A SHORT HISTORICAL SKETCH OF HYDROGRAPHIC WORK OF THE LATVIAN COAST AND TO SEAWARD, AND THE PRESENT STATE OF THE CHARTING THEREOF.

by

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The Baltic Sea was shown on the first chart of the World in the 2nd century A. D. PTOLEMY calls it *Sinus Venutus*. It was during the 16th century that definite outlines were given to the Baltic Sea, *i. e.* when the chart by OLAUS MAGNUS and several Dutch charts of the coast of Europe appeared in 1539.

The first charts dealing with the Baltic as a separate sea appeared in the middle of the 17th century. They were drawn up in Swedish, and the oldest of these was published in 1644 by John MANSAN, Head of the Swedish Navy. The "Pilot" issued with this chart was still in use in 1721. In 1694 the Swedish Admiral ROSENFELD published new charts of the Baltic on Mercator's projection.

After the conquest of the Eastern shore of the Baltic by the Russians all cartographic and hydrographic work passed into the hands of the newly established Russian Navy. In the earlier days they used foreign charts, such as the above-mentionned Swedish and Dutch ones, these being the best that existed at that time.

Among the first hydrographic surveyors employed by Russia the following must be mentioned in connection with Latviai waters :- the Hydrographic Surveyor SHONBEK, who worked in 1705, Captains NAGAJEFF and WINKOFF, 1746 to 1752, who commenced the collection of the more or less accurate information then existant and carried out surveys (WINKOFF's name appears frequently in connection with sand-banks: WINKOFF's sand-bank opposite Ovisi). Members of the Academy fixed the astronomical positions at some of the principal ports including Riga. NAGAJEFF drew up and issued an atlas of charts together with sailing directions, which passed through several editions and was used for more than 50 years.

Surveying instruments of greater accuracy became known in Russia in the beginning of the 19th century; amongst these were theodolites and chronometers, and with these the correction of NAGAJEFF's chart was commenced. This work of correction was entrusted at first to SARITCHEFF, whose name will be found applied to different objects on the charts of the Baltic.

From 1816 to 1819 W. STRUVE, an astronomer of Tartu (Dorpat), carried out a remarkable astronomic and geodetic work on the east coast on the Gulf of Riga, from Riga to Ainazi and right into Estonia. He fixed several points astronomically as a foundation for systematic charting of the coast,

and then connected his work with the first notable triangulation of our country made by TENNER from 1822 to 1826.

This completed the first period of surveys, though this period was discontinuous and somewhat accidental in character.

As the science of instrument construction and the theory of cartography progressed, hydrography was based on more certain foundations. In consequence of this progress an hydrographic expedition was sent out in 1828, under the leadership of SCHUBERT, WRANGEL and REINEKE, to carry out a new systematic charting of the coast. SCHUBERT carried out a satisfactory triangulation based astronomically on Tallinna (Reval), and thus collected valuable cartographic material on the East coast of the Baltic. Although he gave special attention to the Gulf of Finland, for instance SCHUBERT's triangulation extended only as far as the coast of Kurzeme (Courland: Liepaja to Strait of Irbe) and connected up with TENNER's net, systematic work was begun on the coast of Latvia also. In 1840 to 1842 WRANGEL made a new triangulation of the coast of Kurzeme; in 1841 he surveyed the coast and coastal waters from Ovisi to the river Irbe, and in 1843 continued the work as far as Cape Kolka. In 1845 a closer examination and survey of the approaches to the Gulf of Riga were carried out. In 1848 attention was directed to the environs of Liepaja where SIEVERS fixed 13 astronomical stations on the Kurzeme coast and constructed a plan of Liepaja harbour and its approaches. In 1853 he completed the hydrographic survey in the vicinity of Cape Kolka and carried out more surveys at Ventspils and the river Venta. In this same year (1853) the expedition under SCHUBERT finished the work allotted to it and, although it had carried out important work on the north and central coasts of Russia, it had barely touched the coasts and waters of Latvia.

