

Map showing the route of the Gjøa.

THE SCIENTIFIC RESULTS
OF THE NORWEGIAN ARCTIC EXPEDITION IN THE GJØA
1903—1906
UNDER THE CONDUCT OF ROALD AMUNDSEN

PART I

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The purpose of the Gjøa Expedition was to explore the regions in the neighbourhood of the North Magnetic Pole and, as far as possible, to determine the present geographical co-ordinates of a mean magnetic pole-point. This accomplished, the plan was to proceed in a westerly direction and attempt to force a ship through the "North-west-passage".

Preliminary preparations were commenced in 1900 and in the summer of 1903 the Expedition was ready to start.

The list of the members of the Expedition was:

1. Chief leader Captain Roald Amundsen.
2. Second in command . . . Lieutenant Godfred Hansen.
3. First mate Mr. Anton Lund.
4. First engineer Sergeant Peder Ristvedt.
5. Second mate Mr. Helmer Hansen.
6. Second engineer Mr. Gustav Juel Wiik.
7. Steward Mr. Adolf Henrik Lindstrøm.

In connection with the scientific work special duties were allotted to some of the members according to the following list:

- Magnetician Roald Amundsen, assisted by Gustav Wiik.
- Ethnographer Roald Amundsen.
- Zoologist Roald Amundsen, assisted by Adolf Lindstrøm.
- Mineralogist Roald Amundsen.
- Astronomer Godfred Hansen.
- Cartographer Godfred Hansen.
- Meteorologist Peder Ristvedt, assisted by Gustav Wiik.

The other members had to assist wherever necessary.

In the night between the 16th and 17th of June 1903, the Gjøa, with a steamtug in front of her, left the harbour of Oslo. At 6 o'clock in the morning she called at Horten to load some nitrated cotton and passed Færder at 11 a. m., where the steam-tug left. By sail and motor she cruised along the coast and passed the Lister Light on the 21st, which was the last view that her crew had of Norway. From here the course was set for Fair Hill, the bearing of which was obtained on the 25th in northwesterly direction.

The 9th of July they were off the coast of Greenland, and as they met with fog here, they did not get bearing of land until the 11th, when they had Cape Farewell to the east. Having navigated in ice and fog through Davis Strait they got bearing of "Sukkertoppen" on the 20th, noticing here for the first time that the compass was not reliable. "This is a known fact along the west coast of Greenland", says Amundsen in his book "Nordvest-passagen", "while the compass is reliable enough further out".

On the 25th, at 1 p. m., the Gjøa dropped anchor at Godhavn. According to the plan some dogs and outfit were to be taken on board here, and in the meantime a magnetic station was occupied.

NO. 1.

SCIENTIFIC WORK OF THE EXPEDITION

BY

THE EDITORIAL COMMITTEE

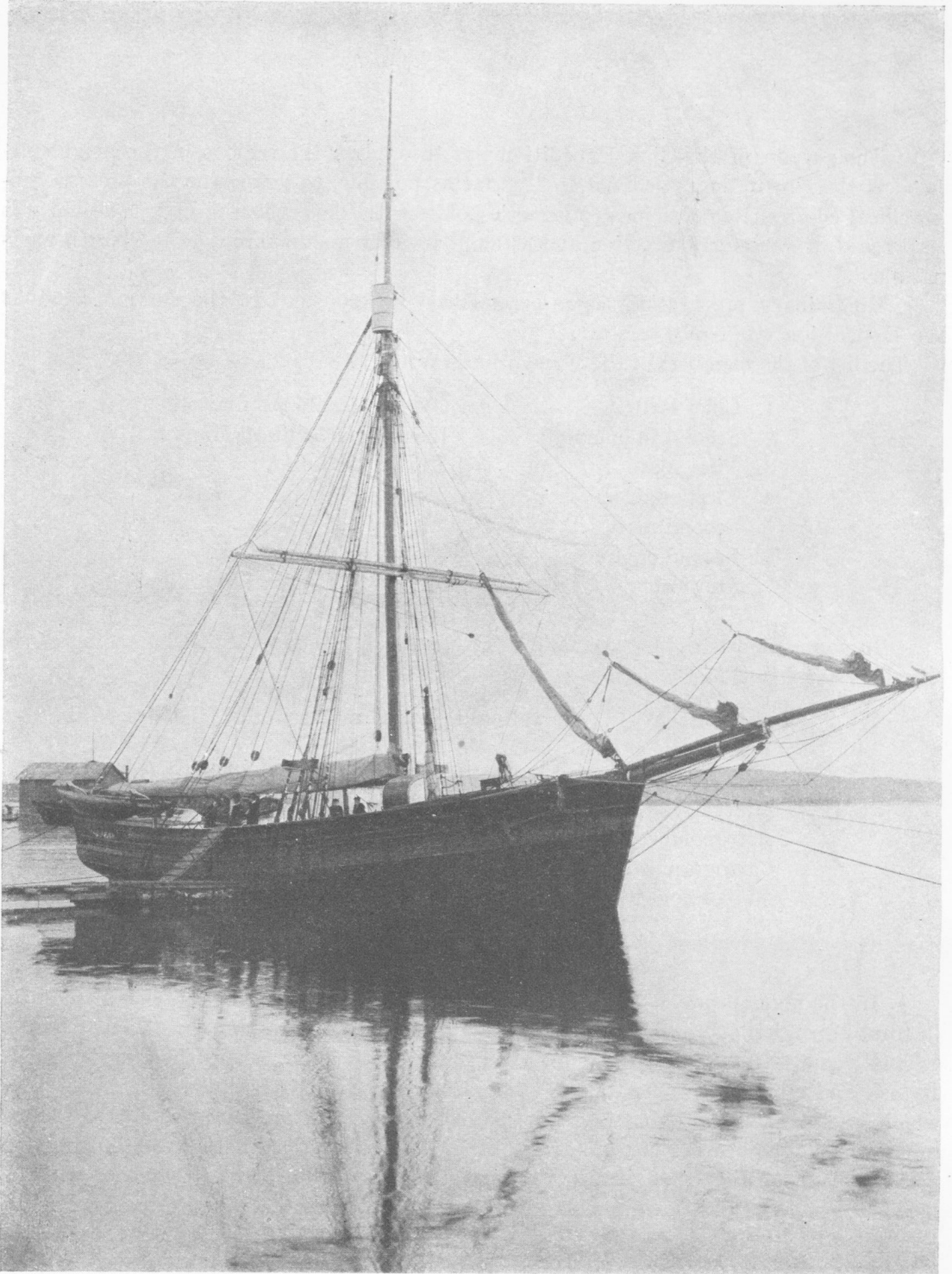


Fig. 1. The "Gjøa", in which Roald Amundsen forced the North-west-passage.

On the 31st the *Gjøa* was ready to start again, and in the afternoon they weighed anchor and proceeded northward through Baffin's Bay off the west coast of Greenland. On the 13th of August they were off Cape York, the extreme point at the north side of Melville Bay, and on the 15th they reached Dalrymple Rock, where they were to fetch a depot, left for them by some Scotch whalers. During their stay here, they were visited by the "Danish Literary Greenland Expedition" under Mylius Erichsen, and also here they met for the first time with a tribe of uncivilized Eskimos.

