

The Strand Flat of Spitsbergen.

By W. Werenskiold.

An almost level plain stretches along the west coast of West Spitsbergen, from South Cape (Sørkapp) to well north of Cross Bay (Krossfjorden), with varying breadth, from 200 m to 10 km. The same flat rim continues along the shores of the fiords, more or less well developed.

I have visited these parts several times during the summers of 1917, 1918, 1919, 1923, working as geologist and topographer — living in tents, rowing in small boats from place to place. There are no harbours on the outer coast — only rocks and small skerries; the problem is to get on shore and off shore through the surf. All went well, however.

In 1919 (Dr) Orvin and I made a preliminary survey of the district between Horn Sound and Bell Sound, which was practically unknown. Next year I worked in the same area as topographer; but not till now (1952) has the topographical map been finished, in a scale of 1:50000, based on aerial photos. In 1919 I partook in the investigations of the land to the south of Horn Sound.

I shall here make some remarks on the strand flat to the south of Bell Sound.

The strand flat is well developed along the coasts of the South Cape Land; here are peculiar conditions, however, which will be mentioned later.

A great glacier (Olsok-bre) enters the sea about half way between South Cape and Horn Sound. Close to the northern border of this ice-front, a hill named Mt Hilmar rises to a height of 825 m.

Farther to the north the strand flat extends in varying breadth to the mouth of Horn Sound. The rock is sandstone, shales, lime-

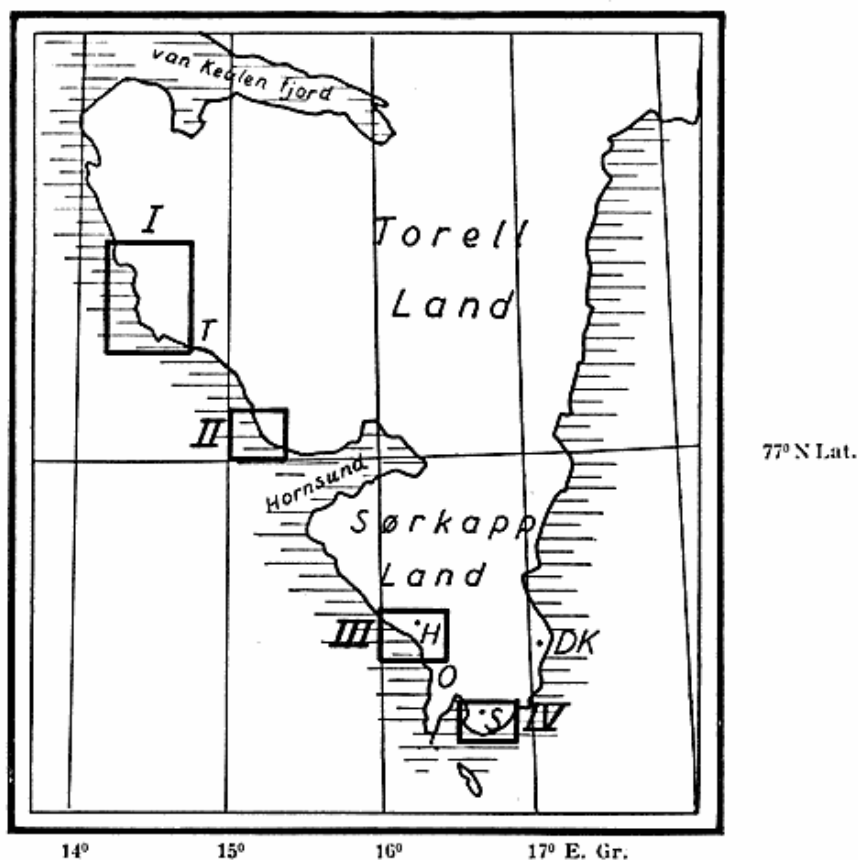


Fig. 1. Sketch map of part of West Spitsbergen, from Bell Sound to South Cape (Sørkapp).
 T: Torell Glacier. D: Dunøyane. H: Hilmar. O: Olsol Gl. S: Sørkapp Fjell.
 DK: Dummer Kerl (Dumskolten).

stone, belonging to the Hecla Hoek system (Cambrian), and farther north, sandstones belonging to the Carboniferous system (Kulm).

Several faults cut through the plain, but these have no direct bearing upon the formation of the strand flat.

