

METHODS AND RESULTS

—OF—

TORONTO OBSERVATIONS

Paper read by Lieut. Andrew Gordon, R.N., Deputy Sup't Meteorological Service of Canada, before the Hamilton Association, April 13th, 1882.

The Toronto observatory was one of five which were established by the Imperial Government with a view to extending the knowledge of magnetic phenomena.

The elements on which the determination of the earth's magnetic force is based are the declination, inclination, and intensity. The declination determines the direction of the force referred to the plane of the meridian (astronomical). The inclination determines its direction in reference to the horizontal plane. If in addition to these quantities we know the measure of the intensity expressed in some absolute unit, the force will be completely determined. The absolute unit which has been adopted by English observers is for mass, the grain, for space the foot; and for time the second. The idea may be readily grasped from the following: When two south poles, distant one foot from each other, are charged to equal strength, and repel one another with a force which, if continued uniform, would produce in one second a velocity of one foot per second in a mass of one grain, each pole is said to be charged with unit magnetic force.

For the purpose of detecting and examining the more minute changes in the magnetic force a different system of elements is employed, the intensity being resolved into two portions in the plane of the magnetic meridian, one portion horizontal and the other vertical. It is readily seen that these two components may be substituted for the total intensity and the inclination, being connected with them by the relations,

$$X = R \cos i; Y = R \sin i$$

where X and Y are the horizontal and vertical components of the force, and R and i the intensity and inclination respectively. Variations in R and i are then expressed in terms of the variations in X and Y .

Of these elements the declination was the first to be examined, and I shall now treat briefly of it. The declination called by sailors the variation has been the subject of investigation for hundreds of years. Humboldt awards the distinction of having discovered the changes in declination to Columbus, who on the 18th September 1492 records the fact that in lat. 28° north and long 28° west or thereabouts, the direction of the needle changed from east of north to west of north. It appears however, that the heathen Chinese was aware of this fact as early as the twelfth century, for in a treatise by a Chinese philosopher at this date it is distinctly stated that the magnetised needle did not point north and south but always declined to the east or south.

It is the business of a permanent observatory to watch and record the changes which take place in the elements of magnetic force. These changes are of three kinds, called secular changes, periodic changes and disturbances.

The secular change is that which takes place from month to month and year to year, and taking the Toronto observations of declination, the change has been from $1^\circ 14'$ 8 west in 1841 to $3^\circ 51'$ west at the present time; the annual increase varying in amount from $1'$ 8 in 1848 to $7'$ 5 in 1875. The necessity for careful and long continu-