On the evening of the 16th they weighed anchor and sailed towards the south-east into Baffin's Bay and set course for Lancaster Strait. On the 19th they were off North Devon and rounded, towards mid-night, Cape Horsburgh on Philpot's Island. In the fore-noon of the 21st after having passed Cape Warrender they sailed up Lancaster Strait, where they kept to the west, off Devon, until, in the after-noon of the 22nd, they anchored up in Erebus Bay on Beechey Island. "These parts are very different from the wild and broken mountain formations of Greenland. Here the plateau prevails, being broken, however, now and then by hills; the scenery is barren but not unappealing."

The 23rd appeared with mist, but Wiik began at once to take magnetic observations. As the course towards the magnetic pole was dependent on the result of these measurements, the performance was followed with great interest by the whole crew. "The needle left free, oscillated for a long time to and fro, at last pointing towards south-west. In spite of the appealing hunting grounds towards north-west, everyone was satisfied with the result, my original plan could be followed, we had always, my comrades and I, agreed that the best way through the North-west-passage lay just in the direction where the magnetic needle pointed."

On the 24th of August they left Beechey Island with course set for Limestone Island. On the evening of the 26th they were off Prescott Island in Franklin Strait and here the compass refused to work, the directing component of the magnetic force being too weak. On the 31st they passed Cape Adelaide on Boothia Felix, where James Ross in 1830 had taken a series of magnetic measurements, the result of which gave data to locate the magnetic pole point.

The navigation in these unknown seas was of course difficult, and as they also met with fog, they were very often unable to orientate themselves. The seas proved to be shallow and very often blocked up with hidden rocks, with which they several times made a too intimate acquaintance. It may in fact be deemed a miracle that they finally got through.

From Franklin Strait they proceeded into James Ross' Strait, and by Rae Strait into Simpson Strait, and on the 9th of September they rounded the extreme point of King William's Land, "Point Luigi d'Abruzzi," as it was named by Amundsen. While they were searching for a convenient anchor-place for the night in Petersen's Bay, the man on outlook in the mast suddenly reported that he saw the finest little harbour, and outside this little cove, which later on got the name of Gjøahavn, they anchored for the night.

At the first sight of Gjøahavn, Amundsen decided to try if the ship could pass into this excellent harbour, and if so, take possession of the land about it as a base station for his magnetic researches. The next three days were used for a preliminary examination of the surrounding land and after having sounded the harbour and examined other conditions as well as could be done by a general view, they proceeded into Gjøahavn where they anchored at 8 o'clock in the evening of September 12th, 1903.

The sandy land about Gjøahavn was rather level and well fitted for putting up the necessary buildings. A preliminary measurement gave $89^{\circ} 15'$ as value for the inclination and the distance between the station and the magnetic pole as 90 miles,

thus in every respect agreeing very well with what Professor Schmidt had suggested as being the most convenient place for the magnetic station.

Gjøahavn and the surrounding land may be described as follows:

The cove cuts into Neumayer's Peninsula about one kilometer in direction almost true north. The entrance lies a little less than one and one half kilometer north of von Bezold's Point, the southern extreme point of the peninsula. Nearly one kilometer south of this point Anton Lund's Island extends in a southerly direction like a break-water, one kilometer long, and forms together with Neumayer's Peninsula the boundary of Petersen's Bay.

The cove is narrow in the middle, thus forming an exterior and an interior harbour. The first, Framnesbugten, with Framnes Peninsula (trigonometrical point "Framnes") as boundary on the west, is entirely open to the south, and to the north it is connected with the real Gjøahavn through a very narrow sound. This sound is, to quote Amundsen, so narrow, "that there would hardly be space enough for two ships to pass each other, but the soundings gave dept enough, on the average some 6 fathoms of water."

Inside the narrow sound, the western shore of the cove bears to the north, then turns eastward to the mouth of Lindstrøm's River, while the eastern shore bears N. E., then E. by S. towards the mouth of a brook, and from here again N. E. by N. up to the mouth of Lindstrøm's River.

At the north-east corner Lindstrøm's River comes down from the east through a valley of the same name, and at the south-eastern corner a small brook comes down from a pond to the south-east. Off the mouth of the brook the Gjøa had her anchoring place for 23 months.

The harbour and the country about it are described in "Nordvest-passagen" as follows: "The harbour itself was in every respect suitable. The narrow entrance would prevent the larger pack-ice from entering and the basin within was so small that no wind, from whichever direction it might come, could be troublesome. The land about the harbour was rather low and rose gradually to a height of 50 metres. The soil consisted of sand covered with moss. Fresh water was to be found in some small rivers, and if they should dry up, which they threatened to do just now, there was a fresh water pond of suitable size on the hillside".

The land was hilly with lakes and streams in the valleys, which is evident from the following account: "Otherwise they found the country particularly suitable for reindeer, low and moss-covered, with rivers and lakes everywhere."

One gets a good impression of this hilly land from the map of Gjøahavn and surrounding land, Fig. 2. The hills are seen to run parallel to the coast and between the lakes. This hilly range extends along the south-west coast of Neumayer's Peninsula from Gjøahavn down towards the von Bezold's Point. There were thus rows of hills and on the most northerly of these, the one which is located between the sound on the west and the valley with the brook on the east, a place was chosen on which to erect the houses. For more than one reason the ship had to be completely unloaded. The two permanent observers, Ristvedt and Wiik, were to live ashore while the other members of the Expedition were to make themselves comfortable in the fore and stern cabins of the Gjøa. The galley on deck was pulled down and put up again in the empty cargo room and here Lindstrøm had his kitchen during the whole stay at King William's Land.

"Monday, the 14th of September, at 5 o'clock in the morning, we worked the ship close up against the shore, putting her alongside as if the shore were a quay" to quote Amundsen.

First of all they had to get the dogs ashore. They were taken to the valley near the mouth of the small brook, where later on a kennel was built. Now came the unloading of the cargo, which was done by the aid of a cableway. One end of a steel wire was

fastened to the mast of the ship while the other end was fastened to an old shoreline, some 20 metres above the present, by the aid of a Kedge anchor hooked into the clayey soil. In this way they got all the heavy boxes quite easily on shore.