To the north of Horn Sound, there is first an area of hard metamorphic rocks, amphibolites and gneisses, with a narrow coastal plain, for a distance of about 10 km. Then follows an inaccessible stretch, low muddy flats with many shifting streams, issuing from the margin of the great S. Torell Glacier, a kind of "Malaspina" type. The glacier enters the sea with a vertical cliff, 40—50 m high, for a distance of 6 km. Then follows a flat, wet delta between the two glaciers, about 3 km; farther to the north west the ice cliff of North Torell Glacier stretches for a new distance of 6 km. Outside this coast, the sea is very shallow, with muddy flats and banks. A group of small islands, Down Islands (Dunøyane), lie off the southern part of the coast, and the Ice Islands (Isøyane) just off

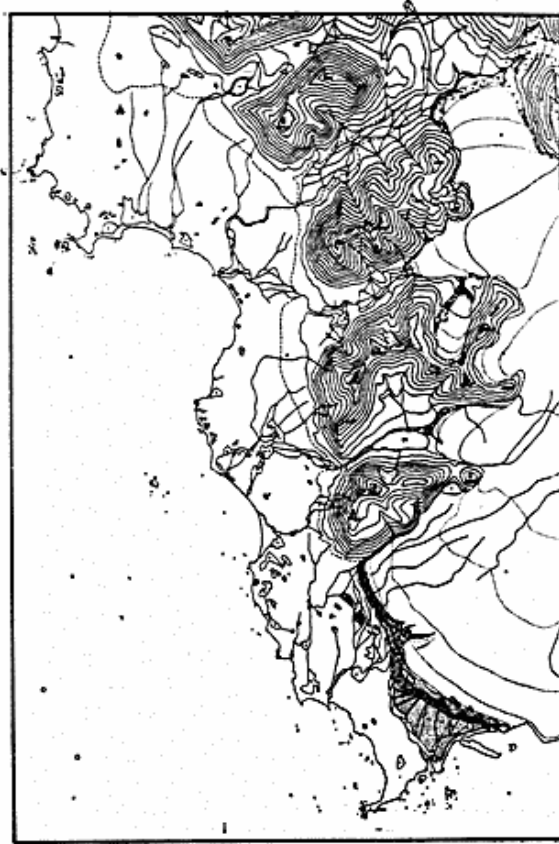


Fig. 2. 1. Coast of W. Spitsbergen, between $77^{\circ} 10'$ and $77^{\circ} 20'$. Scale 1: 200000, contour interval 50 m. — Norsk Polar-Institut.

the above mentioned delta between the two Torell glaciers. These islands are built up of limestone.

To the north of Torell Glacier follow the broader strand flat, 2 to 5 km in breadth, to the mouth of Bell Sound.

I shall now give a more detailed account of these strand flats, beginning with the last mentioned district between Bell Sound and the Torell glaciers.

The strand flat is to a great extent covered with shingle and gravel, that form a great many raised beaches; but the rock is peeping through the cover at many places. The platform has been abraded in solid rock.

The coast-line shows many bays and capes. The capes generally consist of hard quartzitic rocks, the smaller or broader bays have been formed on layers of softer rocks, all belonging to the Hecla Hoek series.

Low ridges of quartzite run across the plain, following the strike of the beds, NW-SE; at the coast these hard ribs project in steep

caples, and they continue in long rows of rocks and skerries. At the caples the cliffs are almost vertical, about 8 m high; along the base a rocky ledge appears at low tide, some two metres broad.

The sea off the coast is shallow for a great distance, with many rocks and small skerries.

Behind the bays lagoons are generally found, separated from the sea by raised beach ridge. These lagoons are situated some metres

