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Author(s): Olaf Holtedahl

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A CROSSING OF NOVAYA ZEMLYA

Olaf Holtedahl, Ph.D., Professor of Geology at the
University of Kristiania

THE principal object of the Norwegian scientific expedition to Novaya Zemlya in the summer of 1921 was a geological, botanical, and zoological investigation of certain districts of that Arctic region, which politically belongs to Russia, but which, with the exception of a few Samoyed families that live in not more than four colonies, is totally desolate and uninhabited. The author, who was the leader of the expedition, had for his task the study of the rock formations in order thereby to augment our present extremely scanty knowledge of the stratigraphy and general geological structure of Novaya Zemlya. According to the programme of the expedition, we were first to study the splendid section right across the country which Matochkin Strait with its steep mountain sides offer to geologists, in order later on to endeavour to investigate conditions in districts farther north.

On account of unusually favourable ice conditions in the early summer, we were able to enter and proceed eastward with our investigations along Matochkin Strait as early as the beginning of July. We carried our work right up to the eastern opening of the strait, where we were about July 20. However, in the course of the preceding two or three days so much ice had driven in from the Kara Sea on account of steady east wind, that we were barely able to force our way with our little vessel, the motor cutter *Blaaffjell* of Tromsø (50 reg. tons), back through the strait westwards. During the remainder of the summer there was constantly drift ice in the strait.

As a principal field of investigation in the north I had decided upon Mashigin Fjord and its environs, a district which was previously very little known, and from there I hoped to be able to undertake a journey over to the east coast in order to ascertain whether the geological structure of the mountain range was the same in the north as at Matochkin Strait.

On the evening of July 28 the *Blaaffjell* anchored in glorious weather at the inner part of Mashigin Fjord, in an inner basin which is omitted from the maps, and the following day I was up on one of the highest peaks in the neighbourhood—in the course of a subsequent survey it was found to be 946 metres high—in order to obtain bearings for our journey with sledges and skis eastwards. The conditions appeared to be favourable, since from what I could observe there extended east-north-east of the upper end of Mashigin Fjord a glacier track eastward into the interior. It also appeared that by following a glacier which ran into the end of the fjord from the north-east (we called it Norway glacier: see sketch-map) it would be possible to gain this track in the interior. Early in the morning of July 31 we began our preparations for the journey, in which were

to take part, besides the present author, our young physician, a medical student named Reidar Tveten, and my cousin Reidar Holtedahl. Ski-sledges, skis, tent, and other articles of our equipment were overhauled, our provisions brought out and carefully packed, mainly in tin boxes which were placed in a box the width of which corresponded to that of the sledge.

About noon everything was in order, and after dinner we went ashore to the edge of the ice at the western part of the front of the glacier mentioned above. We arrived without very great difficulty, although even for a rowing-boat the sea was very shallow there, and assisted by other members of the expedition and by some of the crew we reached the glacier. The sledge was soon packed, and the first but steep part of the way up the glacier was traversed. About 10 kilometres from the sea we pitched our tent, whilst I set off to ascend a mountain just to the north (the south-western peak of the Trollheimen mountains), whence I hoped to be able to obtain a good view eastwards. I was not disappointed, and I saw that there extended an extremely straight and smooth glacial surface for a very great distance east-north-east, the direction most favourable for a crossing. However, almost as soon as I reached the summit (which according to aneroid was 880 metres high) the fog came drifting inland and the view was hidden. This fog was the introduction to a period of bad weather which lasted the whole week we spent inland. Instead of the continual clear weather which we had both before and after our journey, there were mists, dull weather, rain, sleet and real snow-storms succeeding each other. During that period there was also bad weather on the coast. Those of our companions who had accompanied us to our first pitch left us at eleven the following evening, and made their way down to the sea in the thick fog.