In 1854 greater attention was given to the Gulf of Riga and the coast of Kurzeme and, until 1859, hydrographic surveys of our coasts and waters were made.

In 1854 the hydrographic expedition reached the river Svête, and in 1856 a survey was made in the southern part of the Gulf of Riga, and the survey of Riga itself and the work from Ovisi to the southward was continued. In 1857 considerable surveys were carried out in the Gulf of Riga where several parties were at work on both the eastern and western coasts, and ships carried on the survey in the central part of the Gulf.

Meanwhile TARANZOFF made a small triangulation of the East coast and off-shore surveys were made near Ventspils and Pâvilosta. At the same time Liepaja Lake was sounded out and some surveys were made in the river Daugava (JOVEZ and TCHUPROFF). In 1858 a survey of the Gulf of Riga was being carried out in the vicinity of Mêrsrags, and the survey off the coast of the Baltic near Pape was completed. In 1859 the various areas surveyed by the different parties were finally connected up, vessels were sent to obtain soundings in the deeper parts of the Baltic and to examine some of the shoals (*e. g.* the bank off Cape Kolka which had changed very much since 1843), and this completed the systematic hydrographic work of the expedition.

The next systematic hydrographic survey on our coast was not carried

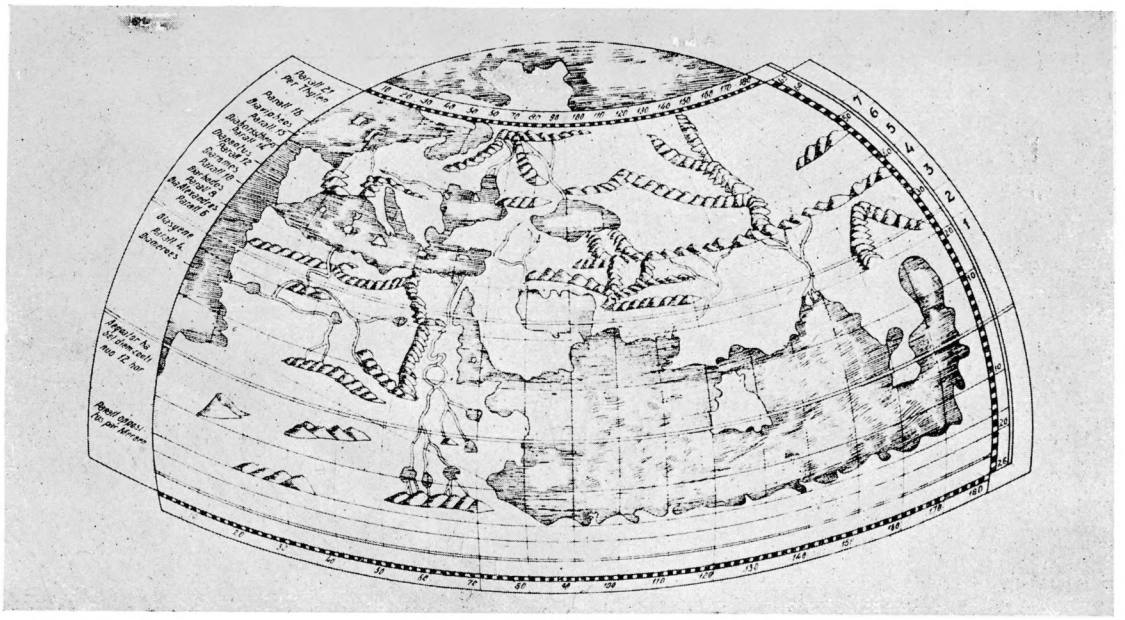

FIGURE 1.

Ptolemy's Chart of the World - 2nd century A. D.
(A copy in collection of Geophysical Institute of Latvian University.)

Carte du Monde de Ptolémée, 2e siècle après J.-C.
(Copie de la collection de l'Institut Géophysique de l'Université de Lettonie.)