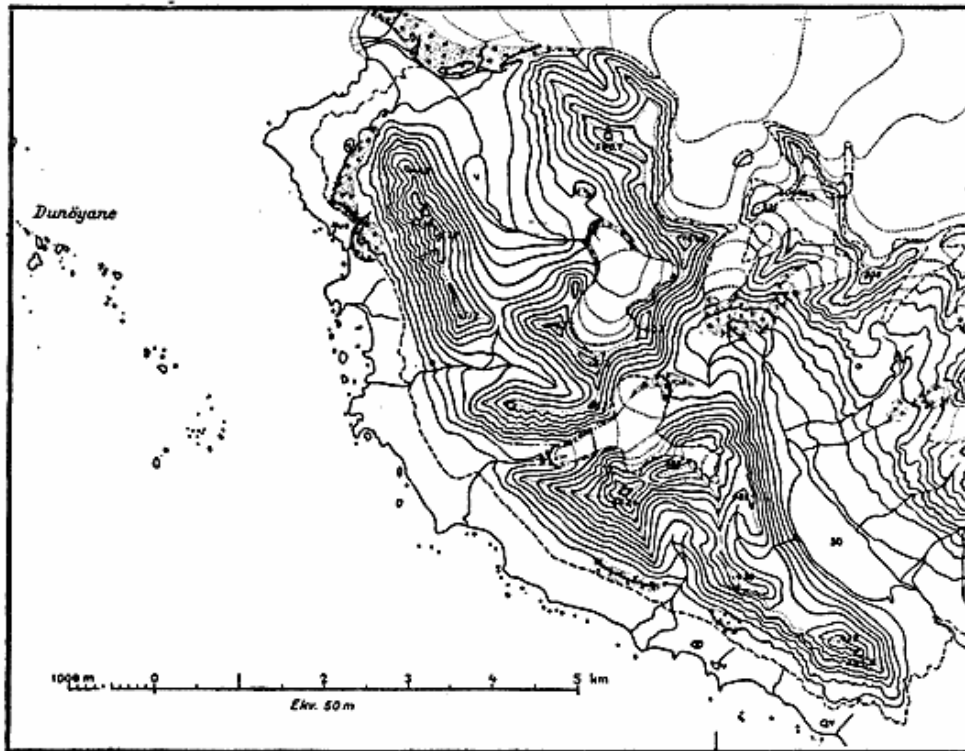


Fig. 3. II. Coast of W. Spitsbergen, north of Horn Sound. Lower border of map, 77° N Lat. Scale 1:100000, contour interval 50 m. — Norsk Polar-Institut.

above sea level and have fresh water, as a result of a recent relative uplift of the land.

The plain is dotted with shallow lakes; brooks and rivers often run parallel to the coast for long distances owing to the blockade by raised beaches.

The strand flat rises from 8 m to a height of about 20 m. It shows no vestiges of ice erosion, except at the outermost promontories — at Cape Klaveness we (A. Hoel and I) found typical glaciated rocks, striae etc. on the quartzite. The strand flat has obviously been glaciated some time, but the action of the sea has obliterated all signs of glaciation, except those mentioned.

The strand flat is bordered by a mountain ridge, a wall rising to heights of about 600 m; but the ridge is cut through by several valleys, that offer passages to the inland ice behind; and from this extensive ice field separate tongues lead down into the back ground of all these valleys.