The provisions had been packed in soldered tin boxes which were enclosed in cases of wood. The provision cases were one by one sent ashore, the wooden cases were removed, as they were to be used as material for the building of the houses. The tin boxes were piled up on the hillside. On the 17th the unloading was completed, the pile

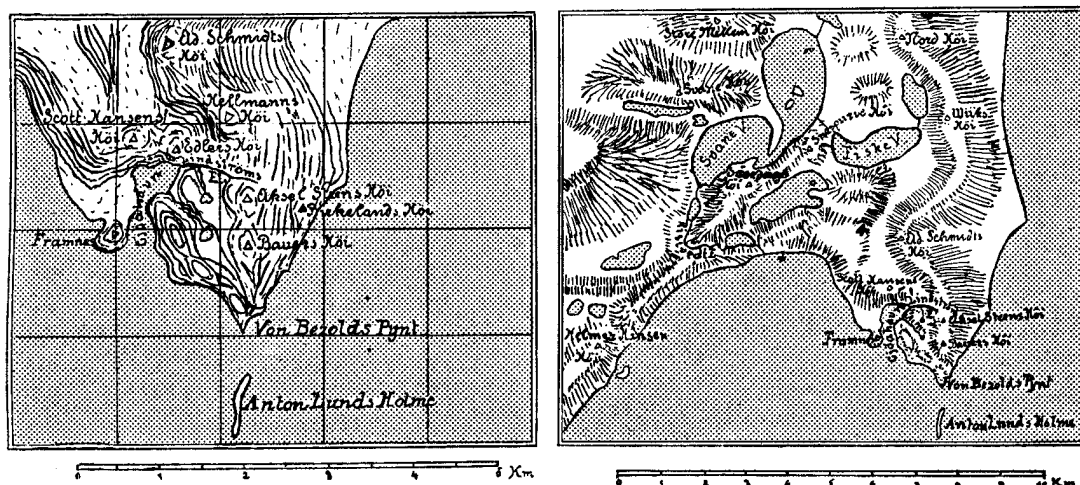


Fig. 2. Map of Neumayer's Peninsula and Gjøahavn.

of tin boxes was covered with canvas and a ditch was dug around the pile to drain away the water.

Having cleared up on land and made things ship-shape on board, they commenced to build on shore. The first to be built was the house for the magnetic recording instruments, "The Variation House."

While taking magnetic measurements at the base station the instrument should always, according to Professor Schmidt, be orientated along an unchangeable base-line direction. (Fundamentalrichtung). The geographical direction of this line was also decisive for the arrangement of the houses. The first thing to be done was to take the necessary astronomical and magnetic observations for determining this base-line. Regarding this important magnetic observation, we quote from Wiik's diary dated the 21st of September: "Several days I have tried to obtain observations of declination but had to give it up, as the magnetic conditions seemed to be exceptionally stormy, however, the series of to-day may be accepted for the base-line direction." As angle of magnetic declination and as geographical co-ordinates they found

$$D = 1^{\circ} 31' \text{ E. } \varphi = 68^{\circ} 37' 38'' \text{ N. } \lambda = 95^{\circ} 54' 51'' \text{ W.}$$

The observations were taken on the before-mentioned hill and, on the very spot where the instrument had stood, the foundation for the variation instruments was dug. Wiik's diary, the so-called "Register Journal," which in the List, page 15, has the number 32, gives the following account: The foundation for the instruments was made of cement mixed with stones, it was one metre above the ground and on the top of it a marble slab was carefully placed in a level position. All the empty wooden cases had in the meantime been carried up on the hill, which was 25 metres above sea level, 200 metres from the shore and 500 metres from the place where the Gjøa lay in her winter quarters. The packing cases had all been made the same size, $80 \times 50 \times 40$ cm., and they were of course absolutely non-magnetic, the boards having been put

together with brass nails. About the building Amundsen gives the following account in "Nordvest-passagen": "The house was built by placing one case on top of another and filling them with sand. About 40 packing cases were used. The house, outside as well as inside, was covered with tar-board and finally covered up with sand. Around the house we dug a deep ditch to drain off the water." On the 26th the house was finished, being some three metres long and three metres broad. The door opened to the south and had a spacious outer corridor. Later on as the snow accumulated, access to the house was through a long snow tunnel.

The next house to be built was the living-house for the two observers. The work began on September the 29th and was finished on the 17th of October. The house was built on the hillside, some 75 metres away from the Variation House, to the south of the same and nearly 30 metres above sea level. This house was also built of packing-cases filled with sand, 60 cases were required, and it was 3 metres long, 3 metres broad and 2 metres high under the ceiling, which was horizontal. The floor was made of wooden boards and covered with reindeer skins, two windows were put in, one towards Simpson Strait and the other towards the harbour, where the Gjøa lay. The entrance was on the western side. In front of the door, some 20 metres away, a flag-pole 4 metres high was raised and a little to the north of this the meteorological screen was put up. On the other side they put a stand for the rain or snow gauge.

In the meantime the "Absolute House," where the absolute magnetic observations were to be taken, had been constructed. It was placed 75 metres north of the "Variation House" and exactly in the base-line direction. It was made of solid blocks of snow. The snow blocks were cut out with a saw and made an excellent building material. The house was 8 metres long, 2 metres broad and 1,8 metres high from floor to ceiling. Transparent canvas was stretched tightly across the tops of the walls as a ceiling and thus they had a very comfortable magnetic observatory. In the summer the snow house was replaced by a tent.

On the 2nd of October the Gjøa was hauled out into the bay to the winter quarters, some 50 metres from the shore. Ristvedt and Wiik took possession of the living-house on shore which was called "Magnetten." It had only one room and Ristvedt put up his barometers etc. and made himself comfortable in the half part allotted to him, while Wiik arranged his photographic laboratory at the other end of the room. The house proved to be very comfortable, in fact much more so than the ship.

The last building to be erected was the astronomical observatory, "Uranienborg." Again we quote from "Nordvest-passagen": "One morning we gathered all the men to assist the astronomer, Lieutenant Hansen, in making a house suitable for his use. He preferred the "arched style," therefore we cheerfully began to put up an eskimohut, "iglu," as the Eskimos call the ice houses they live in. I shall not claim that the building turned out to be a very splendid edifice; however, there it was. An empty barrel served as a stand for the telescope."

This done, all the more permanent buildings were ready. Little by little more buildings were required. As all the spare magnets had to be stored, a hut was built some 70 metres west of the Absolute Observatory. It was constructed of snow and during the summer replaced by a tent. In January, 1904, they put up an auxiliary magnetic observatory, specially made for observation of inclination, by which arrangement the constant moving of the theodolite from the tripod in the Absolute House was avoided. This new observatory was put 87 metres north of the Absolute House, and of course in the base-line direction. It also was constructed of snow. Later on, in 1905, two new snow-huts, Iglu 1 and Iglu 2, were added, placed in line with the other houses, in the base-line direction, still farther to the north. At the end of October the Eskimos arrived and between 70 and 80 settled down in the neighbourhood. They constructed their iglus

to the west of the Absolute House, about 100 metres from the little hut which had been built for the spare magnets.

By means of a small map, shown in "Nordvest-passagen," and some occasional measurements given by Amundsen, Wiik and Ristvedt, in connection with some trigonometrical points, we have tried to construct a map, Fig. 3, which will be found on page 10. The different measurements, given by the above mentioned members of the Expedition, do not always agree, wherefore the map can not claim to be exact, but it gives a fairly good idea of Gjøahavn with all the buildings and the surrounding land, where some of the trigonometrical points have been entered. One of these stations was also a magnetic field station, Edler's Høi, situated in the base-line direction. The angle from the astronomical observatory „Uranienborg" to „Edlers' Høi," reckoned from the south, is given as 196° .

