	3403	147 — 152	162	172 — 177	177	147 — 152	182	
545		157	177					
555		162	182 — 192		197	157 — 162	187 — 192	
570	3406	156	190 — 192		192 — 194	157	182	
585		172	202		207	152	207 — 212	
(J Route)								
J 10	3307	124	144		134	109* — 119	154+	
					149			
20	3350	119	169 — 174		149	99	144	

(Degress true)

Station number	Elevation (m)	Direction of erosional relief				Direction of depostional relief		
		Sastrugi			Erosion pit	Dune		
		I	II	III		I	II	III
J 30	3304	114	134 — 139	149	144 — 149	119+ — 124	149	
40	3302	119	144* — 149		134 — 144	114*	134	
50	3299	114	139 — 149		144 — 149	104	159	
60	3290	105	145		135 — 145	105*	155 — 160	
70	3279	105	120	130 — 135	130 — 135	105	125 — 130	
80		105	135		135	105+	130+	145
90		110	130	150	130	105	120	
100	3245	95	150		140	95*	125	
110	3229	100 — 105	140 — 145		125 — 135	100*‡	120	
120	3213	101	136		121 — 126	101 — 106		
130		126 — 131	151	111 × 136	136	106		
140	3186	121 — 126	146 — 151		131	96* — 101	116	
150	3176	96	106	131 — 136	131	96*	106	
160	3155	101	131+		131	86	111	126
170	3151	106	146		111 — 141 — 151	106*		

(Degress true)

Station number	Elevation (m)	Direction of erosional relief				Direction of depostional relief		
		Sastrugi I	Sastrugi II	Sastrugi III	Erosion pit	Dune I	Dune II	Dune III
J 190	3126	116	126*		121 — 126	81		
200	3107	111	116 — 121		116	76	121 — 126	
210	3085	102	117	133 — 137	122	117		
220	3041	112 — 117	127		122 — 127	102 — 107		
230	3034	117			112	87	132	
240	2987	112	122*			92		
250	2962	117				87		
260	2904	117				97		
270	2886	102	122	132		102*	117	127 — 132
280	2856	116 — 118				78	98 — 108	
290	2849	103	123			73 — 78		
300	2798	113 — 118						
310	2797	113	118 — 123			88		
320	2783	108	118			83		
330	2741	118				78	118	
340	2697	108 — 118				103		
350	2667	107 — 111				64 — 69	89	

(Degress true)

Station number	Elevation (m)	Direction of erosional relief				Direction of depostional relief		
		Sastrugi			Erosion pit	Dune		
		I	II	III		I	II	III
J 360	2637	109	119		109	79 — 84	129	
370	2603	109				79		
380	2565	104	109			84		
390	2551	107 — 109				84		
400	2523	104				84	94	
420	2484	107 — 109				79 — 81	84	
430	2455	84	99			74		
440	2431	98 — 100				85		
450	2386	90	112		90	82		
470		85	102			80		
480	2348	95				70		

Table 2. Direction of surface relief along Routes S, H, Z, X, A and C in 1973 - 1974. (Degress true)

Station number	Elevation (m)	Direction of erosional relief			Direction of depositional relief		
		Sastrugi	Giant sastrugi	Erosion pit	Barchan	Dune	Drift
S 16	554	83					
23	788	77					
H 30		108			108		
35		68					
49		90					
88		78					93
101	1309			83			63
116	1341	97					52
146	1425		92	102			
170		82		77	70		
210		82		82			57
255		105					45
258	1742	62					72
297		105					30
302	1898	90				45	
S 122	1910	91	79			53	
Z 11	1978	86		91			
25	2031	60					
26	2036		63	71			
30	2056	105				75	
32-1		123		101		36,49	
37	2074		105			75	
39	2084					41	
40	2083			96			
57	2090		76			21	
74	2163			106		41	
79	2161	75					
82	2161			101		49	
89	2172	80				80	
92	2181	110				35	
101	2202		100			50	

(Degress true)

