Section 3.—Terrestrial Magnetism

The study of the magnetic phenomena of the earth is of paramount importance in the field of geophysics. The cause and origin of the earth's magnetic field are not fully known and in this regard it has something in common with that other great natural phenomenon, gravitation.

The magnetic field is not confined within the earth. It extends far out into space and at a height of 4,000 miles is still one-eighth as great as at the surface. The magnetic field is being constantly affected and deformed by effects of the sun, moon and radiations from space. It is subject to changes both in direction and magnitude. There is a slow progressive change throughout the years known as secular variation. There are orderly daily changes varying in magnitude and character with geographic position, with the seasons and with cycles of disturbances on the sun. There are also short-period and sudden commencement disturbances known as magnetic storms which apparently are linked up with solar disturbance and other cosmical phenomena. Great magnetic storms are usually accompanied by brilliant auroral displays.

Although the earth's magnetic field is not apparent to the senses, it can be measured with facility. There are three magnetic elements whose values must be known to supply a complete knowledge of the magnetic field at any place. These are the declination, inclination and intensity. The declination, sometimes called variation of the compass, is measured in the horizontal plane and represents the angular distance between the true and magnetic meridians. The inclination or dip is measured in the vertical plane and represents the angular distance between the direction of the magnetic field and the horizon. The intensity, if measured in the plane of inclination, is known as total intensity but if measured in the horizontal or vertical plane is known as horizontal or vertical intensity.

Probably the most practical use made of the earth's magnetic field has been in surveying and in navigation by water and air. The magnetic compass was used in early survey work in Canada to delineate the boundaries of parcels of land. Its importance to navigation is universally recognized. Another important practical use, now probably ranking equal to that of navigation, occurs in mapping magnetic anomalies caused by bodies of magnetic ore. Magnetic methods and techniques in geophysical prospecting for ore and favourable locations for oil are being employed more and more extensively. The science of terrestrial magnetism plays an important part in the study of highly penetrating radiation known as cosmic rays, in the study of currents of electricity in the earth which frequently interrupt telegraphic communications by land line and cable, and related electrical phenomena in the air which have an important effect on the transmission and reception of radio waves.

The development of the science of terrestrial magnetism in Canada closely parallels the development of the country. Magnetic observations were made at Halifax, N.S., by Champlain in 1604. Observations at Quebec date back to 1642 and at Montreal to 1700. Owing to the voyages of the Hudson's Bay Company into Hudson Bay, magnetic observations were made as early as 1668 at Fort Albany and 1725 at York Factory. Captain Cook observed at Nootka, Vancouver Island, in 1778. Observations in Northern Canada and the Canadian Arctic were commenced in 1818 and continued for an entire century by such explorers and scientists as Parry, Franklin, Sabine, Ross, Lefroy, Greely, Amundsen and Stefansson. Although the magnetic investigations accomplished by many Arctic explorers have