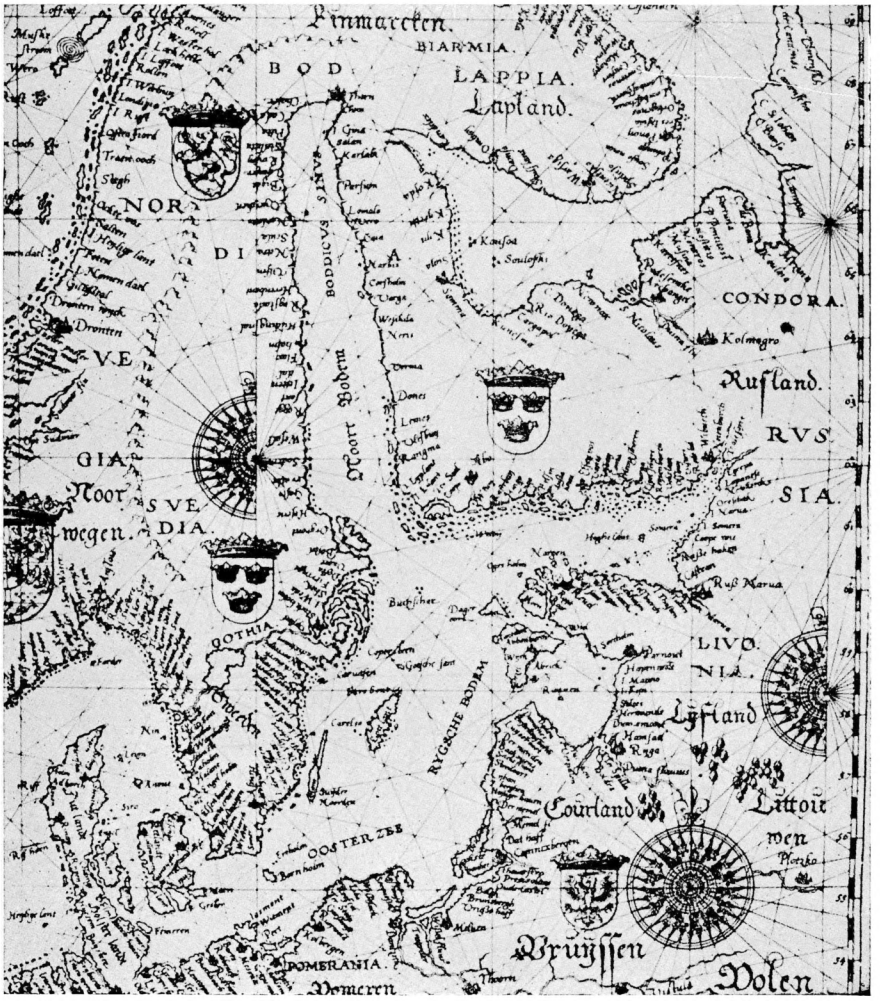

FIGURE 2.

A cutting from the Dutch navigational chart of the North and Baltic Seas. 16th Century.
(From Monumenta Cartographica, *by* F. WIEDER.)

Coupure d'une carte hollandaise de navigation de la Mer du Nord et de la Mer Baltique du XVIe siècle.
(D'après les Monumenta Cartographica *de* F. WIEDER.)