Station number	Elevation (m)	Direction of erosional relief			Direction of depositional relief		
		Sastrugi	Giant sastrugi	Erosion pit	Barchan	Dune	Drift
X 6	2169	90,100				40	
10	2151	100				40	
14	2123	100				15	
20		115		115			75
C 146	2077			101		81	
140	2050			95			
135	2046	95		95			
130	2026	100		105			
123	2041		100-105				
117	1952		110				
115	1978		110				
110	1937	102					
105	1884	112					
100	1871	102					
98	1872	112					
95	1844	90					
90	1850	100					
84	1841	105					
81	1815	100	120				
75	1797	120		115			
70	1795			120			
66	1789	115					
66	1777	110					
56	1793	115					
54	1811	110					
50	1844	115					
48	1841	120					
45	1847	115					
43	1856	120		120			
40	1861	115					
38	1854					105	

(Degress true)

Station number	Elevation (m)	Direction of erosional relief			Direction of depositional relief		
		Sastrugi	Giant sastrugi	Erosion pit	Barchan	Dune	Drift
C 37	1853			125			
35	1849	120		120			
30	1840	115		115			
25	1830	115					
20	1812	115					
15	1811	115					
10	1816	125-115					
A 004	2317	100					
021		100					
030		105					
034		120-105					
038		105				75	
042		110					
050	2453	110					
054		105					
060		100					
066		113				93	
070		135				105	
072		110					
078		113					
083	2478	115					
084			117			97	
088		107					
094		112				72	
098		107					
101	2517	115					
102		112					
110		112					
122		112					
134		91					
137	2557	105					

(Degress true)

Station number	Elevation (m)	Direction of erosional relief			Direction of depositional relief		
		Sastrugi	Giant sastrugi	Erosion pit	Barchan	Dune	Drift
A 138		111					
146		113				86	
147		115					
154		106				71	
157		120					
161		85					
S 240	2639	100					
239	2628	105				75	
235	2582	105				85	
230	1554	110				90	
225	2510	105				85	
220	2458	105				80	
215	2422	105				80	
210	2380	100				75	
205	2351	105				85	
200	2309	105				85	
195	2256	90				80	
190	2228	100				75	
185	2162	98				72	
182	2148	105				90	
174	2066	100				75	
171	2074		104			69	
112	1790	85				60	
84	1563	90				63	
45	1220	95					

Table 3. Surface slope along Routes H. I and J.
A positive/negative sign of inclination
indicates an angle of elevation/depression.

Station number	Surface slope				Mean direction (Degrees true)
	Downhill		Uphill		
	Direction (Degrees true)	Inclination (Minutes)	Direction (Degrees true)	Inclination (Minutes)	
H 100	269	−32	134	+62	269
120	269	−20	89	+36	269
140	269,313	−16	89	+38	313
180	358	−15	133	+14	358
200	343	−17	103	+20	313
220	313	−15	88,133	+22	313
230	312	−16	87	+24	312
240	312	−18	——	——	312
280	357	−11	177	+40	357
I 20	351	−12	126	+ 7	332
35	261,306	− 8	81	+ 4	261
60	306	− 9	216	+ 5	351
75	305	−12	170	+11	350
100	260	−11	125	+14	305
115	305	−10	170	+ 9	350
140	305	− 7	125	+ 6	305
155	305,350	− 7	170	+ 6	350
220	350	− 2	215	+14	12
235	350	− 3	170,215	+ 5	12
260	349	−13	214	+ 6	12
275	349	− 7	169	+ 4	349
338	34	− 6	214	− 2	64
355	79	− 8	259	+ 1	64
380	78	− 5	258	+ 3	56
390	78	− 6	213,258	+ 4	56
420	33	− 8	213	+ 3	33
440	33	− 6	258	+0.3	56

Station number	Surface slope				Mean direction (Degrees true)
	Downhill		Uphill		
	Direction (Degrees true)	Inclination (Minutes)	Direction (Degrees true)	Inclination (Minutes)	
I 460	78	− 5	258	-0.5	78
485	77	− 7	212	+ 4	55
515	32	− 8	257	+ 2	55
540	257	+ 1	347	+ 7	257
570	32	− 6	257	+ 2	75
600	347	− 6	122	+ 4	347
J 20	34	− 7	259	+ 7	34
45	349	− 3	169	+ 5	349
70	305	− 6	125	+ 1	331
95	305	− 5	125	+ 5	305
120	81	−10	261	+ 2	81
140	351	− 8	171	+ 2	351
180	306	− 9	171	+ 7	336
210	352	− 5	172	+ 6	352
230	37	−13	172	+ 2	352
250	307	−17	172	+ 8	352
275	38	−12	173	+10	353
290	308	−19	173	+11	328
310	308	− 2	173	+12	353
320	353	−14	128	+13	308
330	353	−16	173	+10	353
350	354	−11	129	+ 8	337
370	354	−19	129	+ 9	309
390	309	−15	129	+ 7	309
408	309	− 7	129	+13	309
430	309	−15	174	+12	331
450	310	− 6	130	+25	330
460	310	−10	175	+10	330
480	265	−14	130	+10	310

