a month in the northern seas on board the S.S. *Hakuhô-maru*, a watch-boat (330 tons burthen) belonging to the Fisheries Bureau, a small volcanic islet had formed about 900 metres off east coast of Alaid Island, at a point 155°40'10" E., 50°50'30" N. When he visited the place on the morning of January 26, 1934, it was about 200 metres in diameter and 50 metres high. He approached the islet to a distance of 400 metres, taking photographs from various directions and distances. At first it was emitting white clouds, with scarcely any audible detonations. This state of quiescence lasted for 1 to 1 ½ hours, when, after a few minutes of extreme quiet, it changed suddenly into a violent explosion, shooting up dark clouds to a height of 3000 metres. It then subsided into another monotonous emission of white clouds. The volcano apparently took on the intermittent Strombolian phase, repeating explosions every 1 to 2 hours.

The crater, which is horse-shoe shaped, opens towards the north-east. The solid ejecta carried upwards with the cloud or projected directly from the crater are deposited mostly on the south-west flank of the crater. Needless to say, the new islet is still in process of growth. (It is stated that it has been named Taketomi-zima).

It is reported that the first glimpse of the present eruption was obtained from Murakami Bay, Paramshir Island, on November 13, 1933. Since swarms of volcanic shocks had been felt there in the interval between October 20 and November 10, it is possible that the eruption began towards the end of October, or more probably in early November. The sea where the new islet now lies was sounded in 1932, and found to be about 20 metres deep.

OBSERVATION OF DIP OF SEA HORIZON ON BOARD THE "KASUGA"

by

Tosio AKIYOSI

(In Japanese. *Suiro Yôhô* (Hydrographic Bulletin) 12 (1933), pp. 1-6).

Extract from the *Japanese Journal of Astronomy and Geophysics*, Vol. XI, No. 3, National Research Council of Japan, Tokyo, 1934, p. (41).

This article gives a brief description of the observations of the dip of the sea horizon which have hitherto been carried out by the Japanese Navy, and is followed by the result of observations of the same kind made by the author on board H.I.J.M.S. *Kasuga*, at a height of about 15 metres, on her cruise from Yokosuka to Zinsen, Dairen, Shanghai and return, in September-October 1932, the instrument used being a Pulfrich instrument for measurement of the dip. From the data obtained at 80 positions at sea, the following result was derived: —

$$\text{Actual dip} - \text{normal dip} \left(1'.776\sqrt{\text{Height in metres}}\right) = 0'.08\,D,$$

where D is the temperature difference between water and air in degrees Centigrade. The absolute value of the factor D, the determination of which was the main object, was, however, rather too small as compared with those derived in the past. Although the result should not be regarded as definite, because of the poor conditions of observation and chiefly because of the small amount of D (only varying between $+5^\circ$ and -3° throughout the whole voyage), these observations may afford material for further study of the problem.

TRAITE DE GEODESIE

(A TREATISE ON GEODESY).

by

Captain P. TARDI.

(Paris, Gauthier-Villars, 1934).

Nothing has ever replaced, until now, the treatise on Geodesy by L. B. Francœur which dates back to 1835 and is now out of print. The lack of a treatise of this kind in the French language has been all the more vexatious in that geodetic science has advanced considerably during the past century and has tackled many new problems. The treatise by Captain TARDI, an officer attached to the Geographical Service of the French Army who has taken part in many geodetic expeditions, contains the essentials of the methods employed in the latter Service, which has always kept up to date as regards improvements both to instruments and methods. Everything which has been condensed into these two volumes would be hard to find other than scattered among special monographs. The exposition is clear and swift, the proofs are often merely mentioned by a word of reminder, and over-specialised details of the theories are passed over so as to include only what is indispensable for the geodesist to know.

A preface by General G. PERRIER contains a brief but most interesting review of a century's progress as well as a very useful list of the principal foreign works on the subject.

Vol. I contains some general considerations, and a historical account of the great geodetic operations and of the international organisations concerned in the matter; then follows a reminder of some mathematical formulae and a brief but very clear summary of the theory of errors and the method of least squares.

The author then deals with the measurement of bases and with material based on the use of "invar" metal; he describes the instruments for angular measurement and their accessories, besides certain azimuth circles and theodolites which comprise recent improvements. He describes the methods of observation of azimuth and zenith, and gives us the benefit of his experience by means of detailed advice on preliminary reconnaissance, plans of work, the lay-out of primary chains, the construction of beacons, heliographs and electric night signals.

One chapter is devoted to the determination of heights, with the precautions to be taken both in geodetic and in geometric or barometric levelling. Orthometric correction is well described, also the difference between the orthometric height and the dynamic quantity.

After a reminder of various formulae relative to the ellipsoid of revolution and to geodetic lines, the way to work out triangles is described, being based on the theorems of LEGENDRE and GAUSS; then the geographical co-ordinates, azimuths and distances are calculated by the methods actually used in the French Geographical Service, and to this are added a few tables to simplify the calculation.