The exact geographical co-ordinates are according to Professor Geelmuyden's revised calculations:

For Uranienborg, U $\varphi = 68^\circ 37' 18''$ N, $\lambda = 95^\circ 53' 0''$ W
 » Edler's Høi, E. H. . . . $\varphi = 68^\circ 37' 41''$ N, $\lambda = 95^\circ 53' 21''$ W

Putting for the latitude and longitude 31 and 11 metres respectively for 1'', we find that Edler's Høi is situated 820 metres to the north and 230 metres to the west of Uranienborg. The Gjøa, lying 50 metres off shore, is given as 470 metres from the permanent tripod in the Absolute Observatory, A, in the map. As now the base-line direction strikes Edler's Høi, one is able to locate all of the houses except the living-house, whose distance from the Variation House is given but not the direction of the line between them. It was stated to lie on the highest point of the hill and the most probable place may therefore be where we have put it on the map. In the following list co-ordinates and signs for 8 places are given:

Station	Sign.	φ		λ		Dist. from U.	
		°	'	°	'	m	m
Absolute House	A	68	37 14 N	95	53 25 W	158 S	270 W
Variation House	V		37 10		53 25	220 S	270 W
Living-House	M		37 9		53 20	270 S	220 W
Edler's Høi	E. H.		37 41		53 21	820 N	230 W
Framnes	Fr.		37 9		54 16	280 S	800 W
Scott Hansen's Høi	S. H. H.		37 47		54 8	900 N	750 W
Aksel Steen's Høi	A. S. H.		37 27		52 10	280 N	550 E
Bauer's Høi	B. H.		37 7		52 5	350 S	610 E

We have also used on the map the following signs:

The Gjøa G, The Kennel H, Provision Tent P, Inclination House I, Store Room for the spare magnets L.

On the 3rd of October, the day after the Gjøa had been laid up in her winter quarters, the ice was strong enough to carry a man and thus a convenient connection between the ship and the shore was established.

During the darkest part of winter, very little could be done in the line of field work, but all were occupied with preparations for the planned sledge expedition to the magnetic pole on Boothia Felix. At the end of February two sledges were loaded with provisions and other necessities. However, the start had to be postponed to the end of March because of the low temperatures, and the first magnetic field station on Matty Island, St. 1, was reached on the 9th of April. A good series of magnetic observations was made here during the days between the 9th and the 15th, but they had bad luck, as the watch used for the observations was smashed. Ristvedt, Amundsen's companion on the journey, had to make an extra trip of more than 100 miles back to Gjøahavn

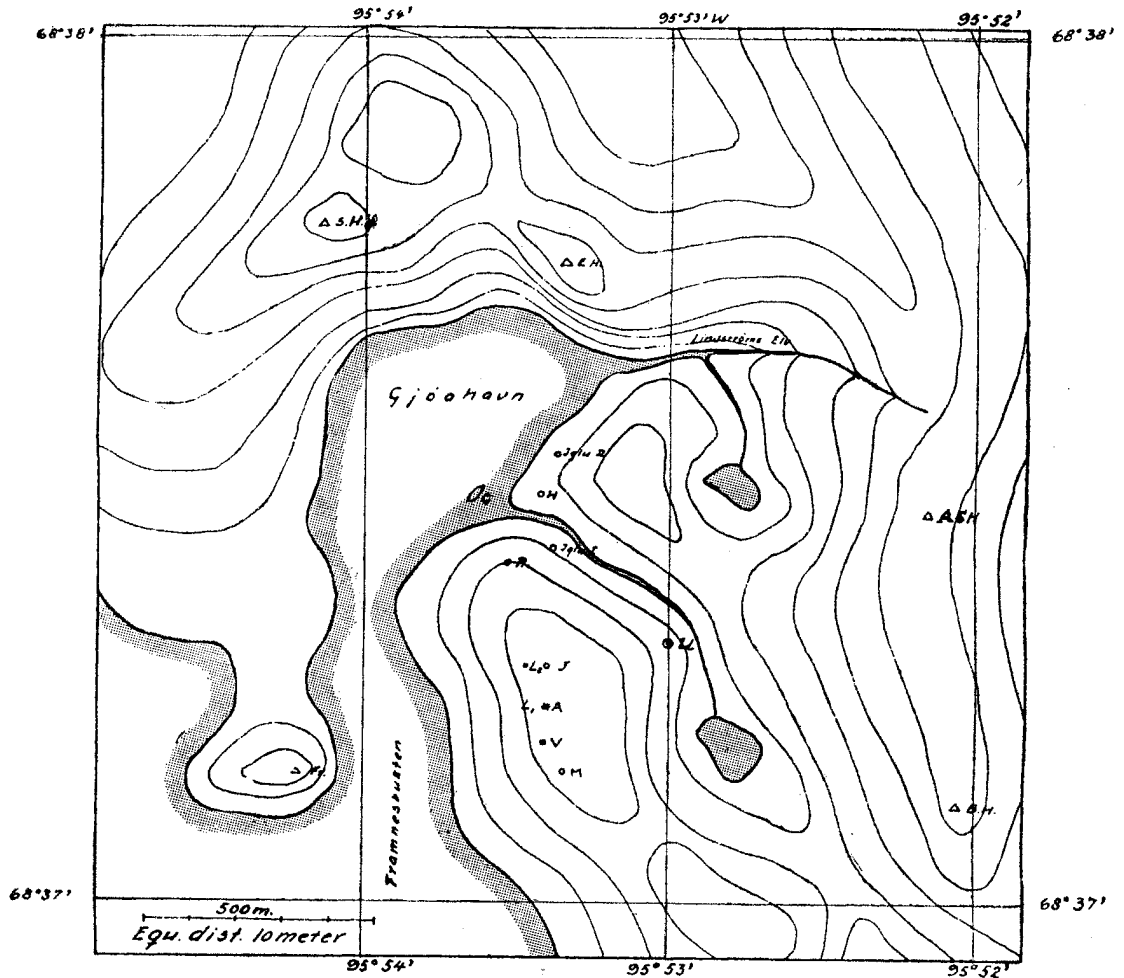


Fig. 3. Map of Gjøahavn and the surrounding land.

to get another watch. On the 21st they crossed the ice to Boothia Felix, where, a little north of Cape Christian Frederik, a depot was placed. One of the two sledges was left here, and the 10 dogs were harnessed before the other sledge, which weighed about 300 Kg. Regarding the latter part of the expedition we quote from "Nordvest-passagen": "The journey along the coast of Boothia did not present very much of interest. We were close to the magnetic poles, both old and new, and we probably passed both. A little east of „The Tasmania Island” we placed our most northern magnetic station and turned southwards on the 7th of May. It had been my intention to go back and fetch our depot and, thus equipped, to try to reach "Victoria Harbour" on the east coast of Boothia Felix, where Ross, about 1830, had wintered with the "Victory." A series of magnetic observations taken here would be very interesting, perhaps more so than the pole itself. I was, however, unable to carry out this plan. As we passed an old Eskimo wintering place, on our way southwards, my left foot, which for a long time had bothered me, probably on account of too tight lacing, now became quite unusable and I had to lay up for a while. From the 12th to the 18th I had to keep quiet, but in the evening of the 18th I could continue. The 21st of May we reached the depot, which, however, we found had been completely robbed by our friends Kaumallo and Kalakchjie. There was nothing to be done but to try to reach Gjøahavn as quickly as possible, a journey which was accomplished by the 27th of May."

