

continuous changes in the earth's magnetism known as secular variation. Owing to the difficulty of covering a country of so large an area as Canada with ground observations, a gyro-controlled airborne magnetometer has been developed which is able to make the necessary observations of magnetic intensity and direction from the air. Although this instrument is dependent on ground observations for calibration and standardization, it has the great advantage of making continuous records of the magnetic elements along the line of flight and can accumulate in a few hours magnetic mapping information which would otherwise take years to obtain. It is also able to operate in the Arctic regions and over bodies of water where observations at ground or water level are difficult to secure. Magnetic maps of Canada showing the horizontal, vertical and total force, the declination, the rate of secular change and the position of the north magnetic pole, are issued every five years. In addition to purely magnetic maps, more detailed information on magnetic declination is provided for all large scale maps and especially for marine and air navigation charts issued by the Government of Canada. Special surveys are frequently undertaken to provide base stations for geophysical surveys in mineralogically important regions and detailed magnetic data are made available to those requiring them for scientific or commercial purposes.

In addition to the work on mapping, magnetic observatories are maintained at Agincourt, Ont., Meanook, Alta., Baker Lake and Resolute Bay, N.W.T. These observatories are for the purpose of studying the daily and seasonal changes in the earth's magnetism as well as the sudden and unpredictable phenomena known as magnetic storms. One major function of the magnetic observatories is to act as controls for ground and airborne observations which would otherwise be difficult of interpretation when the earth's field is rapidly changing.

An equally important aim of the Observatory work is a study of the causes of short term magnetic variation which appear to be largely dependent upon the effects of the sun's radiation on the upper atmosphere of the earth. Close co-operation with other magnetic observatories throughout the world is maintained, particularly in connection with the interpretation of magnetic storms and their relationship to sunspots, auroras and other phenomena of the upper atmosphere. An additional type of observation now being undertaken is the measurement of earth currents which are closely associated with atmospheric magnetic phenomena.

Supplementing the activities outlined above, studies now in progress are aimed at a clearer understanding of the origin of the earth's magnetic field (now considered to be a consequence of motions in the earth's liquid core) and its long term variations. Evidence for such variations is found not only in the familiar secular changes which are confirmed on the basis of a few years of observation but also in the magnetization of rocks deposited in previous geological epochs, some of which indicate a direction of the earth's field very different from that prevailing today. An extensive investigation is now in progress to examine the magnetization of sedimentary and igneous rocks of known geological age throughout Canada to see whether the information which they give can be used to construct a more complete theory of the earth's magnetism.

*Gravity.*—Variations of gravity over the earth's surface are both common and of great scientific and commercial importance. Measurements of gravity were first made by observing the frequency of vibration of a pendulum, the frequency increasing with increasing gravity. It is still the standard method of comparing the force of gravity at widely separated points on the earth's surface. In recent years it has been supplemented and to some extent superseded by the use of an instrument called the gravimeter or gravity meter which operates on the principle of the spring balance and has great advantages from the point of view of portability and speed of operation.