On the following morning we began our march towards the east. At first we proceeded fairly quickly, as we were all three able to pull the sledge at once. The surface of the snow was fairly firm, dry, and even, and our skis did good service. Later on in the day considerable difficulties arose. The snow was often saturated with water, and we were obliged to cross a number of streams of melted ice, one of which in particular was broad, and it was with great exertions that we succeeded in crossing it. We then reached a tract of very uneven ice with a good deal of moraine material scattered about. As happened almost constantly on the following days, only two men were thus able to draw the sledge, since it was always necessary for one of us to walk beside the sledge and support it. Nevertheless it often upset.

The following day there was a thick fog, and we could not see the mountains around us. As however the weather had been somewhat clear the previous evening, and we had then taken our bearing, we were able to continue our journey with the aid of the compass. After a while the fog cleared a little so that we could take our bearings again, but then the

mist again grew quite thick, and we proceeded for a long distance with the aid of our compass alone. It was not until the afternoon that the weather began to clear up for good and we could see the mountain ranges to the north and south. We soon had a fairly long view forwards, and as there was a decided decline in our favour and the surface of the snow was good, although not particularly even, we proceeded rapidly. At last we could distinctly see a coast-line not so very far distant, and we understood that the glacier runs right down to the upper end of a fjord. We kept on for some distance and then pitched our tent. The ice was hard and uneven, and we were obliged to use a hammer and chisel in order to make holes for the ski sticks which served as fastenings for the guy-ropes of the tent.

It was our intention not to take the sledge further, but on the following day to set off with some provisions and make a trip down to the fjord and along its side, and then return to our tent towards evening. Unfortunately when we set off on the following morning the weather was extremely bad, and we experienced an icy-cold east wind, with snow and sleet which turned into rain at the coast. At first we could see nothing except the glacier on which we were walking, but little by little the weather cleared slightly. We went down to the edge of the glacier on the north side, and after having waded across a river of considerable breadth, we continued along the north side of the fjord. About 7 kilometres from the upper end I ascended a hill about 300 metres in height (the land to both sides of the fjord is generally not more than 400-500 metres), and there obtained quite a good view of the fjord and of the immediate environs. I saw clearly that outside the mouth of the fjord there lay one or more very large low islands, and it was now certain that the fjord to which we had descended was, as I had also anticipated from the direction of our march, that which has its mouth marked on the maps inside Pakhtussov island, a fjord which was visited in the first part of August 1897 by H. J. Pearson and Colonel H. W. Feilden on the Norwegian Arctic vessel the *Laura*. The fjord was named Zivolka Fjord by Pearson after an early traveller to Novaya Zemlya, who, sometimes accompanied by Lieut. Pakhtussov, made several voyages of discovery to the coasts of Novaya Zemlya in the thirties of last century.

In his book 'Beyond Petsora Eastward' (London, 1899), Pearson has several photographs of Zivolka Fjord with the inner part of the glacier along which we had approached, a glacier which Pearson named the "Ibis" glacier, in honour of the English Ornithological periodical of that name. The same photographs also appear as illustrations to Feilden's article "Visits to Barents and Kara Seas, with Rambles in Novaya Zemlya, 1895 and 1897," in the *Geographical Journal*, vol. 11, pp. 355 and 359 (April 1898).

During my trip to the above-mentioned point of vantage my two companions made a large bonfire of driftwood, and it was a delicious

experience to warm myself and dry my drenched clothes. Somewhat further in we built a cairn close to the shore, and then returned to our tent, which we reached fairly late in the evening.

I shall not trouble the reader with a description of the return journey, which in the main passed off like that to the east. The last part of the distance we traversed by another route, following a small glacier ("Foggy glacier") which ended just east of a small lake close to the upper end of Mashigin Fjord. We were obliged to carry our things, including sledge and skis, first down the huge terminal moraine, about 150 metres high, then across a flat sandy delta with many rivers running between the moraine and the said lake, and finally along the south side of the lake down to the coast. By dint of fairly steady labour we succeeded in getting our things down to the sea on the evening of August 6, the date on which I had arranged to meet our vessel the *Blaafjell*, which since we left her had mainly lain farther out in the fjord, where the other parties had carried out their investigations. She had reached her place of anchorage at the end of the fjord some hours in advance, and the same evening we were safely on board.