The summer was used for cartographic and magnetic survey around the base station. The magnetic work began on the 5th of June with a trip to Hovgaard Island and the work was continued throughout the summer and autumn, until low temperatures

prevented the field work. The time between taking observations at the different stations was used for taking control observations at the base station. It had been planned to put a magnetic field station on the east coast of King William's Land, "as far towards the north as we might be able to advance." Unfortunately, however, this plan could not be carried out, although attempts were made. The last series of field observations were taken during August, when winter had already set in. In the beginning of February 1905, the field work was again resumed, in spite of low temperatures. The old stations around Gjøahavn were repaired and new stations added. No expedition for magnetic survey could be made now on account of preparations for a cartographic expedition to Victoria Land. This expedition, conducted by Lieutenant Hansen, with Ristvedt as his companion, left Gjøahavn on the 2nd of April 1905, and succeeded in mapping the hitherto unknown coast, later named "Haakon VII's Coast", where the most northern station, situated on $72^{\circ} 2'$ north latitude and $104^{\circ} 45'$ west longitude, was reached on the 26th of May. The party returned to Gjøahavn at 8 o'clock in the evening of the 25th of June. This last expedition was merely a geographical one and they did not carry instruments for magnetic or meteorological observations.

The 30th of June 1905, the last photographic paper was placed on the cylinder of the magnetic recorder. By this time they had obtained an almost unbroken series of photograms, covering 19 months. The variometers were put into a large packing-case and stored on board the ship. The following day they began to pull down the "Variation House" and during the whole month of July they were occupied with preparations for the departure from Gjøahavn.

In the event of some new expedition coming to these regions, it would be of special interest to be able to know the exact point where all the absolute magnetic observations were taken, and therefore Amundsen dug a hole into the ground, where the tripod of the magnetic theodolite had stood, and in it he placed a yellow limestone, one foot long and half a foot broad, which bore the mark "G" cut into its surface. The site of the variometers was marked by a mound. The late director of "Deutsche Seewarte", Professor Dr. von Neumayer, had taken great interest in Amundsen's plans concerning the magnetic work and he had personally aided Amundsen during his preliminary preparations. Amundsen therefore had taken with him a photograph of Neumayer and intended, as an act of honour, to put it in the ground at the magnetic pole, or as near to this place as would be possible. During the sledge expedition on Boothia Felix, where they took observations in the immediate neighbourhood of the magnetic pole, Amundsen carried with him this photograph, but did not find any convenient place into which to put it. He therefore decided to put a tin box containing the photograph under the foundation of the variometers at Gjøahavn. This was done secretly in the night of August 7th, because Amundsen feared that the Eskimos, if they knew about it, would later on dig it up. The 12th of August, at 9 o'clock in the evening, the last meteorological observation was taken at the station and the instruments were that same evening carried on board the ship. "Exactly at 3 o'clock in the morning of the 13th of August 1905, the winch played merrily on Gjøa's deck." The first part of the task had successfully been finished. Now the turn came for the "North-west-passage."

From Petersen's Bay they entered Simpson Strait and sailed through Palander Strait into Queen Maud's Sea. In the morning of the 16th the south point of Jenny Lind's Island was rounded and on the 19th they entered Dease Strait between Victoria Land and the American Continent. Dolphin Strait and Union Strait, the western outlet from this strait, was passed on the 22nd and from here they sailed northwards towards Nelson Head on Baring's Land, where they arrived on the morning of the 26th, and on this same day, at half past nine in the morning, they caught sight of a ship. "The North-west-passage was an accomplished fact".

The 3rd of September 1905, they made fast to an ice-floe off King Point, where they were forced to face another wintering. Close to the place to where the Gjøa had made fast, lay a stranded whaling schooner, "The Bonanza," which had some time before been run ashore as a wreck. The first mate of "The Bonanza", who was keeping watch on the cargo in the ship during the winter, was building a house on the hill-side near by. It was in fact he, a Norwegian, who had piloted the Gjøa to this place, where, according to his three years' experience in these regions, fairly good winter quarters were to be had, in spite of its being quite open. The place where the Gjøa lay was convenient because they could watch the ice, and, if it should loosen, they could easily get out. On the 5th, however, they had to haul the Gjøa inside of the grounded-up ice, as a gale from the north-west sprang up.

"The new ice increased in thickness every night and soon our fate was settled for the coming winter. Saturday, the 9th, the ice was strong enough to carry a man and we had to accept the fact that our third winter had begun." Thus Amundsen closes the chapter about the passage itself, in his book "Nordvest-passagen." Just before the above we read: "The bay outside was very shallow and covered with grounded-up ice. There was thus little possibility for movement of the shore-ice. Sten, the mate of "The Bonanza", told us that three whalers had wintered here without having observed any movement of the ice."

This open bay, off King Point, became the winter quarters and anchoring place of the Gjøa for the following ten months. The large Mackenzie River, flowing from the south-east into the ocean, through a wide delta some miles to the east, made an open lane along the shore, while the ice, pressing on from the north towards King Point and Key Point, a headland about 15 miles to the west, forming a bay towards the north-west, where a river flows out, also made a lane along the coast. The ground and the soil here were somewhat similar to those of King William's Land, a hill-land of small elevation covered with moss and with lakes and rivers here and there.¹⁾

Realizing that they had to remain here, they immediately set about preparations for the winter. Monday, the 11th of September, they started the construction of a house. They also this winter decided on making two houses, both of which were to be built from drift-wood. The first was to be the living-house and the second a magnetic variation house. The observer, Lieutenant Hansen, lived on board the Gjøa, which was frozen in off the shore. He was in charge of the meteorological as well as the astronomical observations. Here the barometers were put up and the snow-gauge placed on a post on the ice. The meteorological screen, not the one used at Gjøahavn, was placed on the ice, on posts one metre high. The living-house was built about 150 metres south of the ship.

Amundsen made a trip in September to Herschel Island to get the mail and he says in his report: "During my absence good work had been done on board and on shore. Lund had constructed a new meteorological screen, so made that the snowdrift could not pack into it. Already the day after my arrival home, the 30th of September, I put, assisted by Ristvedt, all the meteorological instruments in place and began taking observations the 1st of October."

The living-house, which was to accommodate four men, had only one room. On the 15th of September the roof was put on. It was made like the turf-tents of the Lapps, and was built on the most level part of the hill. The Variation House was placed to the east of this house at a distance of 200 metres. It lay 25 metres from the shore, on a hill, 35 metres above sea level. The hill sloped steeply towards the sea to the north. The base-line direction was determined from a series of observations taken by Wiik on the 22nd of September. The house was dug into the ground about four or five feet.

¹⁾ For further information we refer to "Nordvest-passagen".

It was 3.2 metres long and 2 metres broad. The foundation for the instruments consisted of a marble slab which was placed in a level position directly on the frozen ground. As building material they used boards taken from the wrecked "Bonanza." The roof was covered with tar-board and old sails, on the top of which they piled up earth, so that only the ridge of the roof was visible. On this ridge they placed two flag-poles, which were used as "Mark" for the observations of declination. The entrance faced southwest and was reached through a five-metre long corridor, made of canvas. The doorway was covered with a rug.

