



## RECORD OF THE HYDROGRAPHIC WORK UNDERTAKEN BY THE RUSSIAN NAVY DURING THE PAST CENTURY

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*(See Hydrographic Review, Vol. V, No 1, page 70).*

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In order to convey some idea of the scope of the hydrographic work carried out by the Russian Navy during the past century, each ocean will be considered separately.

*THE BALTIC SEA.* This sea has played an important rôle for Russia and for that reason the survey of this part of the ocean has been zealously prosecuted. The coast of Finland especially, with its numerous intricate reefs, required considerable work.

A detailed reconnaissance of this sea, commenced in 1828, was continued up to 1853 by a special expedition composed of 30 to 40 officers and 400 seamen and of 6 to 8 vessels of the fleet. The first work to be undertaken was the triangulation along the entire Russian Baltic coast, starting with the islands of Oland, with the exception of the Gulf of Bothnia. The work consisted of plane table surveys along the coast, based on the triangulation, and lines of soundings from boats and vessels. Boat soundings were taken by running parallel lines of soundings spaced from 50 to 80 sagenes (1 sagene equals 7 feet or 2.1336 metres). Based on this work, there were published 25 charts and 3 plans covering the entire coastline from the northern part of the Gulf of Finland from Hangö to Petersburg and further to the southward, including the islands of Dagö and Oesel.

After 1853, the expedition was reduced to almost half its former strength. The remaining personnel was able to complete the descriptive work of the Russian Baltic coast in about 1860, with the exception of the Gulf of Bothnia and the reefs of Oland and Abo. Since that time the hydrographic work has consisted largely in completing the plans already prepared or obtaining des-

criptions of the reefs off the coast of Finland which had been omitted. The lack of method in the work, which was carried out largely in order to meet the various demands of the fleet, as well as the errors, which were discovered later, in the points of control, had somewhat detracted from the value of the work. Besides the configuration of the bottom, which is extremely complicated near the coast of Finland, rendered the work more difficult. The distance between parallel lines of soundings of from 50 to 80 sagènes, as mentioned above, did not make for safety of navigation in those regions, as was realized later. That is why it was found necessary, with the supplementary soundings, to resort to sweeping in the channels.

As a result of these recognized faults a systematic survey was undertaken in 1908, under a newly organized expedition. The work started with a new triangulation, beginning with a measured base at Oland, and continuing to the eastward. Special care was devoted to the accurate beaconing of the control points of the triangulation. The uninterrupted survey of the plans of the reefs of Oland was carried out in this manner; soundings spaced from 30 to 50 sagènes and from 10 to 15 sagènes in the channels.

The war put an end to the work of this expedition which covered the whole of the Oland archipelago and part of the reefs and channels to the east of this island.

After the War and during the last few years, accurate surveys have been commenced in those waters of the Gulf of Finland which remain under the Soviet Union, in order that the charts of this region, based on data obtained about a hundred years ago, might be brought up to date.

As a result of this continuous work, there have now been published among the charts of the Baltic Sea, 42 charts of the Gulf of Finland, 14 of the Gulf of Riga and of Moonsund, 29 of the Gulf of Bothnia and 33 of the Baltic.

In addition there have been published:— (1) Sailing Directions for the Russian Baltic coast; (2) Sailing Directions for the Baltic, parts I, II, and III; (3) Sailing Directions for the Southern portion of the Gulf of Bothnia and for the reefs of Oland.

In the *BLACK SEA* and the *SEA OF AZOV*, two systematic surveys have been completed during the past hundred years. The first surveying expedition, from 1825 to 1836, worked from definitely predetermined astronomical stations as bases, although for the most part, these surveys were confined to plane table surveys along the sea-coast. However, thanks to the attention to detail in this systematic work, the charts based thereon served until 1873. The work of filling in the gaps in the charts and completing the work on the river mouths and ports was continued until 1871; at which time the Hydrographic Expedition of the Black Sea was organized. This expedition, composed of 20 to 60 officers and from 3 to 5 vessels, continued the work until 1887. By that time its personnel had been gradually reduced to 20 officers and it was then designated as the expedition for partial surveys. This expedition carried out plane table surveys based on triangulations together with boat soundings, as well as the more widely spaced soundings from vessels. In this manner the whole Russian coast with but small exceptions, was surveyed.

As a result the Black Sea is now covered by 74 charts and plans and the Sea of Azov by 10 charts. Further, Sailing Directions were published for the Sea of Azov in 1926 and for the Black Sea in 1927.

*THE WHITE SEA* was explored systematically for the first time by an expedition working from 1827 until 1831. This work was based on 31 astronomical stations and was supplemented by lines of boat soundings and by soundings from vessels to a distance of 20 miles from the coast. Besides, detailed surveys of the anchorages and bays were completed. In this brief period the work could not be carried out in great detail, owing to the great expanse of the basin with its numerous reefs and complicated tides.