The valleys are all to a certain degree "hanging" in relation to

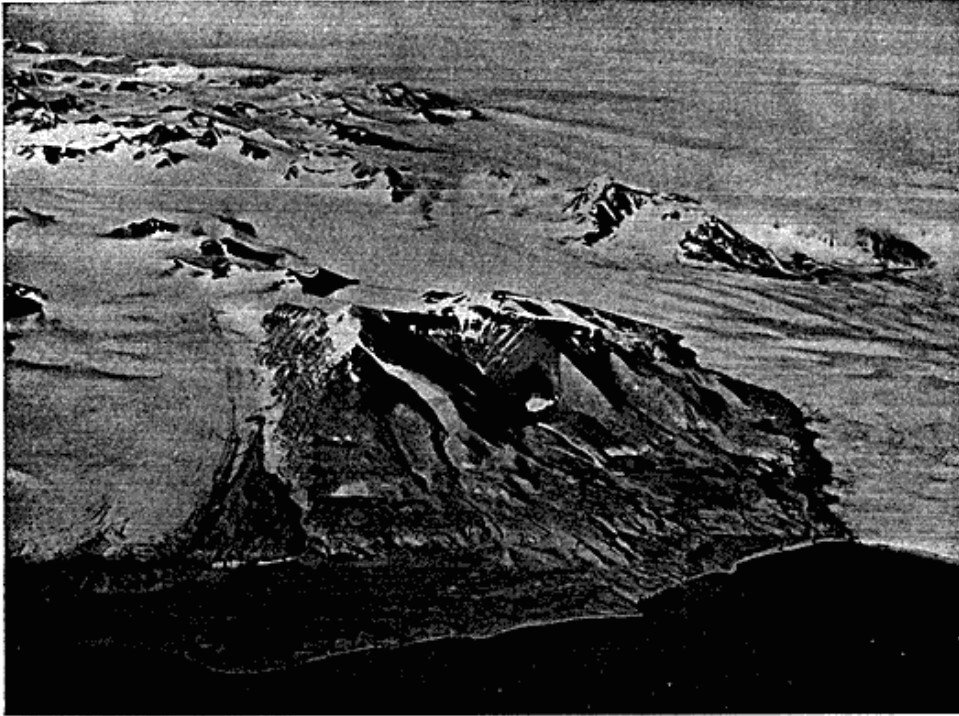


Fig. 4. West coast of West Spitsbergen, 15 km to the North of South Cape. Olsok Gl. to the right. Left centre, Mt. Hilmar, 825 m. Flat-lying triassic beds on top, brown sandstone; below, light grey limestone, Hecla Hoek series. Flat low coastal plain; abrasion cliffs rising from 20 to 80 m; broad platform abutting against older cliffs, 185 to 225 m. Uppermost, a ledge, 334 m above sea level, with numerous round boulders. — Air photo by Bernhard Luncke, of the Norwegian Polar Institute.

the strand flat. The rivers have cut down narrow gorges through the steps that lead from the flat valley floors down to the costal plain. In the southernmost valley, (Brevassdalen) there is still a lake, 97 m above sea level. In the next valley (Turrvassdalen, meaning Dry Lake Valley) a lake has been drained by the down-cutting of the outlet; the flat former lake bottom is absolutely bare, with steep beaches, showing that the draining has been quite recent.

These facts show that the strand flat has been formed before the last glaciation; but on these rather soft rocks the sea has later

on abraded into the foot of the hills, along the inner border, so effectively that the valleys became "hanging". Then the sea has retired, and left a number of raised beaches all over the flat.

To the south of Horn Sound, the structure of the strand flat is more complicated. I have measured a profile from the sea just to the north of Olsok Glacier, towards Mt Hilmar (825 m).

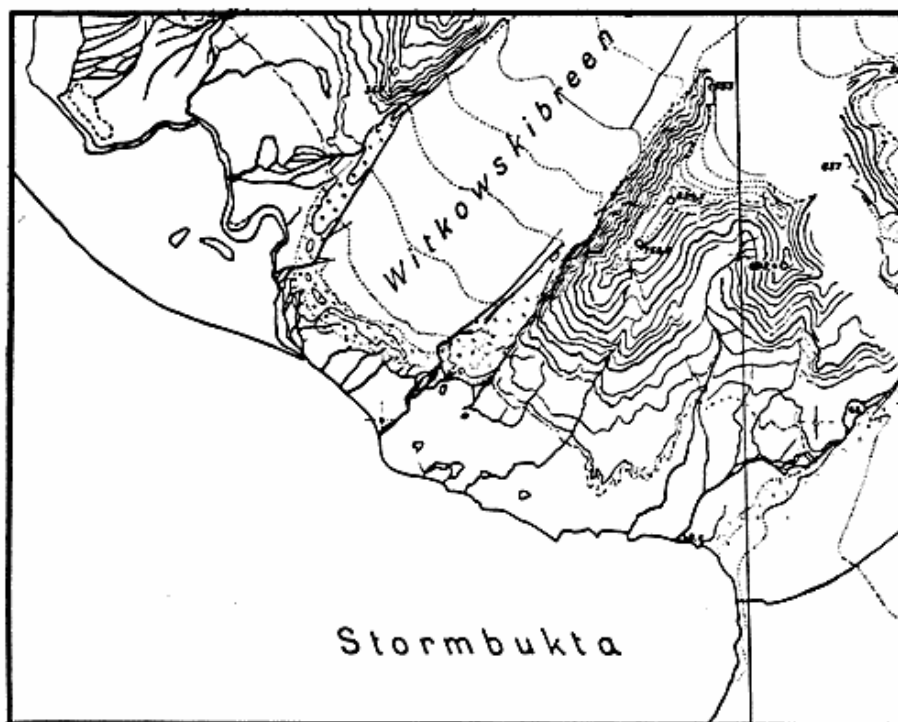


Fig. 5. III. Coast of W. Spitsbergen. Lower border of map, $76^{\circ} 40'$ N Lat. Scale 1: 100000, contour interval 50 m. — Norsk Polar-Institut. O: Olsok Glacier. Mt. Hilmar in right centre.

First, there is a steep cliff, 8 m high; a flat plain, 450 m broad, rises gradually to a height of 20 m above sea level. Then comes a steep slope with typical abrasion forms, precipitous headlands and narrow clefts, leading up to another plain, which rises from 80 m above sea level, at the outer rim, to 120 m along the inner border. This plain is 700 m broad, and not so flat as the lowermost. It is spread with rounded boulders of red sandstone — the rock below is limestone.

The next step leads up to a ledge, 300 m broad, 185 m above sea level along the outer edge, 225 m at the inner border.