About the other buildings and where they were placed in relation to each other very little has been stated. The Absolute House was also constructed from drift-wood and boards taken from the wrecked ship. It lay of course in the base-line direction, and as there was no room for it on the north side of the Variation House, it was placed on the other side of this house, probably some 70 metres in a south-westerly direction. The distance between the Variation House and the living-house was about 200 metres and we may conclude from photographs given in "Nordvest-passagen" that the living-house lay about 70 metres from the sea and in a western direction from the Variation House. Some 50 metres farther towards the west, Sten, the mate of the wrecked "Bonanza," had built his house, against the shore. To the north of Sten's house, the wrecked whaler lay, while the Gjøa lay frozen fast some 60 metres farther out and a little more to the east. The living-house lay some 150 metres south of the Gjøa.

The geographical co-ordinates, given for King Point, are according to Professor Geelmuyden:

$$\varphi = 69^{\circ} 6' 40'' \text{ N.}, \quad \lambda = 138^{\circ} 8' 10'' \text{ W.}$$

Nothing is stated as to which point these co-ordinates refer to, but as there can only be a question of the three places, the ship, the living-house, and the magnetic observatory, distributed over a distance of 150 metres in the direction north-south, the uncertainty of the latitude ought not to be greater than five seconds.

Amundsen went to Fort Yukon and stayed away the whole winter, he returned to the station on the 12th of March. Helmer Hansen and Ristvedt went hunting the greater part of the winter in the woods about Mackenzie River in order to secure provisions. The wintering at King Point was not so lonely as it had been at Gjøahavn. Besides the coming and going of the Eskimos, they received visits from the other ships which were frozen fast in the ice. Not less than 11 ships lay frozen fast in their neighbourhood. The life at the station went on smoothly until the middle of March, when the happy days were broken by the sudden death of Wiik. He had felt unwell for some days, but kept on performing his duties until the 22nd, on which day he took his last magnetic observation. A week later on the 30th of March 1906, he died. "I closed the eyes of the deceased", Amundsen says, "and for a while we sat with him in silence and grief. Wiik had been our good friend, and through his cheerful disposition and his merry jokes he had given us many a jolly hour. Death is always a dreary guest. For us, in our position, far away from kindred and friends, it perhaps affected us still more than it otherwise would have done. As soon as possible we took up our work, the great comforter and helpmate."

The magnetic recording instruments were kept going until the first of April, but no absolute measurements were taken until Amundsen took up the observations again at the beginning of May. From now on absolute measurements were taken until the end of June, without, however, any registering. Amundsen had, in fact, decided to transform the Variation House into a tomb. After the variation instruments had been packed, the coffin, containing the dead body of Wiik, was put into the room. This solemn act took place the 9th of May. After having placed the coffin inside, the opening was blocked

up, and a tall cross was erected at the northern side of the house, towards the sea. The site of the Absolute Observatory at King Point was also marked for the benefit of future expeditions by the aid of a large stone with "Gjøa, 1905—06" marked upon it.

The 10th of July, at 5 o'clock in the afternoon, they weighed anchor and sailed westward. They did not get very far. Already on the 13th they were blocked by the pack ice off Herschel Island and had to seek refuge in a harbour, where they anchored at a quarter to three in the morning. They made some vain attempts to force their way through some lanes in the ice, but had to return to the harbour. On the 11th of August, at half past 9 in the forenoon, they succeeded in continuing the journey, but not until the evening of the 21st they could round Point Barrow, the northwest point of the American continent. From here on they found open water between the ice and the shore, and in the evening of the 23rd, when off Cape Prince of Wales, they sighted ice for the last time, and they anchored off Nome on the 31st of August, at mid-night.

The scientific material of the Expedition had been packed and stored away on board the ship. The magnetic photograms, after being developed, had been packed in 13 soldered tinned iron boxes. Books and papers, containing written data, had also been packed in the same way. On the arrival at Nome everything was placed in wooden packing cases and sent off to Oslo, where they arrived in October 1906.

Already during the stay at King Point Amundsen had communicated with Europe. Steen, Assistant Director of the Meteorological Institute in Oslo, had received a letter from Amundsen giving an account of the scientific results of the Expedition, and saying that an immediate test of the constants of his magnetic instruments would be of great interest. On receiving this letter Steen wrote to L. A. Bauer, Director of the Department of Terrestrial Magnetism of the Carnegie Institution of Washington, asking him to obtain permission for Amundsen to visit the magnetic observatory at Sitka in Alaska for the purpose in question.

Having received the information that Sitka Observatory was at his disposal, Amundsen left Nome with the Gjøa and made for the small island off the coast of Alaska, where this observatory lay. On arriving there, the absolute magnetic instruments were brought ashore, and owing to difficulty in unloading the Seeman Magnetometer was unfortunately lost in the sea. During the days between the 21st and the 24th of September Amundsen personally took observations at Sitka. However, as he had to join his men, who in the meantime had sailed the Gjøa to Seattle, he left his instruments at the observatory for further examination, which took place in February 1907.

On the voyage from Sitka to Seattle some papers were lost during a storm. Among these papers was the Journal "Voyage King Point—Nome." From Seattle the Expedition continued to San Francisco and the Gjøa passed the Golden Gate on the 19th of October. Both at Seattle and San Francisco the Expedition was received enthusiastically and at the last city the Gjøa was left for good and has since been taken care of by the city as a souvenir. Amundsen and his men crossed the American continent by rail and proceeded to Norway, where they arrived at Kristiansand on the 19th of November 1906. The Norwegian Government had, in honour of the Expedition, ordered one of its men-of-war, the "Norge", to meet them at Kristiansand, and on Tuesday, the 20th of November, at 1 p. m., the "Norge" with Amundsen and his men on board, entered the harbour of Oslo, where the official reception took place. As they passed the old fortress of Akershus a grand salute was given them.

The packing-cases, containing the scientific material of the Expedition, were on arrival at Oslo in October 1906, brought to the Historical Museum and were stored in the vaults until the authorities had arranged for the distribution of the contents of the different boxes for further examination by the scientists concerned. Already on the

11th of December 1906, two of the boxes containing magnetic, meteorological and astronomical data, were opened in the presence of Roald Amundsen and Aksel S. Steen. The cases contained about 700 magnetograms, and 100 solidly bound books, most of which were small notebooks, 16×10 cm., but a few were larger, 29×23 cm., each of them containing 100 leaves. As these were taken out they were provided with consecutive numbers, from 1 to 94. A document was at that time prepared in which the contents of each book were recorded and which was signed by Amundsen and Steen.

Below we give a translation of this document.

Magnetism.

