

CONSTRUCTION OF PLOTTING SHEETS OF GENERAL BATHYMETRIC CHART OF THE OCEANS

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(See previous report on preparation of 3rd edition of this chart, Vol. XXX, No. 1, dated May 1953, of the *International Hydrographic Review*).

With respect to the first two editions of the General Bathymetric Chart of the Oceans, the Mercator projection was adopted between latitudes 72° North and South. Following directions of the International Hydrographic Conferences to continue the work undertaken by the Scientific Staff of the Prince of Monaco, this same projection was retained in the third edition ; there could moreover be no question of changing the projection if use was to be made of the extensive continental topography of the second edition, supplied by M. de Margerie, the geographer, or of the stones for its reproduction, which were still on hand.

Sheets of both series A and B are therefore drawn up on the Mercator projection on the scale of 1/10 000 000 at the Equator.

On the Mercator chart one degree of longitude should be 11.132387 mm. wide (Hayford's ellipsoid); and 90°, i.e. the width of a sheet, amounts to 1.001915 metres. Such measurements, subject to variations in the size of the paper, have been strictly complied with on the final chart.

At the limits of sheets A (Lat. 46° 40' N. or S.) the chart is on the scale of 1 : 6 884 500.

At the limits of sheets B (Lat. 72° 00' N. or S.) the chart is on the scale of 1 : 3 099 608.

Sheets C in the first and second editions, constructed respectively in 1905 and 1923 and supplying the polar sections, were plotted on the gnomonic projection, and the scale selected is identical with the scale of sheets B on the joint parallel of 72° (see J. Thoulet — *Bulletin du Musée Océanographique de Monaco*, No. 21, 25th December 1904).

Although the various types of projection that may be used only slightly alter the shape of the polar sections, the choice of the gnomonic projection does not appear to be a happy one, since no advantage is derived thereby in the polar areas, and it moreover suffers from the drawback of neither retaining angles nor areas.

Furthermore, explorations that have occurred since the charts were constructed have led to considerable alteration of the topographical material, and it is no longer advantageous to use reproductions from the old stone originals. Another type of projection could be used with no additional expense.

In order to preserve the angle-retaining property supplied by the Mercator projection, in plotting the polar section sheets for the third edition we adopted

the conformal central projection, which, provided flattening is neglected, is actually similar to the polar stereographic projection, regarding which tables calculated for the international ellipsoid were compiled by Captain L. Tonta, a Director of the International Hydrographic Bureau, and appear in the *Hydrographic Review*, Vol. VI, No. 1, May 1929, pp. 102-103.

In this projection, the value of the linear modulus is 1.025 at Lat. 72° and decreases to 1 as one moves towards the pole.

The scale was moreover so selected as to retain the same scale on the 72nd parallel as the sheets on the Mercator projection. Under these conditions, the scale on the 72nd parallel in the final chart is 1 : 3 177 338 at the pole.

As pointed out on previous occasions, the International Hydrographic Bureau in plotting its sheets uses paper overlaid with a Mercator grid supplied by the Japanese Hydrographic Office.

The constants of these plotting sheets are as follows : Width of 10° section : ...1013 mm. up to latitude 65°. Each plotting sheet is 10° wide, i.e. 1013 mm. Width of 10° section : ...506.5 mm. between latitudes 65° and 72°, each plotting sheet having a width of 20°, or 1013 mm.

As previously mentioned, 10° of longitude on the chart itself are equivalent to 111.32 mm., each 90 degree sheet having a width of 1.002 mm.

The scales of the plotting sheets for soundings at the various latitudes are as follows :

Lat. 0°	(Equator)	0.000 000 91,	or 1.7 mm. per nautical mile
46° 40'		0.000 001 33	2.5 mm.
65°		0.000 002 14	4.0 mm.
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65°		0.000 001 08	2.0 mm.
72°		0.000 001 47	2.7 mm.

On the chart, the polar section radii are respectively :

At Lat. 72°	.....	637.8 mm.
75°	.....	525.9 mm.
80°	.....	346.1 mm.
85°	.....	171.7 mm.

For the polar sections, we originally selected a scale of 1 : 2 000 000 at the pole. Since it proved to be too small for the plotting sheets (1 Mile=0.93 millimeter), we adopted a scale at the pole of 1 : 1 000 000 (i.e.: the same as on the Equator or 1 Mile=1.85 millimeters), thus enabling the adoption, for the radii of the parallels, of the figures supplied by the *Hydrographic Review* table and the plotting of graduations every 10', 5' or even 2'. A minute of latitude is thus 1.875 mm. wide, a convenient amount for plotting purposes.

A few radii of parallels for plotting sheet purposes are shown below :

72°	.....	202.603 cm.
75°	.....	168.475 cm.
80°	.....	111.973 cm.
85°	.....	55.884 cm.

Since these radii are too large for the direct plotting of the arcs, the parallel arcs will be plotted by points using the rectangular coordinates supplied by the known formulae $x=R \cos \omega$, $y=R \sin \omega$ in terms of their radii and the difference in longitude ω .

In order to enable the projection to be constructed by the printers, that is the grid for each zinc plate, a list of lengths of the polar section radii for every degree need only be supplied.

These lengths are obtained by multiplying the figures in Captain Tonta's table by 0.314 729, whose logarithm is 9.4979365.

On the Mercator chart each degree of longitude should measure 11.1321 mm., i.e. 111.320 mm. per 10-degree sheet. In the polar sections, the radius of the outer circle should measure 637.839 mm.