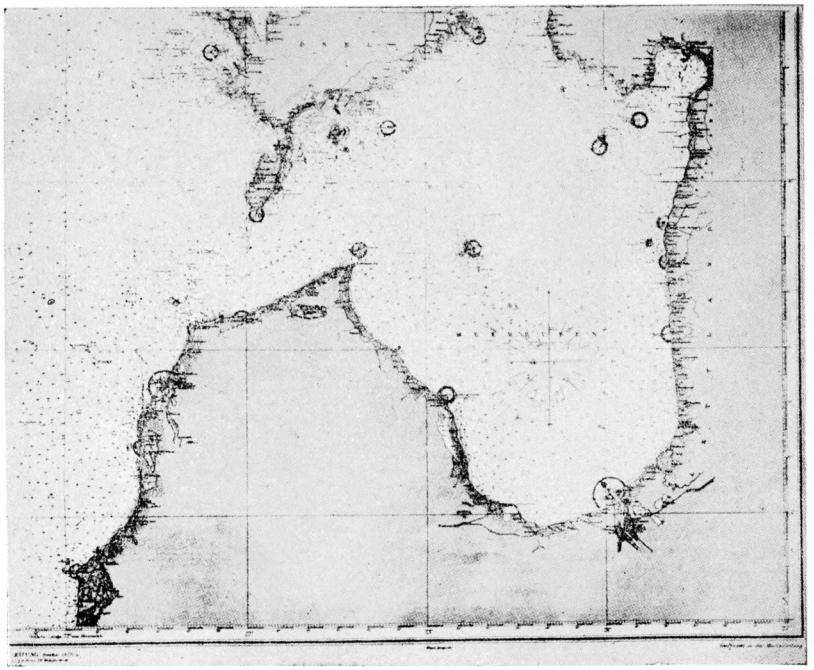

FIGURE 4.

A cutting from a modern German chart of the Baltic Sea, published in 1928.

Coupure d'une carte allemande moderne de la Mer Baltique, publiée en 1928.

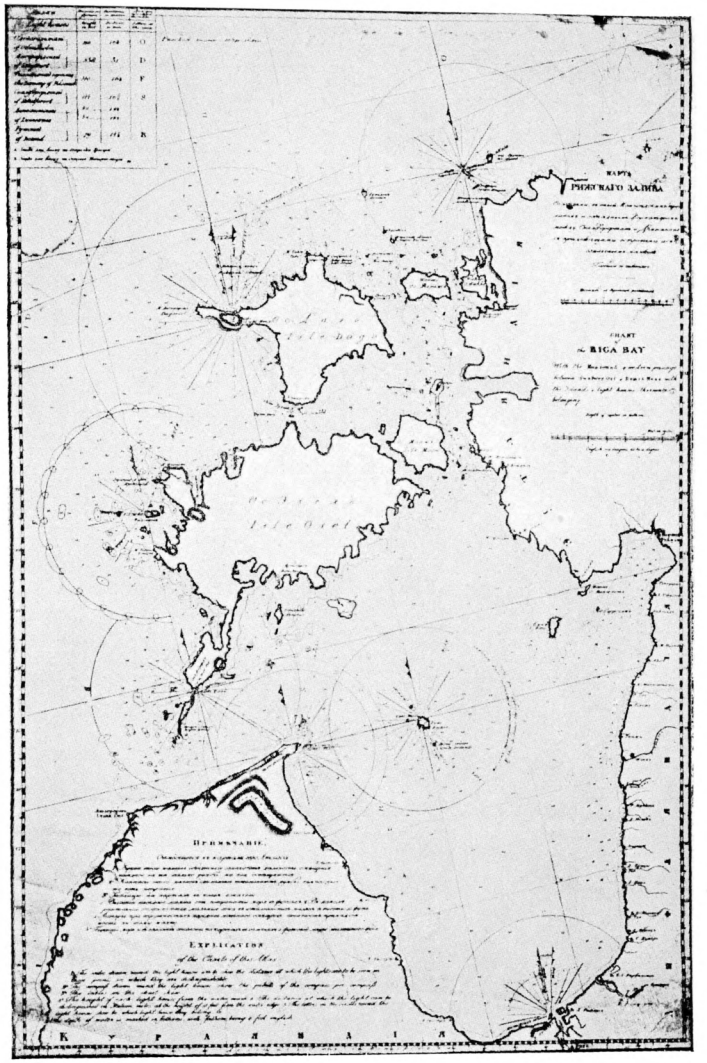

FIGURE 3.