- No. 1. Observations of declination, deflection, oscillation, inclination and total intensity at Godhavn and on Beechey Island.
- » 2 and 3. Journal for declination at Gjøahavn.
- » 4. Journal for inclination and total intensity at Gjøahavn.
- » 5. Journal for observations with the earth-inductor at Gjøahavn.
- » 6. Journal for declination, deflection, inclination and total intensity during the sledge expedition in the spring of 1904. (I).
- » 7. Journal for declination, deflection, inclination and total intensity observed at the stations near the base station. (II).
- » 8, a and b. Deflection observed at some of the stations near the base station (not entered in any other journal).
- » 9. Observations of total intensity and inclination at Gjøahavn. (I). Entered in journal No. 4.
- » 10. Inclination (II). Entered in journal No. 4.
- » 11 to 15. Field observations. (I. II. III. IV and V). Entered in journals No. 6 and No. 7.
- » 16 to 19. Deflection (I. II. III. IV). Entered in journal No. 3.
- » 20 to 24. Declination (I. II. III. IV. V). Entered in journal No. 2.
- » 25. Observations with the earth-inductor. Entered in journal No. 5.
- » 26 to 30. Field observations. (I. II. III). Entered in journals No. 1 and No. 6.
- » 31. Instrument Journal for Gjøahavn.
- » 32. Register Journal for Gjøahavn.
- » 33 to 37. Chronometer comparisons. (I. II. III. IV. V).
- » 38 to 40. Declination. (I. II. III). Entered in journals No. 47, 48 and 49.
- » 41. Inclination. (I). Entered in journal No. 50.
- » 42 to 45. Deflection and oscillation. (Originals), (I. II. III. IV). Entered in journals No. 51 to 54.
- » 46. Chronometer comparisons.
- » 47 to 49. Declination at King Point. (Journals No. I. II. III).
- » 50. Observations of inclination and total intensity at King Point. (Journal).
- » 51 to 54. Deflection and oscillation at King Point. (Journals No. I. II. III. IV).
- » 55. Remarks to the observations of oscillation at King Point.
- » 56. Register Journal for King Point.
- » 57. Comparison of chronometers at King Point.
- » 58 to 70. Magnetograms, November 1903 to June 1905, for Gjøahavn, and October 1905 to March 1906, for King Point.

Meteorology.

- No. 71. Barograms. Nov. 16 1903 to July 31 1905, Gjøahavn. 1
- » 72. Thermograms. Nov. 2 1903 to July 31 1905, Gjøahavn. 2
- » 73. Barograms. Oct. 2 1905 to June 30 1906, King Point. 3

No. 74.	Thermograms. Oct. 2 1905 to June 30 1906, King Point.	4
» 75.	Journal. (copy). Oslo, July 11 1903 to Gjøahavn, Nov. 1 1903. On board	5
» 76.	Journal (copy). Nov. 2 1903 to Jan. 18 1905, Gjøahavn. On board	6
» 77.	Journal (copy). Jan. 19 1905 to Aug. 11 1905, Gjøahavn. On board	7
» 78.	Journal (copy). Aug. 13 to Sept. 29 1905. On board	8
» 79.	Journal (copy). Oct. 1 1905 to June 30 1906, King Point	9
» 80.	Northern Lights Journal. Nov. 4 1903 to March 2 1905, Gjøahavn	10
» 81.	Northern Lights Journal. Oct. 22 1905 to March 26 1906, King Point. . . .	11
» 82 and 83.	Remarks to the meteorological observations (including thermo- meter corrections) for Gjøahavn and King Point	12, 13
» 84.	Meteorological observations during the Expedition. (Supplementary remarks to Meteorological Journal, 1903 to 1905). Gjøahavn	14
» 85 and 86.	Journal (rough) July 30 to Nov. 2 1903. On board and Gjøahavn 15, 16	
» 87 and 88	(Rough). Nov. 2 1903 to June 3 1905. Gjøahavn	17, 18
» 89 and 90.	(Rough) June 4 1905 to June 30 1906. King Point	19, 20

Astronomy.

- No. 91. A parcel containing astronomical observations.
» 92 to 94. Comparisons of chronometers for 1903 to 1905.

After this first examination, all the documents were replaced in the boxes. During the year 1907 the scientists who were interested in Amundsen's observations discussed the question of what should be done to make this important material universally available. They agreed that this could be accomplished if the State Authorities would furnish the necessary funds for a critical examination, discussion and publication. The Ministry of Education being informed of the situation, took the first official step and wrote a letter to the Senate of the University in Oslo, dated the 7th of January 1908, in which the Ministry asks the Senate to form a committee, competent to make a formal proposal as to what measures ought to be taken. The result of this was that on the 25th of the same month the following members of a preliminary committee were appointed:

1. Dr. H. Mohn, Professor at the University and Director of the Meteorological Institute in Oslo.
2. Dr. R. Collett, Professor and Director of the Zoological Museum in Oslo.
3. Dr. Yngvar Nielsen, Professor and Director of the Ethnographical Museum in Oslo.
4. Dr. J. N. F. Wille, Professor and Director of the Botanical Garden in Oslo.
5. Aksel S. Steen, Assistant Director of the Meteorological Institute in Oslo.

This Committee submitted to the Senate of the University a letter, dated the 28th of February, and as this letter forms the foundation for the later treatment of the scientific material of the Gjøa Expedition, we give the following extract:

"In reference to a communication, dated 25th of January this year, in which the esteemed Senate requests us to form a committee with authority to make proposals for the treatment and publication of the scientific material collected by the Gjøa Expedition, the members of the Committee permit themselves to make the following statement;

The scientific material in question consists of:

1. Collected specimens of ethnographical, botanical, zoological and mineralogical (geological) nature.
2. Observations of astronomical, topographical, meteorological and magnetic nature.

The collected specimens have been transferred to the Ethnographical, Botanical, Zoological and Mineralogical Museums respectively, and the observed data are stored in the vaults of the Historical Museum.

The Committee is of the opinion that the following plan should be adopted:

- I. The botanical, zoological and mineralogical (geological) material is not too extensive to be dealt with by the staffs of the above mentioned institutions, and published in scientific reviews without special expense to the Government.
- II. The discussion of the ethnographical material, which has already been exhibited in the Ethnographical Museum with a catalogue, can at once be commenced. The paper, containing the discussion, will probably cost.
- III. The astronomical and topographical observations cover determinations of time and geographical position, comparisons of chronometers, triangulation, altitude and distance measurements and cartographic works.

Besides final determinations, extracted from the mentioned material, accompanied by explanations, the following charts ought to be worked out and published:

- a. Neumayer's Peninsula with surrounding territory.
- b. Kong Haakon VII's Coast and Royal Geographical Society's Island.
- c. The route traversed by the Gjøa.

The estimated expense for so doing is.

- IV. Meteorology. The meteorological observations of the Gjøa Expedition have been made according to instructions similar to those of the Second Fram Expedition. Expenses for discussion and publishing of these data amounted to , and we estimate the expenses required for the publishing of the meteorological material of the Gjøa Expedition to be.
- V. Terrestrial Magnetism. It is known that the chief purpose of the Gjøa Expedition was to reach the neighbourhood of the magnetic north pole, and during two winters to make magnetic observations and surveys as extensive as circumstances allowed. This plan has been fully carried out, and even more has been accomplished, as Roald Amundsen succeeded in returning through the North-west-passage, and procured during a third wintering at King Point additional material consisting of magnetic variation curves registered during 6 months at a locality from which up till then no such material had been obtained.

