

ART. XIII.—*The Glaciers of Alaska, Russian America*; by
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ON approaching the northwest coast of America from the west the mountain chain of the interior is seen to be lofty and alpine in its character. The ridges are sharply serrated, and rise here and there into needle-like pinnacles, giving an outline against the sky that contrasts strongly with the gently sloping sides of the truncated cone of Edgecombe, a fine extinct volcano which marks the entrance to the harbor of Sitka.

The rocky peaks of the interior rise above broad fields of snow, which give birth to numerous glaciers, while Edgecombe, and the ridges upon the coast, are in great part covered with a dense forest of pines and firs. No glaciers are found upon the coast at Sitka or south of it, for under the influence of the warm currents of the Pacific, the climate is comparatively mild, while a short distance in the interior, the winters are almost Arctic in severity.

The principal stream in the vicinity of Sitka, is the Stickeen; which rises in the "Blue Mountains," opposite the head-waters of the Mackenzie, and flows in a general southeasterly direction parallel with the coast until it breaks through the mountains east, and a little north, of Sitka. When the snows are melting, the river becomes much swollen and is then navigable with difficulty by small steamboats for about 125 miles above its mouth. The valley is generally narrow and the river is not bordered by a great breadth of alluvial land.

In ascending this river one glacier after another comes into view; all of them are upon the right bank of the stream and descend from the inner slope of the mountain range. There are four large glaciers and several smaller ones visible within a distance of 60 or 70 miles from the mouth.

The first glacier observed, fills a rocky gorge of rapid descent, about two miles from the river, and looks like an enormous cascade. The mountains are greatly eroded by it, for it is overhung by freshly broken cliffs of rock evidently produced by the glacier.

The second glacier is much larger, and has less inclination. It sweeps grandly out into the valley from an opening between high mountains from a source that is not visible. It ends at the level of the river in an irregular bluff of ice, a mile and a half or two miles in length, and about 150 feet high. Two or more terminal moraines protect it from the direct action of the stream. What

* The observations upon which this article is based were made in May, 1863, while a guest on his Imperial Russian Majesty's Corvette "Rynda," Commander Banarguine, by whose courtesy the writer accompanied Lt. Pereleshin on a reconnaissance, in a whale boat, of the Stickeen river, under the orders of Admiral Popoff.
—W. P. B.

at first appeared as a range of ordinary hills along the river, proved on landing to be an ancient terminal moraine, crescent-shaped, and covered with a forest. It extends the full length of the front of the glacier. The following extract from my notes will answer for a description of the end of this glacier.

We found the bank composed of large angular blocks of granite mingled with smaller fragments and sand. It is an outer and older moraine, separated from a second one by a belt of marshland overgrown with alders and grass, and interspersed with ponds of water. Crossing this low space we clambered up the loose granitic debris of the inner moraine, which is quite bare of vegetation and has a recently formed appearance. These hills are from 20 to 40 feet high, and form a continuous line parallel with the outer and ancient moraine. From their tops we had a full view of the ice cliffs of the end of the glacier, rising before us like a wall, but separated from the moraine by a second belt of marsh and ponds. Here, however, there were no plants or trees. It was a scene of utter desolation. Great blocks of granite lay piled in confusion among heaps of sand or sand-cones or were perched upon narrow columns of ice-glacier tables apparently ready to topple over at the slightest touch. The edges of great masses of ice could be seen around pools of water, but most of the surface was hidden by a deposit of mud, gravel and broken rock. It was evident, however, that all this was upon a foundation of ice, for here and there it was uplifted, apparently, in great masses leaving chasms filled with mud and water. Over this fearful and dangerous place we crossed to the firmer and comparatively unbroken slope of ice at the foot of the bluff, and afterward had to climb over snow and ice only, in the attempt to reach the top of the glacier. From below it had appeared to us to be quite possible to accomplish this if we followed the least broken part of the slope, but it proved to be difficult, and finally impossible. Fissures which could not be seen from a short distance were met at intervals, some of them being so wide that we were forced to turn aside. As we ascended, the crevasses were more numerous but were generally filled with hard snow to which we occasionally trusted. The surface soon became precipitous and broken into irregular stair-like blocks with smooth sides and so large that it was impossible to make our way over them without ladders or tools to cut a foothold. Here we turned and enjoyed the sight of this great expanse of ice, broken into such enormous blocks and ledges. The sun illuminated the crevasses with the most beautiful aquamarine tints, passing into a deep sea-blue where they were narrow and deep. In one direction the ice presented the remarkable appearance of a succession of cones or pyramids with curved sides. In the oppo-

site direction and at the same level the outlines were totally different, showing merely a succession of terraces or steps inclined

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inward toward the glacier and broken by longitudinal crevasses. The annexed sketches were made from this point of view. No. 1 is taken looking up the river, over the end of the glacier, and

shows the pyramids of ice. The line of ponds, and the two moraines are seen at the base, and the river on the extreme

2.