A chart of the Gulf of Riga published by SPAFARJEFF *in 1818. This chart shows the magnetic meridians. The variation near Riga is shown as 13° W., in 1930 it was 2° E. (From the collection of the Latvian Marine Department).*

Carte du Golfe de Riga, publiée en 1818 par SPAFARJEFF. *Les méridiens magnétiques figurent sur cette carte. La déclinaison au voisinage de Riga est indiquée comme étant égale à 13° Ouest ; en 1930 cette déclinaison était de 2° Est. (Extrait de la collection du Ministère de la Marine Lettone).*

out until about 35 years later, and during this time topographic work was carried out on land. This topographic work, in 1878 and 1880, included the coast of Kurzeme, and was based on SHULGIN'S triangulation; in about 1882 it was carried out near Riga and the Gulf of Riga. The approaches to the Gulf of Riga still claimed attention at those places where the relief of the sea bottom shows rapid changes, *e. g.* surveys were made in this vicinity from 1882 to 1887. The next surveys carried out in 1888-1889 are noticeable inasmuch as they included the first systematic measurement of the three magnetic elements at many points on our coast. These were made by ZHDANKO and the result of his work was published in the form of a magnetic chart in 1890.

During the 90's of last century the enlargement of the harbour of Liepaja was proposed and consequently a new hydrographic survey of Liepaja and its surroundings was begun.

In 1894 this survey was extended and a systematic survey of the coast of Kurzeme and off-shore sounding were begun. The triangulation used was still that of SHULGIN (the longitude was always reckoned from Reval) but this was connected with SHULGIN'S precise triangulation and special secondary triangulations were made by MALZOFF, PASHKOFF, and BUCHTEJEFF. On reaching the Ovisi Bank in 1900, and having completed a new survey from Pape to Mikelbâka, the expedition completed its work.

During 1901 and 1902 some small surveys were made and the coördinates of certain lighthouses were determined.

In the second half of last century greater attention was given to lighthouses ; old ones were restored and new ones built. Particular attention was given to the approaches to the Gulf of Riga and consequently our most powerful lighthouse, Mikelbâka, was constructed here. A new branch of our hydrographic work was established by the commencement of systematic hydrometeorological and oceanographical surveys in the 70's of last century. In accordance with international agreement a programme was drawn up and materials were collected for hydrographic, oceanographic and climatologic data. The Hydro-meteorological Division was formed at the Central Hydrographic Department. Information relative to and books on the subject of climate, temperature of the sea, salinity state of the ice *etc.* were published. In particular the valuable magazine *Sapiski po gidrografii* was of the greatest use, and the work, as laid down in the programme, continued and made much progress.

In the present century the Hydrographic Office of Russia carried out no work of importance in our waters. Some minor surveys of several small harbours only were made in collaboration with other Government Offices (*e. g.* plans of Riga, Ventspils and other harbours) (*).

In 1911 and 1912 the astronomer KAMENSKY carried out a few determinations of magnetic declination in the vicinity of Liepaja and in the latter year at Daugavgriva also. At the same time TRUBJATCHINSKIJ made more systematic magnetic determinations on the coast between Ainazi and Pape,

(*) Special attention is directed to the topographic mapping of the territory by the Imperial Russian War Department during the first ten years of the present century.