The magnetic material of the Gjøa Expedition covers: a., b., . . . j.

From the account given above every magnetician will understand that here we have to do with a material which may be placed side by side with anything previously collected for study of terrestrial magnetism.

We can not discuss this material in detail, but what we can and will do, and also what may be said to be a national duty, is to present this unique collection of observations to the scientific world in such a form that every magnetician may be able to found his special studies on the reduced data.

In the first place we consider it desirable to publish reproductions of the photographic records thus prepared, so that they can be easily used. From this point of view the Committee proposes the following plan for the reduction, discussion and publishing:

1. Control Observations.

In order to determine the constants of the absolute instruments and the magnets, the observations at Postdam and Sitka must be reduced. The reduced data are to be compared with similar data from the Expedition itself and final values for said constants must be decided upon.

2. Scale Values.

Observed data for calculation of the scale values of the variometers must be compiled and final values decided upon.

3. Time.

Concerning the reduction of time, data extracted from the comparisons of the chronometers, as well as astronomical data, must be worked out before these data can be of use for the reduction of the magnetic material.

4. Base-line Values.

The absolute data reduced from the observations taken at Gjøahavn and at King Point must be discussed and the values of the base-lines of the photograms must be decided upon.

5. Absolute Observations.

The absolute magnetic observations are to be published *in extenso*.

6. Photograms.

The photograms, prepared in the customary way, are to be reproduced the same as original size.

The publication shall, according to this plan, comprise at least four volumes. The work is so extensive that it can probably not be completed in less time than four years, and it is therefore impossible to estimate expenses. However, the Committee wishes to remark that the work must be conducted by a responsible editor, who must personally undertake the fundamental determinations and prepare the results for publication, and who for routine computation may be assisted by computers and also receive assistance for graphical work.

To cover the salaries and other expenses the Committee suggests an average annual sum of

As already one year has passed since the Expedition returned and as inquiries, especially concerning the magnetic data, have been repeatedly received from foreign countries, one gathers that the results extracted from the scientific data of the Expedition, are awaited with anticipation and special interest, the Committee deems it necessary to advise that the work should be begun at once, and that for the financial period, April 1st 1908 to June 1st 1909, an appropriation of the sum of should be applied for.

In connection with what has been said above the Committee proposes, in order to hasten the work, that the esteemed Senate should, under supposition that the proposed appropriation will be given, call upon the Ministry of Education for the appointment of an Editorial Committee, consisting, for example, of three members, who being responsible to the Ministry, shall undertake to edit the papers, keep accounts and forward budget proposals for the following periods etc."

On the 10th of March the Senate of the University submitted to the Ministry of Education the above-stated proposals accompanied by a statement from which we give the following extract:

„ On receipt of the letter referred to above the Senate appointed a Committee which should make a proposal concerning what ought to be done as to the treatment and publishing of the scientific material collected by the Expedition. This committee—the members of which were the Professors Mohn, Collett, Yngvar Nielsen, Wille and the Meteorologist Aksel S. Steen, submitted the accompanying proposal of the 28th of last month.

From this proposal it will be gathered that the Committee estimated that for treatment and publishing the material in question a sum of about would be required. Furthermore the Committee proposes the immediate appointment of an Editorial Committee which shall undertake to edit the papers, keep accounts, and forward budget proposals for the following periods etc.

The Senate agrees with the Committee that it is necessary, and desirable out of consideration for foreign countries, that the discussion of the scientific material of the Gjøa Expedition should commence as soon as possible and we therefore strongly recom-

mend that an appropriation necessary for this purpose be granted. The Senate is of the opinion that this appropriation ought not to be posted on the budget of the University, but should be entered as a special item on the "Cultus Budget," as the appropriation in question must be considered as coming under the special appropriation, which was granted last year to the Expedition on the condition that the collections gathered by the Expedition should be transferred to the Norwegian State as its Property. As to the proposal of the Committee and the details of the same the Senate does not find occasion for any remarks and it also agrees with the Committee in the proposal that ought to be granted for this period.

As members of the Editorial Committee, mentioned above, the Senate proposes the Professors Mohn, Yngvar Nielsen, Geelmuyden and the Meteorologist Aksel S. Steen, who having been asked, have declared themselves willing to serve as such."

The proposal of the Committee, as well as the suggestion added by the Senate of the University, were accepted by the Government and sanctioned by the "Storting." The first appropriation was granted already in May 1908, and the Editorial Committee could at once go to work. Professor Mohn was elected President and Steen Secretary and Treasurer.

Since 1908 much has been changed. All the original members of the Editorial Committee had died long before the work was completed. Director Steen died in May 1915 and his place was taken by the two Meteorologists Nils Russeltvedt and Aage Graarud, the first being asked to succeed Steen as a member of the Committee, while Graarud took over the work of Secretary and Treasurer. Professor Yngvar Nielsen died in March 1916, and Professor Mohn in September of the same year. The Government then asked Mr. Graarud to join the Committee.

Professor Yngvar Nielsen had been assisted by Dr. Solberg, at present Professor in Ethnography at the University in Oslo, in the discussion of the ethnographical material, and after having agreed to finish this part of the work, Professor Solberg proposed that Ethnography should be published separately, a request that was granted shortly afterwards.

The Editorial Committee was thus reduced to three members and since 1920 it has consisted of Mr. Russeltvedt and Mr. Graarud, as in the spring of 1920 Professor Geelmuyden also died. As he had finished the discussion of the astronomical data of the Expedition before his death, it was not deemed necessary to replace Professor Geelmuyden on the Committee.

As to the arrangement of the data, the astronomical part has been placed first, followed by the meteorological, while the chief contents of the publication, Terrestrial Magnetism, form the last part.

The different manuscripts were completed in 1922 but, owing to the difficult financial situation after the war, the Government could not provide the funds necessary for their publication, except for Part III, containing the magnetograms. However, the magnetograms had to be reproduced in one quarter the original size instead of in full size, as planned when the reduction of the data was commenced.

After the death of Roald Amundsen in 1928 a Fund was created to his memory. This fund was legally instituted in December 1930 under the name "Roald Amundsen's Memorial Fund" and the Board of Trustees resolved that the income of the fund should be used for no other purpose than the publication of the Scientific Results of the Gjøa Expedition until such publication was completed. The memory of the great explorer could not be honoured in a more appropriate manner.

The Committee extends its respectful thanks to the Board of Trustees for this generosity, which has made possible the publication of the two first parts of the work.

As to the arrangement, the astronomical data have been placed first and followed by the meteorological, forming together Part I, while the magnetic observations are contained in Part II. On account of the expense the observed material has not been given *in extenso* as originally intended, but the instruments, their corrections and the methods of reduction have been described in detail. Each part has been provided with a special introduction giving information as to the persons who in course of time have taken part in the work.

In the spring of 1931 the manuscripts have been critically examined and revised by Dr. H. U. Sverdrup, to whom the Committee extends its sincere thanks.

Oslo, 1931.

Editorial Committee,

Nils Russelvedt.

Aage Graarud.