DE HYDROGRAPHISCHE OPNEMING VAN DEN O. I. ARCHIPEL

THE HYDROGRAPHIC SURVEY OF THE NETHERLANDS EAST INDIAN ARCHIPELAGO

From an article by Captain J. L. LUYMES.

In an article published under this title in the March number of the "Tijdschrift van het Koninglijk Nederlandsch Aardrijkskundig Genootschap" (Royal Netherlands Geographical Journal) by Captain J. L. H. LUYMES, is given a popular description of the surveying and charting of the Dutch portion of the extensive Eastern Archipelago, from the beginning of the subjection of the islands by his country to the present time. It is divided into three parts, viz :— historical, one describing the methods of field-work, and the third treating of the work done in the office. In an Index Chart accompanying the article, and reproduced with this summary, is shown the progress made by the systematic surveys conducted since 1858.

The article begins by recalling the expedition that sailed in 1595, under the command of the brothers DE HOUTMAN, in order to discover the route to islands producing tropical produce. This was one of the efforts of the Dutch to reach the initial source of this valuable merchandise, after PHILIP II of SPAIN had closed the Portuguese harbours to Dutch ships.

The expedition based its work on charts made by Petrus PLANCIUS, the famous priest, who took to geography after the translation of a Bible the title page of which was adorned with a map of the world and by the "Itinerario naer Oost ofte Portugaels Indien" (Itinerary to East or Portuguese India) and the "Reysgheschrift van de navigation der Portugaloysers in Orienten" (Description of the navigation of the Portuguese in the Orient), both compiled by Jan HUYGEN VAN LINSCHOTEN, who spent many years in Goa as a clerk to the archbishop.

The information gained by the expedition, together with what was known already, was charted by a shipmate of the HOUTMANS', named Willem LODEWIJKSZ, and his chart is the first original one made by the Dutch of the Archipelago. The publication : "De eerste schipvaart der Nederlanders naar Oost Indie 1595-1597" (First Voyage of the Dutch to the East Indies) published by the "Linschoten vereeniging" (the Dutch Hackluyt Society) contains a reproduction of this chart.

The "Vereeniggde Oost Indische Compagnie" (United East India Company), owing its inception to the voyages of the DE HOUTMANS and others, collected during its long existence many data concerning the hydrographic conditions of the coasts and seas of the Archipelago. But the Company enjoined secrecy upon its servants and little is known of its knowledge in the early

part of its history. It had its own cartographers, some of them bearing the well-known names: DE BLAEU, DE GRAAFF or VAN KEULEN. The company supplied their shipmasters with valuable, artistically adorned charts, drawn on vellum, which were landed on arrival in the home country or in the Indies and corrected by the cartographers according to new information.

In 1660 the general coastlines of the Archipelago were tolerably well known. This was fairly complete for JAVA, SUMATRA and BORNEO, still incomplete for Celebes, inaccurate for the LITTLE SOENDA islands and the MOLUCCAS, and only sketchy for NEW GUINEA. But no detail chart was placed on the market; the chart-books of that period contained at most a few fairly reliable general charts of the areas concerned.

The greatest merit for the cartography of the Archipelago in the eighteenth century is due to the house of VAN KEULEN, of which Gerard VAN KEULEN became "baas-kaartenlaker" (chief cartographer) of the Company in 1714. After that the grasp of this mercantile body lost much of its power, and the VAN KEULENS crowned their chart-work concerning the earth by publishing the sixth volume of their well-known chart-book: "De nieuwe groote ligtende Zeefakkel" (The new great illuminating Seatorch) in which the whole of their knowledge of the hydrography of the Indian Archipelago was drawn up. With this edition the Netherlands cartography of that time had reached its apex. Better work than the Seatorch contained could not be done in those days.

The instruments which made such work possible were still in their infancy and what could be accomplished with these older ones, the Dutch skippers of that period attained in a way to which admiration is due, as latter-day comparison with charts drawn by methodical surveys has proved. The charts of Halmahera by Pieter STIPPERT (1681); of the Gulf of Tomini (CELEBES) by Jan VAN DER WALL (1682) and of the Geelvink Bay (North NEW GUINEA) by Jacob WEYLAND (1704) are mentioned as examples.

Those older instruments consisted of the compass and the cross-staff. The chart must then be based on latitudes, bearings and dead reckoning. Soundings above some twenty fathoms required manœuvring with the ship; soundings from boats demanded long and laborious excursions. The sailors of those days had to depend, more than the present race, upon their own observations, and the nautical instructions, called "leescaert" (reading-chart) in mediaeval Netherlands were more depended upon than the real chart called "pascaert" (measuring chart).

After the height of Dutch cartography came a sudden downfall so sudden that, in the beginning of the nineteenth century, the same house of VAN KEULEN recommended for the nagivation of the Archipelago the use of British or FRENCH charts and the use of the British Pilot. By this was meant the famous work of Horsburgh, the founder of the modern sailing instructions.