The journey which is here described was not, as will be understood, of any very great length, nor were the heights and ascents on our route such as to cause any obstacles to our progress. From coast to coast the surface of the glacier is very even, and only slightly undulating, the greatest height being about 400 metres. However, it is precisely this low altitude of the surface of the glacier that renders crossing in summer difficult; large areas of the old glacier ice with its crevasses and irregularities lie bare, without an even covering of snow; and where, as in the most elevated tracts, there is snow, it is so sodden with water that the sledge sinks deeply into it. In these conditions, and on account of the bad weather, we were obliged to work hard in order to complete the journey there and back in the week I wished to devote to it. The actual geological task, to show whether there was the same rock formations there as at Matochkin Strait, or whether in the interior there might possibly be post-Palæozoic formations, strata younger than those forming the mountain range, did not require a great deal of time on the whole, for even at a distance I was generally able to establish the presence of the same folds, and the same main constituents in the rock formations, which I had observed in the strait, viz. quartzite, shale, and dolomite, the last mentioned containing badly preserved fossils which indicate their geological age as Devonian. In addition, the moraines carry rock material out to us on the glacier. Where we have stretches of coast whose geology is practically unknown, as in so many parts of Novaya Zemlya, it is more profitable to spend the time there than in the interior, where the collection of geological material requires a disproportionate amount of labour and time.

It will be seen that the glacier-filled depression which we traversed on our journey has its main direction at right angles to the general direction of Novaya Zemlya in that latitude, and at right angles to the direction of the strata. We have here one of the many instances of the predominance on the north island of Novaya Zemlya of transverse and not longitudinal valleys. This condition is of course already indicated by the numerous and sometimes long fjords in the southern half of north island. In the northern half the relief of the solid rock is hidden by huge masses of inland ice. Therefore, in reality, the narrow Matochkin Strait, which cuts transversely through the land-mass, can (as has been pointed out by Chernyshev) not be regarded as the isolated cleft in the country which it appears to be when seen on the map of Novaya Zemlya, and which naturally gives rise to the thought that there exists there a fault fissure, a zone of dislocation, which is not the case. In reality there are a number of similar cuttings, only the others do not extend quite so deeply, or else they are covered by a glacial mass.

From a purely geographical point of view it may be of interest that the crossing from Mashigin to Zivolka fjord has been made, for hitherto the north island had only been crossed at two places. One of these was between Krestovii fjord and Rosmyslov fjord (which is the shortest possible passage across Novaya Zemlya); the other is far north, from Pankratyev peninsula (slightly north of 76°) and across the country towards the south-east. The crossing at the former place was made by the Russian Arctic explorer Russanov and the Italian Candiotti in the summer of 1908, and at the latter by the Russians Pavlov and Wiese in the winter of 1912-13, during the wintering of the Sedov Expedition at Pankratyev peninsula.

THE EXPLORATION OF THE UPPER YARKAND VALLEY IN 1914 BY THE DE FILIPPI EXPEDITION

Lieut.-Colonel H. Wood, R.E., Survey of India

IN the paper read before the Royal Geographical Society by Sir Filippo De Filippi, K.C.I.E., in June 1915 (*Geog. Journ.*, 46, pp. 85 *et seq.*), the general results of the work of this expedition were dealt with; this note is intended to amplify in some particulars the account of the survey and exploration of the Upper Yarkand valley by one of the parties of that expedition.

Previous to 1914, our knowledge of this neighbourhood was based on the sketches and reports of Johnson of the Survey of India in 1864-65, and of the explorer Hayward in 1868. But even so far back as 1876 Shaw had expressed doubts as to the accuracy of the mapping of this region, and Dr. Longstaff in 1910 had independently come to the same conclusions about it.