The charts based on this work, published in 1834, soon ceased to satisfy navigational requirements, but it was not found possible to organize additional work until 1887. It is to be regretted that the numerous demands for exploration in various localities rendered it impossible to systematize this work, the more so as the personnel for the expedition for partial surveys of the White Sea was limited to from 7 to 10 hydrographic surveyors, having only one or two vessels at their disposal. These surveys were based on local triangulations which were joined up with astronomical stations not inter-connected. The surveys covered solely the contour of the coast, and the soundings, in order to expedite the work were not continuous but were confined to the channels. In this manner almost the entire bay of Onega and the coast from Karelia to Letney were surveyed. Later, all of the local triangulation bases were connected up to two bases and this reduction demonstrated the weakness of the original work. As a result, new charts have been issued covering the bay of Onega, giving ample soundings.

During the War, systematic work on a large scale was accomplished based on astronomical stations covering the coast from Kanine to Zimny. This consisted of shore-line surveys from aboard ship, soundings and several plans of the approaches. There are available for this sea, 42 charts and the Sailing Directions, of which the second volume, with instructions for navigation, was corrected and published in 1924.

*THE MURMANSK SEA.* The charts of the coast of this sea, based on work carried out in 1822, 1823 and 1825, were published in 1839-1840. This work had been carried out in boats and aboard vessels and was based on astronomical stations. Only the coast line was mapped; soundings were rare. In spite of that, however, the work had been carried out systematically and the charts have served until recently — being corrected in accordance with data obtained from later explorations of the bays which were transferred to the individual charts from astronomical positions. Meanwhile, in 1905, large errors having been found in the charts of the coast of Murman, an expedition for partial surveys was organized to undertake systematic work. It started with a survey of the Gulf of Kola, based on an accurate triangulation. At the same time, a plane table survey was made based on horizontal coordinates and detailed soundings off the shore-line; first by boat soundings and later by soundings from ships. The expedition was composed of 9 hydrographic surveyors and one vessel.

Later, these surveys were continued in a westerly direction as far as the frontier. Interrupted by the war, they were again resumed by the Arctic Ocean Expedition, which, at present, is successfully working to the eastward, conforming to the previously established plan of work scheduled to be concluded by 1930.

Aside from the charts previously mentioned, a number of charts have been published recently based on these last surveys, so that there are now 26 charts in all, covering the Murmansk Sea. The Sailing Directions for the coast, which have been revised several times to conform to the development of the country, were last issued in 1925.

*THE BARENTZ SEA, NOVAYA ZEMLYA AND THE SEA OF KARA.*

The work done during the past century has not been confined to exploration alone. The increasing economic development of Siberia and the discovery of the possibility of inland navigation on the large Siberian rivers, Ob and Yenessei, led to the organization of a Hydrographic Expedition in 1894, composed of 7 hydrographic surveyors and 2 vessels. The work of the expedition was started on the Yenessei and progressed slowly to the westward. The hydrographic exploration accomplished by this expedition was based on astronomical stations and covered successively the coast and bays of the Sea of Kara. The soundings taken at the same time have given results which make for the safety of navigation. Besides, the Expedition succeeded in discovering a number of anchorages and bays suitable for trans-shipments. The passages leading into the Sea of Kara were most carefully explored, as for example the Yougorsky Shar, which was covered by triangulation, based on which exact surveys and soundings were carried out. Very recently the same work has been carried out in the western approach of the Matotchkin Shar. While the base of the Expedition was located at Archangel, it was assigned the task of undertaking the hydrographic work in the Sea of Barentz during the Summer. The first hydrographic exploration had been made before 1827, but these were restricted to the mapping of the coast line and soundings at wide intervals, giving only a superficial indication of the configuration of the ocean bed. For that reason and since it has now become necessary to open up the mouth of the Petchora to navigation, the Expedition has been forced to undertake a hydrographic survey of this river mouth for the sole purpose of locating the channel and not for detailed study. Likewise, in the case of the Vaigatch Islands and Novaya Zemlya, the exploration has been restricted to a few bays which may serve as a refuge for ships menaced by the Arctic ice. The enormous expanse of the coast and the waters to be explored and the difficulties encountered with ice, make systematic work impossible and render it necessary to base the surveys on accurately located astronomical stations. Plane-table surveys and boat soundings can only be carried out in the bays. The work of the first expedition was suspended in 1905. It was resumed in 1918 in the region of the Sea of Barentz by the Northern Hydrographic Expedition and in the bays and mouths of the Ob and Yenessei rivers by the Government Commission for the Safety of Inland Navigation. Now the work is being

carried through in a systematic manner. The banks of the rivers are gradually being covered by plane-table surveys based on astronomical stations and at times on triangulation.

A similar work is being carried out on the coast of Novaya Zembyla, starting with the Matotchkin Shar in the north and working to the southward, with a net-work of triangulation between astronomical points established with the aid of a small theodolite. A plane-table survey on the scale of 1/100,000, is based on points of this net-work.

As a result of this work it will be possible to prepare new and more accurate charts in the near future to meet the requirements for navigation in the bays as well as in the channels leading to the Sea of Kara and the Straits.