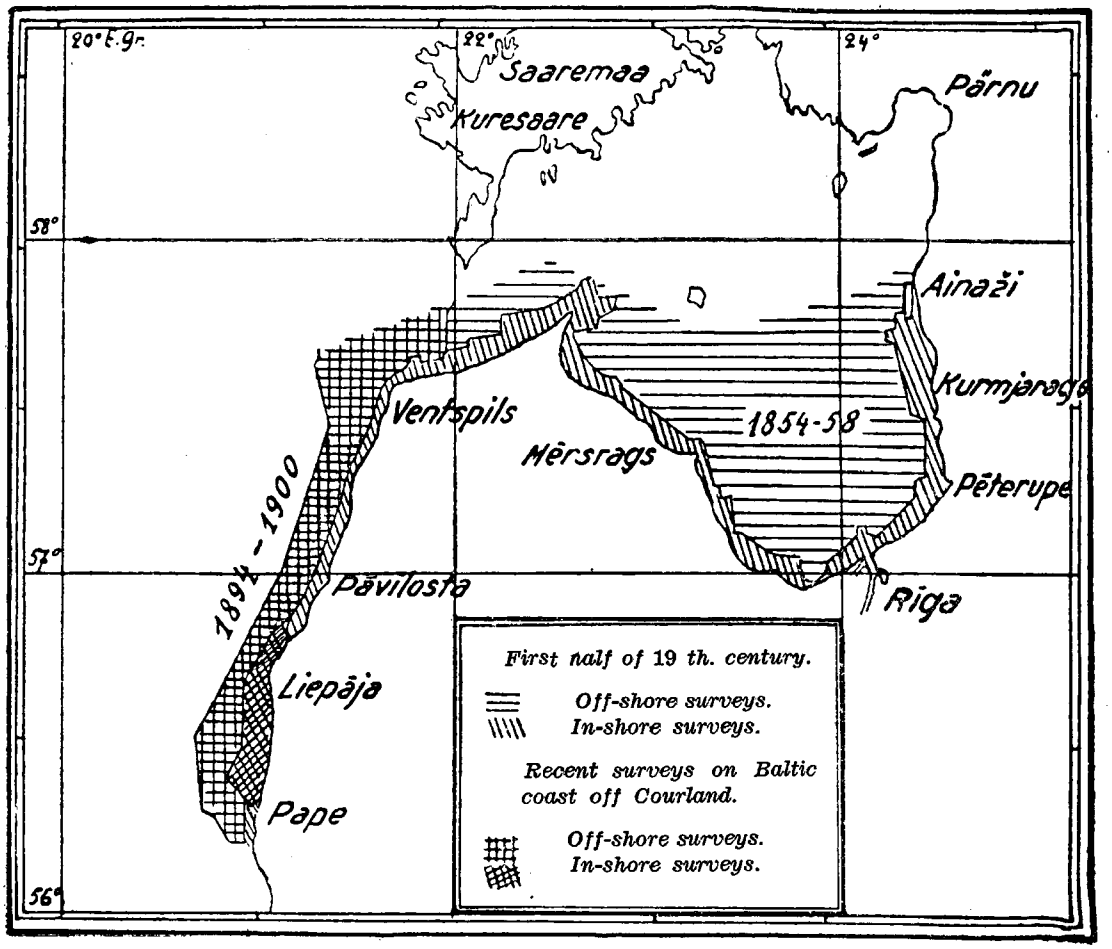

FIGURE 5.

A sketch showing the principal hydrographic work carried out off the Latvian coast.

determining all three elements at 26 stations for the purpose of correcting the isogonic chart of 1908. The results of this work were not published until 1927.

Considerable corrections and special surveys were made by other nations during the War, *e. g.* by the Germans, but generally speaking it was the Russian charts only which could be used. Both before and after the War there were gaps, discordances and other errors in the charts in use. In order to carry out a new survey of the coast of the Baltic which belonged formerly to Russia, a special triangulation was projected. As fairly accurate triangulations (made by the Russian War Department) existed near the coast, it was decided to connect them up and to reduce them to a single ellipsoid *etc.* in order to obtain a connected triangulation of the whole coast from Petrograd to Polangen, and from Petrograd along the Gulf of Finland. The report on the work of connection and reduction made by IVANOFF and the results of this work was printed in 1915 at Petrograd, and was issued under the name of *Triangulacija Baltiskogo Morja,* Part I. This triangulation was used as

the basis for the new survey made by the U. S. S. R. off the coast of Luga Bay.

Let us consider for a moment the data for charts and examine and compare them with other cartographic data taken from topographic maps, plans, trigonometrical nets *etc.* This comparison becomes necessary on account of the fact that charts and maps have to be used for different purposes and on account of the need of checking the value and accuracy of the data.

