

A FEW THOUGHTS ON GEODESY*

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GEODESY is that branch of science which treats of making extended measurements of the earth's surface and of related problems.

Whatever one's viewpoint, no matter what aspect of the subject one considers, a large scope is presented.

From a historical outlook geodesy is one of the oldest of sciences, dating back to before the second century before Christ when Eratosthenes and the famous school of Alexandria produced a measure of the earth's circumference only about 15 per cent. in error. The modern era of geodesy is not quite so old, beginning as it did in the seventeenth century, when Newton discovered the existence of the law of universal gravitation with its corollary of the slight flattening of the earth at the poles.

From the point of view of development there is also presented a large field. At first we find the determination of the figure and dimensions of the earth to have been a fundamental object. Now we find that the object of geodetic work is to furnish precise locations for the controlling points of extensive surveys all over the world with allied problems, and its importance is recognized by all civilized nations, each of which maintains large organizations for this purpose.

Perhaps we may obtain the best idea of how broad a field of investigation is covered by this subject if we consider the scope of the topics covered and involved by modern geodesy.

These may be divided into three main classes with their subdivisions as follows:—

A.—Field determinations containing errors and discrepancies.

1. Triangulation.
2. Astronomical Observations for Latitude, Longitude and Azimuth.
3. Measurement of Base Lines.
4. Precise Levelling.
5. Soundings.
6. Tides and Tidal Phenomena.
7. Gravity.
8. Terrestrial Magnetism.

B.—Office Investigations.

1. Adjustment of Observations.
2. Computation of Geodetic Positions.
3. Correlation of Geodetic positions with Other Surveys.
4. Selection of a Datum Plane.
5. Figure and Dimensions of the Earth.
6. Deviation of the Plumb Line.
7. Anomalies of Distribution of Matter.
8. Refraction.
9. Map Projections.

C.—Publication of Maps and Results.

With such a wide range one would think it a comparatively easy task to select a subject for this paper. It seemed hard, however, to deal with the subject in a way which would be profitable and interesting without dealing with the phases of geodesy with which all are more or less familiar. The writer wishes, moreover, to avoid tiresome details of cumbersome operations, so the subject "A Few Thoughts on Geodesy" has been selected in the

hope that a better conception may be imparted of a few of the broader principles which those in charge of a geodetic survey must constantly and strictly bear in mind.

Let us just refresh our memories with some of the objects of a trigonometrical survey so we may have a number of arguments at hand in case we are asked the question, "Why do all the civilized nations maintain large organizations for the prosecution of these surveys?"

In answering this question the writer wishes to bring to your attention the stand taken by the Dominion Land Surveyors' Association on this subject, and feels that he cannot do better than quote from a memorandum prepared by a committee appointed at the fifth annual meeting of the Dominion Land Surveyors' Association held at Ottawa in March, 1888, to consider the question of a trigonometric survey of the Dominion. This committee was composed of Otto J. Klotz, W. F. King, W. S. Drewry, E. J. Rainboth, and J. S. Dennis.

To put the argument in a few words: Justify the building of a house and the same reasons hold for building a foundation for that house. A justification of a topographic survey along our coast lines, waterways and in the more densely settled parts of our country gives us the reasons why geodetic surveys should be prosecuted. It is just as reasonable to propose building a house without a foundation as it is to think of starting topographic surveys without having their accuracy controlled by a geodetic survey.

Excerpts from the memorandum insofar as they apply to the advantages of a geodetic survey are here given verbatim:—

"The question of the value and utility of a trigonometrical survey has been so settled by almost every civilized nation that it is hardly necessary to advance proof of the statement that it would be of immense practical value to the whole Dominion; but for illustration, and in support of the statement, the following facts are offered:—

"The surveys of this kind, which have been made by other countries, may be briefly referred to.

"First and foremost is the Ordnance Survey of Great Britain and Ireland, covering nearly 111,000 miles, which was begun in 1784 and is now (1888) nearing completion. Then comes the great Trigonometrical Survey of India, inaugurated at the beginning of the present century by Colonel Lambton, which is still in progress, and of which the beneficial results have been inestimable. Belgium is carrying on a survey which, when completed, will furnish 450 sheets of map on a scale of 1/20,000, with contour lines one metre apart.

"Prussia is carrying on an extensive survey, and since 1849 has introduced new and more perfect methods. Russia, with its enormous territory, about twice the size of the United States, including Alaska, has been for many years engaged in prosecuting trigonometrical surveys.

"Norway, although a comparatively poor country, has set itself on having a good topographical map, on a scale of 1/10,000, compiled from trigonometrical surveys.

"Austria has completed a new map of the empire, comprising 715 sheets, also compiled from data furnished by trigonometrical surveys.

"Denmark, Switzerland, Spain, Portugal and Italy are all carrying on trigonometrical surveys, to enable them to map their territories accurately.

"France has completed her survey, and the result is shown in 276 sheets of map.

"On this continent surveys of a high order of precision have been made by the United States government, and the work of the Coast and Geodetic Survey is going

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