

radioactive methods. In addition the University of Toronto co-operates with the Meteorological Division of the Department of Transport to train physicists as meteorologists and gives a course leading to a Master's degree in that subject.

At Queen's (Kingston, Ont.) and McMaster (Hamilton, Ont.) Universities and the University of Western Ontario (London, Ont.) courses in geophysical prospecting are given. The latter has made a specialty of measuring the earth's internal heat while at McMaster the ages of minerals have been determined in conjunction with the university's large program of nuclear studies.

In the universities of Western Canada there has also been specialization. The Universities of Manitoba and Saskatchewan have installed apparatus by which carbonaceous material up to several tens of thousands of years old can be dated. Another such installation is at Dalhousie University. At the University of Manitoba new methods have been developed for detecting and prospecting for radioactive ores from the ground or by air. The University of Saskatchewan has capitalized on its northern location to make outstanding studies of the aurora, of the earth's magnetic field, of the ionosphere, and of radio propagation in Arctic and Subarctic regions. A seismograph station is also maintained at Saskatoon for the Dominion Observatory.

Geophysical prospecting is taught at the Universities of Alberta and British Columbia and the latter has the only Oceanographic Institute at any Canadian university.

Canadian universities are well equipped to train men and carry out research in most phases of geophysics—still a new and expanding subject in whose many and varied branches there exists a great demand for young men and women. Those who decide upon a career in geophysics are not entering upon a field of narrow specialization but are studying a subject as broad as the earth itself.

#### APPLIED GEOPHYSICS IN CANADA

The advance of geophysics has awaited the development of modern physics so that it is only within the past twenty years—more especially within the past ten years—that geophysics has come to play an important part in the Canadian economy. The various fields of investigation which comprise earth physics lead to methods that may be applied commercially in the search for oil and minerals. In the mining industry Canada has been the scene of many new developments in geophysical exploration, and today probably leads the world from the point of view of diversification of methods and volume of activity. One gauge of this leadership is the \$30,000,000 being spent each year in Western Canada on geophysical exploration for oil alone.

The most successful technique so far developed for mapping underground structures associated with oil accumulation is reflection seismology. Elastic waves generated by artificial explosions are recorded on portable seismographs set up nearby. Certain phases on the records may be identified as waves reflected from various geological horizons, and the arrival times of these waves give a measure of the depth to the reflecting layers. Each seismic party in the field requires 15 to 25 men, including geophysicists, technicians and assistants, and the fact that there are currently about 120 parties operating in the four western provinces indicates the scale of the operation.

Certain developments in technique have been made to meet problems peculiar to Canada. In the northern muskeg regions, transportation is a difficulty, and winter operations are often carried on with the instruments mounted on snowmobiles. The tide of exploration has been moving steadily into the Rocky Mountain foothills where the faulted and folded beds have posed new problems in the interpretation of the records. The high cost of seismic exploration has encouraged the use of the gravimeter and airborne magnetometer as reconnaissance instruments. Gravitational and magnetic indications are less direct as most of them arise from conditions within the crystalline rocks beneath the oil-bearing sedimentary formations; but they may point out interesting areas for detailed seismic investigation.