Some of the triangulations on which certain charts and maps are based give different results. Table I gives the geographical latitudes of various points on the coast resulting from different triangulations. In the case of longitudes the matter is complicated in that they are given from different Prime meridians, *e. g.* Paris, Ferro, Pulkovo, Reval, Vilna, Greenwich, the difference of longitudes between which vary in accuracy and the figures themselves vary also.

It will be seen, by examination of Table I, that the maximum difference in latitude of any one point is about 6". It is well-known that a difference of about 5" is due to errors in certain positions, Tartu and Pulkovo. The figures shown in the table for SCHUBERT'S triangulation have been adjusted and are connected with other nets, *viz.* those which are generally accepted for hydrographic work, but if those which are independent determinations were shown the difference would be considerably greater. For example the difference between SCHUBERT and STRUVE was + 6", but with the help of the triangulation this was reduced to — 1" (*See* Bibliogr. 6 *c* page 105 and Table I.). Frequently the work of the survey was based on astronomical positions in the middle of the net and this evidently introduced further difficulties. SCHUBERT determined the longitudes of some stations by astronomical observations and transport of chronometers.

If we compare the charts now in use with objects on the coast we find still greater discrepancies. Table II shows some results of comparison using the geographical coordinates of the triangulation net. For this purpose many copies of each separate chart were compared in order to eliminate errors due to correction, shrinkage *etc.*

As will be seen, these errors are sometimes very considerable. If the error due to the printing, the measurement of the cartographic coordinates and other errors be reckoned at 0.1', differences in latitude up to 0.6' and of longitude of more than 1' still remain. In this table charts which have been considered to be out of date for some time (such as the topographic 3 versts to the inch map) are not given. However, in 1911 and 1912 the above-mentioned topographic map was used as the cartographic basis for the magnetic survey on the Baltic Coast. Some German charts which contained greater errors in geographical longitude (*e. g.* N° 12), French charts (*e. g.* N° 4888) on which the coordinates $\varphi = 56°56'46.5"$, $\lambda = 24°06'32"$ East of Greenwich, are given for Peters Church, Riga, and several others are also omitted.

The great difference of more than 1' in longitude between the Russian chart N° 1571 (published in 1918) and certain others is explained by the following note which appears on it:- "When drawing up this chart, as in other charts, the longitude was assumed to be 30°19'34.5" East of Greenwich

TABLE I.

	Riga, Peter Church	*Daugav-griva Lighthouse*	*Old lighthouse on Cape Kolka*	*Lutheran Church at Ventspils*	*Latvian Church, Liepaja*	*Liepaja Lighthouse*
W. STRUVE : (Sapiski V. Top. d. XVIII., Result. astr. trig. Verm. Livl. 1816-1819).....	56°56'53".13	57°03'37"				
TENNER's triangul. (Sapiski V. top. d. VIII, etc...)...	54".4	38".1	57°45'36".3	57°23'49".5	56°30'19".7	
SCHUBERT's triangul. (Trigon. Sjomka beregov Balt. morja).....	52".19	35".89	34".09	47".29	17".49	
SHULGIN's triangul. (Sapiski XXXVIII)...					19".62	56°31' 4".06
IVANOFF : triangul. of Baltic Sea (Triangul. Balt. Morja)	49".089		30".49	43".74	13".50	30'57".97
Latvijas valsts Trigonom. tikls. Latvian State Triangulation	53".919	37".649				
1903 - 1904, g. triangul. (Sapiski, LXIII, II)	54".1					

the new determination gives the longitude of Petrograd as 30°18'22.2" East of Greenwich". The difference of longitude is, therefore, 1'12". This has now been eliminated but, if it be taken into account, the difference in the coordinates in general is still 0.2' and even more, as may be seen on large scale charts and on plans.

The necessity to connect up the cartography of the whole Baltic was one of the reasons which caused the establishment, in 1924, of an International Baltic Geodetic Committee, the principal object of which was to connect up the first class trigonometrical nets and the adoption of a common programme of Geodetic and Astronomical work. The completion of this programme of work will provide a basis for our hydrography, cartography and other new and wider hydrographic work. A new net of triangulation is now being spread over Latvia by the Government. This triangulation will, of course, be connected with those of the surrounding States.