The extensive title of this Pilot reads: — "Directions for sailing to and from the EAST INDIES, CHINA, NEW HOLLAND, CAPE of GOOD HOPE and the interjacent ports (1809)".

The new instruments, which made more accurate surveys feasible, were the quadrant (sextant) invented by NEWTON and fitted for practical use by

HADLEY (1731) and the nautical chronometer made by HARRISON (1761). The first instrument allowed the observation of more accurate latitudes and of horizontal angles on board ship; by means of the second, differences of longitude could be obtained. Both instruments were already applied to a survey of the coast of Newfoundland in 1765 by the great navigator COOK. The systematic guidance of the British Admiralty, which instituted a hydrographic office in 1795, and the numerous data received from a continually extending fleet, caused British cartography to overshadow more and more that of the Dutch.

Too late the latter country tried to make up their arrears, for which purpose a committee was installed in 1787 "to study the determination of longitude at sea and the methods of charting", and in 1821 a commission was appointed for "ameliorating the Indian charts." At the same time an order was given that a man-of-war should be continually charged with surveying in the Archipelago. This led in 1822 to the commission of the brig "*Jacoba Elisabeth*", which surveyed the straits of SAPOEDI and KARIMATA, and of the corvette "*Courier*" for the charting of BILLITON and adjacent channels.

These were the first NETHERLANDS surveying vessels. But this systematic work was stopped in 1824 and it was 35 years before it was resumed. In that period the advancement of hydrography in the Archipelago was only due to various surveys by men-of-war and by casual individuals, more or less instigated by the direction of the navy. A vigorous, systematic guidance, having continually in view the improvement of charts, was wanting.

It was to be foreseen that in this way the arrears became greater and greater, as the necessity for accurate charts and nautical instructions was continually growing. To meet this, by correcting the existing charts, in 1851 a service was created for fixing astronomical positions and true bearings of points of land and conspicuous objects seen from the places of observation. This service continued till 1894, in which year its functions were transferred to the commanders of the surveying ships, who needed the positions to correct their triangulations and could not always refer back to those determined formerly. Also these older positions were not often situated so as to be of most use for presents needs. The principal meridien of reference was that of Batavia, which was fixed by telegraph with great accuracy, depending on Singapore and those of Makasser, Ternate, Ambon and Timor Kœpang, which were in their turn fixed with accuracy (the first by telegraph in 1871) on that of Batavia. More than 540 astronomical positions have been determined and they have—with the bearings observed at the same time—greatly helped to reconstruct the charts of the non-systematic areas and those areas which had not been surveyed according to modern methods. The increasing complaints as to the insufficiency of charts and the slow progress of improvement, compelled the Dutch to return more and more to the only method giving satisfaction—already followed in 1822 but abolished two years later. But the period was not favourable; the colony did not prosper at that time and its Government shunned the truly gigantic task of charting the Archipelago systematically, with its nearly 2000 islands and its coastlines totalling approxi-

mately 25000 sea-miles, while the technical means were so much more limited than at present. However, there came in 1858 an impulse from outside, which set things going. This impulse was the request of GREAT BRITAIN for permission to survey Banka Strait, the highway of trade from Singapore to Batavia. The request was granted and, in 1859, the British surveying vessel "Saracen" began its work, a commemoration of which lives in the "Stanton Channel" named after her commander. But at the same time the Dutch Government commisioned, in 1858, the brigantine "Pylades" for surveying Banka and adjacent waters. Since then Dutch surveying ships have been working without interruption in the Archipelago; after some years, two, then three, and since 1905 four of them.

Want of practice, insufficient means, inadequate and worn-out vessels caused slow progress. The survey of Banka and adjacent waters took under those circumstances twelve years. More and more protests were raised against this unsatisfactory course of things. But the nineteenth century was ended before the striving for acceleration had its full effect. The surveying ships were then steam vessels, specially built for the work, equipped with two launches; new methods had been adopted and a large number of officers had been trained by an apprenticeship under experienced seniors.

The actual state of affairs on 1 January 1927 is shown on a chart accompanying the article and reproduced as an appendix to this summary. In a few years the first systematic hydrographic survey of the Archipelago will be accomplished, with the exception of some coasts of small importance; about 200 ship years will then have been expended on it.

In the domain of tides, maritime meteorology, and magnetic variation, much has been done by the Royal Magnetic and Meteorological Institute at Batavia, especially by Dr J. P. VAN DER STOK. Since he has shown the way tidal constituents have also been calculated by the surveying ships, so that now the constituents are known for more than 200 places.

In the second part is given a popular description of the methods of hydrography, accompanied by many examples, which is of interest to a public of non-hydrographers and non-sailors, for whom the article has been written, but it may be commented upon in the *Hydrographic Review*.

