

studies, and in the Kirkland Lake area of northern Ontario overburden thicknesses were measured and bedrock channels outlined, a project of possible assistance in locating placer gold deposits.

The Dominion Observatory studies and collects information on the geomagnetic field in Canada and publishes it in the form of maps and charts. Every ten years it issues a set of charts showing the direction and intensity of the field in all parts of the country and, at five-year intervals, it publishes the chart which is greatest in demand—that of magnetic declination (or variation). These charts must be revised periodically because the earth's magnetic field changes its direction and strength from year to year. Most of the information shown on the magnetic charts now originates in surveys carried out with the Observatory's three-component airborne magnetometer. In November 1963, Observatory geophysicists conducted a 37,000-mile survey in the High Arctic—the area extending from the mainland of North America to the North Pole, east to the Greenwich meridian and west to the international dateline. The data collected constitutes part of Canada's contribution to a magnetic map of the world.

Because the auroral zone passes through Canada and the North Magnetic Pole is located within Canadian borders, the Dominion Observatory plays an important role in the world-wide investigation of geomagnetic disturbance.

The Observatory is systematically mapping the gravity field in Canada on a regional basis with measurements at points 8 to 10 miles apart. These results, published in the *Gravity Map Series of the Dominion Observatory*, reveal the major density features of a region and are useful in geological studies. Detailed gravity surveys are also carried out to delineate local crustal structures.

In 1963, the Observatory continued regional gravity mapping activities in Southern Canada and in the Arctic; made an extensive study of the Timmins-Kirkland Lake-Noranda mining areas; continued gravity studies of the Atlantic continental shelf and eastern coastal waters of Canada; made some 600 gravity measurements on the ice of the Arctic Ocean and in the northern Archipelago; and carried out field investigations of six craters of possible meteorite origin in Ontario, Quebec and Saskatchewan. Work was continued on the expansion and modernization of Canada's seismological network, which, when completed, will consist of some 30 seismic stations established at 500-mile intervals throughout the country for the threefold purpose of assisting in the study of the earth's interior by international seismology, assisting in the study of nuclear explosions, and furnishing information on seismic risks in Canada. Three new stations were added in 1963, bringing the number to 16; in addition, there are three private seismological stations which report to the Dominion Observatory.

In 1962, the Observatory, in co-operation with the Department of National Defence and British scientists, set up a crossed array of seismographs at Yellowknife, N.W.T., to assist in policing any test-ban treaty. The array also provides an important tool for the study of the earth's structure.

International Projects.—Canada, like other nations, must shoulder its share of international scientific studies. One such study under way is the Upper Mantle Project, an international scientific study of the earth's upper mantle—that part of the earth's interior lying just below the crust. Two forms of study are being used—the direct approach of geology and the indirect approach of geophysics. Canada's contribution is being carried out by the Department of Mines and Technical Surveys and by some Canadian universities through grants from the National Research Council.

The Geological Survey in 1963 drilled three holes into selected parts of the Muskox Ultrabasic Intrusion in the Northwest Territories and are preparing to drill a deep hole in the Mount Albert Ultrabasic Intrusion in Quebec's Peninsula in 1965—locations where dense mantle material is believed to have broken through the crust to the earth's surface. A detailed study of diabase dykes across the country will also be made in an endeavour to cast some light on conditions within the mantle. Other projects include the start of a