*THE SIBERIAN SEA.* The shores of this sea as well as its islands were not definitely located on the charts up to the period from 1911 to 1914; during which time a special Expedition on two ice-breakers worked in this region. This Expedition completed the hydrographic survey, based on astronomical stations ashore. The soundings, taken *en route*, furnished the first indications of the configuration of the bottom in this basin. A more detailed exploration of some of the bays supplemented by plane-table surveys and boat soundings, completed the data obtained by the Expedition. Among other things, it discovered several detached islets and an archipelago of large islands to the northward of Cape Cheliuskin. Finally the exploration of the mouth of the Kolyma river and the course of the river Lena, completes the list of all that is known of the Siberian Sea.

Combining this region with the preceding, in so far as pertains to the charts issued, there are now 30 charts for the entire Arctic Ocean beginning at Kanin Noss.

*THE PACIFIC OCEAN.* Under this general designation are comprised the Bering Sea and Straits, the Sea of Okhotsk and the portions of the Sea of Japan which bathe the Russian coast. The great expanse of the shore line, measuring almost 20,000 kilometres of uncultivated land sparsely settled, explains the reason why more or less systematic work was not undertaken until 1855. Afterwards a special expedition charged with conducting these surveys was organized in 1880, with base at Vladivostock. It started the systematic exploration which gradually covered all of the Gulf of Peter the Great. In the same way the mouth of the Amur river was thoroughly explored. Also the hydrographic survey of the channel of Tartary was completed and soundings taken from the vessel underway.

Subsequent to 1898, after the annexation of the Gulf of Liaotung, the expedition was dispatched to the waters of that gulf and continued the work there until 1904. Though having but a single vessel at its disposal, the expedition collated sufficient data for the preparation of 22 charts and maps. After the conclusion of the Russo-Japanese War, the expedition moved on to the Sea of Okhotsk which was explored by hydrographic surveys based on astronomical stations. Finally the expedition entered the Bering Sea where its work

was concluded at the island of Karaguine. Numerous soundings supplemented the exploration of the bays, the straits and other regions of importance to navigation, thus insuring that the charts compiled from these data should make for the greatest possible safety in navigation. In all, there exist now 98 charts for this region, and 4 Sailing Directions among which is the Pilot for the Sea of Ohkotsk, which was compiled and published in 1923.

*THE CASPIAN SEA.* The map of this sea, prepared in 1826, was very inaccurate, the errors exceeding 20 to 30 kilometres. Consequently, an Expedition was organized in 1857, comprising an effective personnel of 20 hydrographic surveyors, with one vessel, one schooner, and one barge. The Expedition worked until 1870. During this time it completed the exploration which was remarkable from a scientific standpoint for the scope and the systematic method of the work and its high degree of accuracy. 26 charts, 10 plans and the Sailing Directions which are in use to-day were the results of the work of this Expedition.

However, in spite of the high quality of the work of the Expedition and since no one was charged with the responsibility of keeping the charts up to date, they gradually ceased to be in accord with fact owing to the influence of various natural factors.

Consequently, in 1909, a separate hydrographic expedition was organized composed of 10 hydrographic surveyors with one vessel, which started work in those localities subject to the greatest changes. The work was based on a triangulation accompanied by plane-table surveys, boat soundings and soundings from vessels. Unfortunately, the War interrupted the work in 1915 and consequently it was only possible to correct the charts, (1st) in the vicinity of Petrovsk; (2nd) from Baku to Lencorane; (3rd) in the vicinity of Astrabad and (4th) in the Bay of Krasnovodsk.

In 1920, when the Caspian Sea was again incorporated in the limits of the Soviet Union the work was recommended under the hydrographic expedition of the Administration to ensure the safety of local navigation. Owing to the great number of requirements to be met, this work was carried out without system and only in recent years has it been possible to undertake methodical work. Thus, in 1926 the hydrographic survey of the whole southern coast was made from Astara to Hasan-Kuouli, based on astronomical stations ashore. In 1927 the systematic adjustment of the triangulation of the western coast to the northward of Bahu was started, using this as a basis for the surveys and the soundings run at the same time.

In all, 33 charts of this sea are about to be published partially resulting from this work.

To complete the historical sketch, there remain only to be mentioned the explorations in the Aral Sea, the lakes of Ladoga, Onega and Tchoud and the Lake of Baikal. The first two were surveyed towards the middle of the last century, astronomical stations serving as the basis for the survey of the coast line and the widely spaced soundings. This work made possible the preparation of the charts of these basins which are in use to-day. The exploration of Lake Onega was carried out on the same plan but supplemented in part by

triangulation. The work in Lake Baikal was undertaken by a special expedition which started work in 1896. The plane-table survey of the coast was based partly on astronomical stations and partly triangulation. Boat soundings were taken along the entire coast and, in places where the depth was great, from the ship itself. Several charts of Lake Baikal have been prepared as a result of this work, together with an atlas of maps of the coast and detailed Sailing Directions.