However, some parts are also worth mentioning for hydrographers. In the first place, there are the author's remarks on the slow progress, as long as topographic methods were slavishly copied. This accounts partly for the long duration of the survey of Banka and adjacent waters. The use of the ship, anchored or not, as a temporary station and developping other special hydrographic methods; the restriction to surveying of that which was of real interest to navigation, even in a wide sense; good insight into relative accuracy and the degree of accuracy needed for the object aimed at—were so many causes of acceleration of the surveys. As examples of the accuracy obtained, the author mentions that the triangulation of Soemba, which island has a coastline of approximately 300 sea miles, of which two-thirds were triangulated by means of a ship under way, closed with a difference of 3" in latitude and 19" in longitude. The triangulation of Ceram, with a coast-line of approximately 550 sea-miles, four-fifths being carried out by means of a ship under

way or anchored, closed with a difference of 7.5" in latitude and 21.5" in longitude.

The inaccuracy of hydrographic triangulation compared with topographic methods, makes it necessary to correct the triangulation by astronomical observations after some distance has been covered. Those observations are made now-a-days with a 6 inch universal instrument and radio time signals. The approximate accuracy of the positions amounts to about a maximum error of 2" in latitude (observation on two stars) and 10" in longitude (two stars).

Correction, however, ought not to be made by using only two positions, as it has proved that much abnormal direction of the plumbline prevails in the Archipelago. An example is mentioned, that on the island Tindjil, off the south coast of Java, a deviation in latitude of 37" has been observed. The adjustment of triangulation is therefore at present postponed till a complete part is finished and all the data concerning satisfactory adjustment are collected, under which are also understood astronomical bearings on adjacent islands.

The surveys of Ceram is treated in this manner. Having closed the gap, mentioned above, the differences of triangulation with the observed astronomical positions are considered and moreover, the astronomical bearings which connect Ceram to the North with Misool, this island with Salawatti; Misool with Kofiau, Boo-islands and Halmahera; Ceram to the South with Banda, Manoek Seroea, Nila, Damar and Babar.

This includes many other astronomical positions and, considering them all, an adjustment is sought for, which gives the most probable and least distorted solution.

In several parts of the Archipelago the triangulation can be built upon the topographical one, which gives a gain of time and accuracy. Moreover it has not to be redone whenever a resurvey is necessary.

Soundings are extended to the 200M. line and only sparse soundings are taken beyond this limit, except where vigias are reported. As nearly everywhere, dangers are scarce in deeper water, but still they exist. Owing to lack of time this restriction is accepted, but an echo-sounding apparatus, giving complete satisfaction in a comparatively short time, is much to be desired.

Aeroplanes and wire dragging are both applied and have led to the discovery of several unknown dangers of which examples are given.

The third part describes the work of the office. In it are given some ideas concerning the rules which are followed for drawing the fair sheet destined for the engraver. These rules have as object the adaption of charts as much as possible to the needs of navigation, to make them as clear and legible as possible, and to avoid overcrowding. Mentioned in this part are: general charts, course charts, coast charts, detail charts, and plan charts; which division is made as a basis for the diminishing of details on the chart as the scale becomes smaller. The definition of these five rubrics is given. The different parts of the chart: projection, topography, soundings, depth-lines, orthography, compasses, symbols, graduation, *etc.*, are discussed, and the

international striving for standardisation of charts; the International Hydrographic Bureau and the Conferences of St Petersburg (1912), London (1919) and Monaco (1926) are mentioned.

An idea is given of the methods for compiling charts of non-systematically surveyed areas; the running surveys of former periods are recalled and examples are mentioned of the accuracy attained by those older methods and shown by comparing them with modern surveys of the same areas.

Something is told of the reproduction of charts and of the reasons that lead to the predilection of hydrographic bureaux for copper engraving and printing, which method is now-a-days but seldom used for maps. The desirability of relatively small editions and the necessity for delivering charts corrected up to date is proved.

At the end of this chapter it is stated that the Dutch office publishes of the Archipelago: 2 general charts; 49 course charts (on one of which are 19 plans); 170 coast charts with 115 plans; 55 detail charts with 64 plans; and 77 plan charts containing 588 plans. In all 353 charts. Moreover, the Bureau publishes 6 volumes of nautical instructions, while the List of Lights is published by the Service of Shipping, working under the Navy department at Batavia, and 9 Tide Tables by the Royal Magnetic and Meteorological Observatory at that place.

In concluding the article it is said that completion of the first systematic survey which, with some insignificant exceptions, is to be expected in 1931, ought not to lead to the diminishing of hydrographic activities. Channels and coastlines are liable to changes by nature and also by men; shipping needs more accurate data than formerly, and is increasing on account of the steady growth of commerce and industry in the rapidly developing Archipelago; last and not least, the haste which has prevailed until lately has necessitated that only work that was most necessary has been done. Next to revision of surveys from 69 to 40 years old, deepening and extending are necessary, for which task four surveying vessels, although they can work during the whole year, are not too much. The author concludes by hoping that in this respect the government of NETHERLANDS INDIA will continue to show a broad and foreseeing mind, as has been the case in the last few decades.