The next ledge is situated in the great height of 331 to 334 m; it is 30 to 35 m broad, with numerous round boulders, that form

a fine beach ridge. Strand shingle is found to a height of 338 m, according to observations by Mr A. Hoel.¹⁾

Round the southern foot of South Cape Mt (Sørkappfjellet) a fine platform has been abraded; the outer edge is about 80 m, the inner border 130 m above sea level. The elevated cliff shows grandiose abrasion features.

On the SE slope of Mt. Dummer Kerl (Russian map; Dumskolten, Norw.) I found raised beaches with rounded boulders at

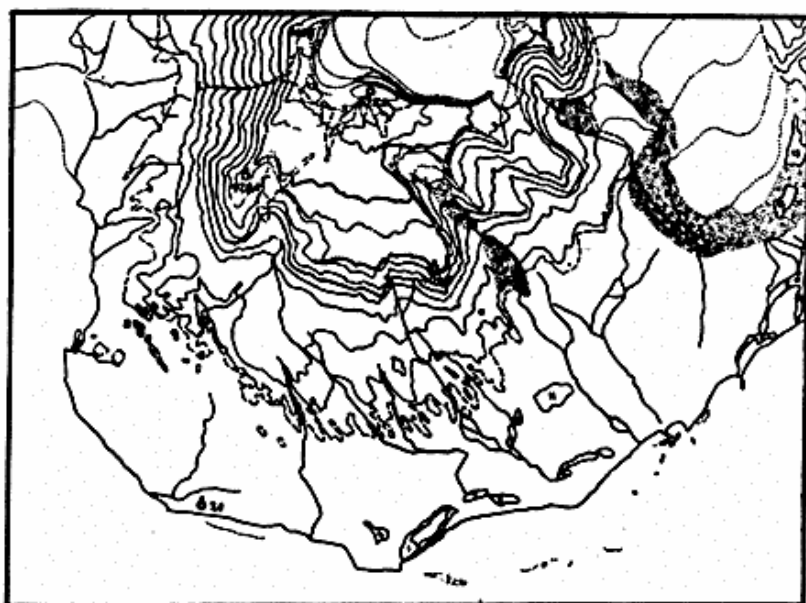


Fig. 6. IV. South Cape Land, W. Spitsbergen. Scale 1: 100000, contour interval 50 m. — Norsk Polar-Institut. Flat-topped hills, conspicuous platform 80—120 m above sea level.

heights of 210 and 340 m. The rock is here soft tertiary shale, but the boulders are made of hard sandstone.

These beaches and strand-lines are all situated on the outer flanks of the hills, freely exposed towards the sea.

Beaches in very high levels have been observed in Franz Josef Land, Grinnell Land, and at other places in the Arctic Regions.

¹⁾ It may be mentioned that in 1919 I discovered some luke-warm springs at the coast of Storm Bay, below Mt. Hilmar. The water discharge of the largest spring — at little lake — is about 150 litres per second, and the temperature 10° C. (50° F.). The water is salt, and bubbling with sulphuretted hydrogen. Some smaller springs in the neighbourhood are warmer, 15° C. (60° F.) and even more stinking.

A peculiar phenomenon may be mentioned here.

Just to the north of the mouth of Horn Sound the strand flat is very narrow, on the hard metamorphic rocks. The flat is bounded by a ridge of steep hills, rising like a wall, up to heights of 663 and 637 m, and much dissected by corries (see fig. 3).

At the inner border of the strand flat, just below the highest and steepest hill-sides, great heaps of rocks and boulders are found, projecting like bastions, with steep fronts and rather even surfaces — appearing like something between a talus and a moraine; and in fact, they have been formed in a corresponding way.

In a rather recent period with somewhat colder climate, steep, isolated snow-patches have accumulated below the highest and steepest mountain walls, at the inner border of the strand flat. In the climate of West Spitsbergen, the weathering and frost-splitting of the rocks is intense, and talus slopes are formed all along the hill-sides. In our case, however, the talus has slid down upon the surface of the snow-patch, forming a rim of stones around the lower end. The inside of the rim was gradually filled up, as the snow field became smaller; at last it melted off, leaving the boulders in a heap, resembling something between a talus and a moraine.

Similar accumulations may be found below steep mountain walls at other places, too.

LIST OF REFERENCES

- Werenskiold, W.*: Spitsbergens fysiske geografi. — Naturen, Bergen, 1920.
Werenskiold, W.: Høie strandlinjer på Spitsbergen. — Norsk geologisk tidsskrift, Oslo, Vol. VII, 1922.
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