Chapter IX deals with the plane representation of the terrestrial ellipsoid; it is largely inspired by the work of Colonel LABORDE which we outlined in *Hydrographic Review* Vol. VII, No. 1, pp. 16-31 and Vol. X, No. 1, pp. 82-87. Without taking up again the theory of conformal projections, Captain TARDI recommends the following method particularly: conformal representation of the ellipsoid on the sphere, then a conformal projection of the sphere analogous to MERCATOR's, taking as equator the great circle which corresponds best with the central axis of the greatest dimension of the country to be represented. If neither dimension appreciably outweighs the other, the author recommends using a stereographic projection. He also studies, on the ellipsoid, LAMBERT's conical development, MERCATOR's projection and that of Mr. ROUSSILHE; he ends with a brief examination of some systems of representation which are not rigorously conformal and by indicating the solutions adopted by France and some other countries for reducing their surveys.

In chapter X we find a description of methods of compensating geodetic net-works, based on the theory of least squares, viz. method of varying the co-ordinates, method of directions and calculation of mean errors.

In the last chapter of the first volume is described the calculation of secondary triangulation by the graphical method of rectangular or geographical co-ordinates. The author seems to prefer this latter procedure which does not entail the use of any system of projection; but it will be necessary, none the less, to end by adopting one of these systems for the reduction of the survey, and we ourselves think that it pays to adopt it as early as possible.

The second volume starts with a rather cursory and occasionally somewhat vague summary of positional astronomy. It becomes more precise in the treatment of atmospheric refraction and the most recent methods of determining time, differences of longitude and the reception of W/T signals. The use of the theodolite and the transit instrument for determining the time are described, as well as apparatus for measuring the personal equation. For measuring latitudes we find descriptions of the methods of

HARREBOW-TALCOTT, VILLARCEAU, ex-meridians, circumpolars, and of the prime vertical; and for determining the azimuth of a beacon, a description of the use of the transit instrument and the theodolite.

Chapter XV is devoted to the method of altitude position lines and of equal altitudes. It can be used with the theodolite, but better with the prismatic astrolabe for which tables and diagrams are indicated which facilitate the preparation of the observations and their working. The author does not perhaps give quite enough prominence to the great advantage offered by the astrolabe over the theodolite on account of the absence of graduation and above all of the use of the mercury trough, the latter being much more certain in use than the bubble level.

The succeeding chapters are concerned with the measurement of gravity and deal with the formula of CLAIRAUT and his generalisations, the use of g to find the shape of the earth, corrections, absolute and relative methods of measurement, various pendulums, measurement of gravity at sea, and the torsion balance.

The three last chapters show how the shape of the earth has been determined, whether by triangulation or by measurements of g. We find there a narrative of the principal measurements made, and are shown the methods for obtaining the deviation from the vertical, for using LAPLACE's points and for tracing the contour lines of the geoid.

Methods of correction in accordance with the hypotheses of isostasy and with those of PRATT and AIRY are rapidly indicated. The volume concludes with a summary review of the vexed questions of oceanic tides, periodical variations of the vertical, the variation of latitude, and the tides of the earth's crust.

P. V.

THE CONTINENTAL UNDULATIONS OF THE GEOID.

by

R. A. HIRVONEN.

(24×17 cm., 89 pp. + 7 fig + 1 pl. - *Suomen Geodeettisen Laitoksen Julkaisuja*, Helsinki, 1934).

The author was entrusted by Professor HEISKANEN with an investigation as to whether existing materials are sufficient to give any information respecting the undulation of the geoid; as to what order are the warpings of the geoid; and as to the degree of accuracy to be expected from the use of STOKES's formula in the reduction of gravity observations.

The results of the author's calculations indicate that a wide field still remains open for improvement as regards reliability; this is due to lack of observations or to the fact that the observations which have been made are not distributed equally over the earth. The author has estimated that 2,000 observations uniformly distributed would be sufficient for the complete solution of the existing problems of the general shape of the geoid, the distance between the observation points being 500 km. This condition should be easily reached by international co-operation. The present results attained are, however, sufficiently satisfactory to ensure that our results are correct as regards their sign and their order of magnitude.

The departure of the geoid from the ellipsoid does not generally exceed 100 metres and on an average is $\pm$ 50 metres.

The ellipticity of the equator can be considered as a fact sufficiently proved. The value $2f = 140$ m. calculated by the author is stated to be in all probability too small rather than too great. The direction of the longer axis is somewhat westwards from Greenwich. It is impossible to discuss the depth to which this ellipticity reaches inside the earth.

The rapid progress of gravity measurements will soon make the results obtained obsolete and useless, if they cannot be easily corrected. Therefore the most expedient method of organising this work ought to become one of the objects of study of the International Geodetic Association.