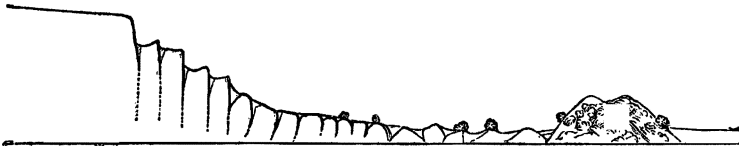


Bluffs of ice. End of Glacier, looking toward the southeast.

right. No. 2 shows the appearance of the glacier in the opposite direction. A broad fissure between one level of the ice and the next is filled with snow.

It is evident that this glacier breaks down in a series of great steps or ledges along the greater part of its front. These steps rise for 20 to 30 feet one above the other and thus produce a stair-like ascent, while at the same time the numerous parallel fissures at right angles break the surface into rectangular blocks, which on the side exposed to the sun soon become worn into the pyramids and cones. The difference of outline in opposite directions is thus explained.

I was inclined to regard the melting action of the water of the river as the cause of this abrupt breaking off of the end of the glacier. There may, however, be a sudden break in the rock foundations at this point, so as to produce an ice-cascade. The following section will perhaps give a clearer idea of the manner in which the glacier breaks down.



Section of end of glacier.

One or more streams descend under the glacier, and reach the river at different places. The rushing and roaring sound was rather startling at some of the crevasses.

Judging from the number of loose blocks of rock at the foot of the glacier, the upper surface must be strewn with them, but this could not be verified by observation. Time did not permit a more extended examination. There would be little difficulty in gaining the surface of the glacier from the side, and, perhaps, at some other points along its front. It was impossible to get our Indian guide to accompany us. They have a tradition of the loss of one of their chiefs upon this glacier.

The ancient terminal moraine of this glacier is significant of an amelioration of the climate. It is also interesting to note the effect which this accumulation of materials from the glacier has had upon the river. It has acted as a dam for the waters, setting them back in the valley for some distance.

In this connection the following notes upon the occurrence of great bodies of ice, undoubtedly glaciers, in the more northern parts of Russian America have a special interest.

According to Sir Edward Belcher* the shores of Icy Bay at the foot of Mount St. Elias, lat. 60°, are lined with glaciers. "The whole of this Bay, and the valley above it, was found to be composed of (apparently) snow-ice, about 30 feet in height at the water cliff, and probably based on a low muddy beach." At Cape Suckling in the same latitude and west of Icy Bay the

* Voyage of the Sulphur, i, 78-80.

same voyager observed a vast mass of ice sloping to the sea, the surface of which presented a most singular aspect, being "one mass of four-sided truncated pyramids." He was not able to account for this and observes "What could produce these special forms? If one could fancy himself perched on an eminence about 500 feet above a city of snow-white pyramidal houses, with smoke-colored flat roofs covering many square miles of surface and rising ridge above ridge in steps, he might form some faint idea of this beautiful freak of Nature."

Vast bodies of ice terminating in cliffs upon the sea are numerous in Prince William Sound, and the thundering noise of the falling of large masses of ice was heard by Vancouver.*

On the shores of an arm of Stephens Passage (northwest of Sitka) a compact body of ice extended for some distance at the time of Vancouver's visit, and from the rugged valleys in the mountains around, immense bodies of ice reached perpendicularly to the sea, so that boats could not land. Similar observations are made, in general, of the mountains of the coast opposite Admiralty island. Two large open bays north and west of Point Couverdeen are terminated by solid mountains of ice rising perpendicularly from the water's edge.

From these various observations we may conclude that the mountain region of Russian and British North America, from latitude 55° to the Polar sea, is dotted with glaciers cutting and scoring the mountains as they descend, and pushing their accumulations of rocky debris either into the ocean, or the rivers of the interior.