TABLE II.

	Salacgriva Church.		*Peterupe Church.*		*White Church of Milgravis.*		*Mersrags Lighthouse.*		*Ventspils Church.*		*Usava Lighthouse.*		*Liepaja Lighthouse.*	
	φ	λ E.Gr	φ	λ Gr.	φ	λ Gr.	φ	λ Gr.	φ	λ Gr.	φ	λ Gr.	φ	λ Gr.
1. Russian Charts, N°s 795, 832, 907, 1560, 1571	57°45'.4	24°22'.8	57°16'.2	24°26'.0	57° 2'.1	24° 6'.2	57°21'.7	23° 8'.1	57°23'.7	21°34'.1	57°12'.7	21°25'.0	56°31'.1	20°59'.5
2. German Sea Charts N°s 15, 16, 21	45'.3	21'.8	16'.2	26'.0	2'.3	5'.3	21'.8	7'.0	23'.8	34'.0	12'.6	25'.0	31'.1	59'.5
3. Russian topographic Maps 1:42000 (also 1:84000) & 1:75000 Latvian.	45'.3	21'.6	15'.6	25'.1	2'.2	5'.2	22'.1	7'.2	23'.9	34'.1	12'.9	24'.8	31'.1	59'.4

The present charts of our waters which we have (drawn up in English, German, Russian, Swedish, French and Estonian as well as the first Latvian) are based, as is stated above, on surveys made in the Gulf of Riga in the middle of the 19th century, while those of the coasts of Kurzeme are based on surveys made at the end of the 19th century. All these charts must be revised in accordance with the results of the new hydrographic surveys and with the descriptions prepared for the sailing directions.

During the twelve years which have elapsed since Latvia gained her independence several new hydrographic surveys have been carried out. Owing to the development of new ports and the enlargement of old ports, geodetic work and hydrographic surveys have been made at Pape, Pâvilosta, Lielirbe, Roja, Ragaciems, Bulli, Pêterupe, Silancu Rava, Salacgriva and Blusupe. New plans have been made of the Harbours of Riga, Ventspils and Liepaja. Great attention has been devoted to the surroundings of the Ovizi Bank where a lightship has recently been established, though it is proposed to build a permanent lighthouse on the sand bank at some future date. Hydrographic surveys have been made near Cape Kolka Bank, at the entrance and in the anchorage of Ainazi and of the coast between Lielupe and Gauja. The first revised charts drawn up in the Latvian language were published in last years ; these were :-

1. The coast of Latvia, Vindau - Domesness - Roign. Ventspils - Kolkas Rags - Roja. (mean scale 1/100,000). Second revised edition.
2. Harbour of Riga. (scale 1/25.000).
3. Harbour of Liepaja (scale 1/10.000).
4. Coast of Liepaja (scale 1/25.000).
5. River Lielupe from Jelgava to the Bridge of Bulduri (scale 1/30.000).

The Hydrographic Section of the Marine Department publishes also Notices to Mariners, and in 1931 issued *Latvijas locis* (Latvian Pilot) by K. PURNS.

The Navigation School "*Krisjanis Valdemars*" publishes a Nautical Year Book, "*Kugniecibas gada grâmata*", in Latvian. This book contains also articles on hydrography.

Included in the work of the summers of 1927 and 1928 was a magnetic survey of the coast and off-lying waters, which was carried out by the Estonian Government yacht *Cecilie*. The results were published in "*Magnetic Measurements in the Baltic Sea along the Latvian Coast*", by L. SLAUCITAJS, Riga, 1930 — with 3 Charts : *D*, *H*, *Z*.

Meteorological observations are being taken, *e. g.* observations from lighthouses with reference to ice conditions in winter (these conditions are observed also by aeroplane), as to sea level and other scientific observations of practical value.

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