aeromagnetic maps of 38 p.c. of Canada's land surface as well as parts of the continental shelves off Nova Scotia and Hudson Bay and other Arctic waters. On regional scales, these maps materially aid in preparing geological maps, particularly in areas of extensive surficial cover, and aid mineral exploration by indicating the trends of rock units selected as being potentially favourable. One of the earliest of the aeromagnetic surveys in 1949 by the Geological Survey of Canada clearly pin-pointed and led to the discovery by an exploration company of the present Marmoraton iron mine, although the ore was completely covered by about 125 feet of flat-lying limestone. The compilation and reduction in scale of many individual aeromagnetic maps, as in the accompanying illustration, shows major structural trends in the Canadian Shield over an area of 71,000 square miles. The heavy northeast-trending line marks the boundary between the Superior province on the southeast and the Churchill province on the northwest. Northeast of the dotted line on the map, the Precambrian rocks are completely covered by flat-lying limestones of the Hudson Bay Lowlands, yet the structural trends in the basement rocks were readily detected.

Regional sea-seismic and aeromagnetic surveys of parts of the Atlantic and Arctic continental shelves are completed and in progress in order to evaluate the deeply buried sequences and structures below these relatively shallow waters and to prepare for more detailed company exploration for off-shore oil and gas.

Electromagnetic methods are principally used by exploration companies to detect buried bodies of anomalous electrical conductivity with respect to normal bedrock. Most conductors so detected prove to be caused by graphitic or barren pyritic zones and are of no commercial value, but a small proportion prove to be orebodies such as a single remarkable discovery, announced in 1964, near Timmins in Ontario.* Prior to drilling, it is commonly not possible to distinguish details of the conductor. Current research in the Geological Survey of Canada is in part directed toward the use of magnetotelluric currents in the detection of buried sulphide deposits but more effort is expended in applying electromagnetic methods to the study of the stratigraphy and nature of unconsolidated sands, gravels, clay and till. These studies, combined with shallow seismic surveys, have been particularly rewarding in defining buried river channels that contain abundant groundwater.

Seismic surveys to depths of about 180 feet are readily made by sending shock waves into the ground from a sledge-hammer blow and recording their reflections. The detection of groundwater reserves, or surficial aquifers, both in surficial material and bedrock, is one application of the method, as discussed above; or depths to bedrock for heavy construction or mineral exploration problems may be determined at relatively low cost. Penetration deep below the surface is effected by detonating explosive charges on land or sea, and recording the reflections of waves from deeply buried, folded or flat-lying strata, or detection of variations, such as oil-bearing reefs, within strata. The Geological Survey of Canada recently defined the thickness of potential oil-bearing strata beneath the waters of Hudson Bay by this method.

Research continues in other new methods of rapidly detecting potentially useful physical variations at and near the earth's surface. Airborne infra-red imagery, for example, discloses slight variations in apparent surface temperature. Several applications are being investigated such as detection of cold groundwaters or hot springs discharging into lakes or rivers, detection of discharge points of warm industrial waste waters, or possibly slightly warmer land surfaces which might be related to sources of geothermal power or some types of ore deposits. The geiger counter and scintillometer continue to

* This deposit was found by astute geological selection of a large area followed by airborne and ground geophysical surveys and, finally, drilling. No significant massive sulphide deposits of this type had formerly been known in this long-established gold-mining district.