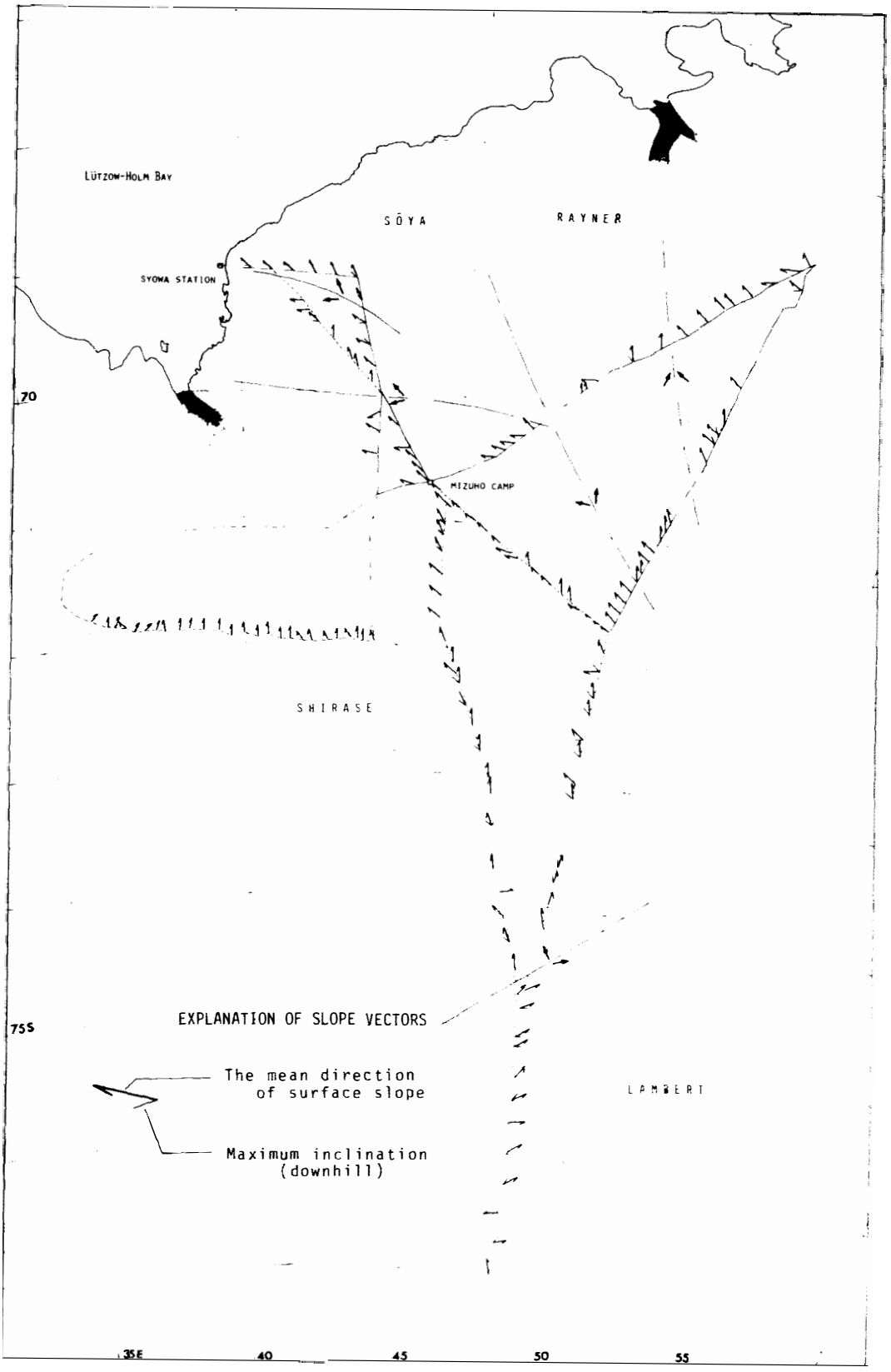

Fig. 1. Distribution of surface slope in Mizuho Plateau.