

evaluation of the quality of Canada's fossil fuels and the development of refining methods for the low-grade, high-sulphur petroleum of the Athabasca oil sands. Mining research is aimed at maximizing ore production with minimum physical hazard and at minimum cost. A five-year project will greatly lower waste rock production and costs by improving the design of the walls of open-pit mines. Research is also being conducted on coal beneficiation and carbonization. In the related area of pyrometallurgy, the extraction of metal by heat, applied research is concentrated on the development of a shaft electric furnace for smelting iron ore. In the mineral sciences, the Canada Centre for Mineral and Energy Technology carries out physical, chemical, crystallographic and magnetic studies to determine mineral characteristics important to extraction and processing methods. The Canada Centre for Mineral and Energy Technology also produces standard reference ores and metals needed by mining and metallurgical companies. In metals research, in addition to improving traditional techniques for metal forming, attention is focused on ensuring the structural soundness of metal pipelines for use in the Arctic. Another program is directed toward the development of methods of mineral recovery that will reduce pollution problems. Research is conducted on the development of chemical methods of ore processing that avoid the sulphur dioxide production of the smelting process and the conversion of mineral waste into useful materials such as fillers and ceramics.

The Canada Centre for Mineral and Energy Technology is assisted in its work by the National Advisory Committee on Mining and Metallurgical Research, comprising senior executives and researchers from industry, government and universities.

The Geological Survey of Canada maps and studies the geology of Canada. It is the major organization engaged in this work in Canada and its studies extend to all provinces and territories. Its activities are designed to support two programs of the federal Department of Energy, Mines and Resources: the Mineral and Energy Resources Program and the Earth Sciences Program. A principal aim of the former is to ascertain the mineral and energy resource potential available to Canada and thus the Survey expends considerable effort in such fields as estimating the potential abundance and probable distribution of mineral and fuel resources. This is done by providing the necessary systematic geological framework, by defining those settings favourable to the occurrence of the various types of mineral commodities and fuels and by comparing these, by appraising foreign mineral and fuel resources and by other studies. The Earth Sciences Program includes activities designed to assist in effective use and conservation of resources and in the management and preservation of man's environment throughout Canada. To assist in this, the Geological Survey provides geologically based information on land resources and terrain performance, which is derived from geological, geomorphic, geophysical, geotechnical and related studies of earth and rock materials, land forms and associated dynamic processes.

In support of these activities, the Survey each year sends about 100 parties into various parts of Canada. The results of its studies are published in memoirs, bulletins, papers, maps and numerous scientific technical journals. Headquarters is in Ottawa but there are several regional offices of which the Institute of Sedimentary and Petroleum Geology in Calgary and the Atlantic Geoscience Centre at Dartmouth are the largest. The former studies the geology of Canada's western and northern sedimentary basins and the latter investigates the bottom morphology and structure of the continental shelves and the floors of the open ocean. A smaller contingent of geologists on the west coast is developing similar marine-geology studies in that area.

The Earth Physics Branch carries out much geophysical work of interest to the mineral industry. It studies, collects and publishes, in the form of maps and charts, information on the geomagnetic field in Canada. Most of the information published is obtained from airborne geomagnetic surveys, which have ranged over the whole of Canada and across the Atlantic to Scandinavia. In addition, the Branch maintains a network of 10 permanent geomagnetic observatories, as well as temporary observatories in summer at many widely distributed sites. It also operates a network of 31 seismic stations to assist in the study of the earth's interior and to obtain data for its quantitative assessment of seismic risk throughout Canada. In gravity research, another means of studying the composition of the earth's crust, the Branch is systematically mapping variations in the earth's gravity on a regional basis throughout Canada, including the Arctic and the floors of the Gulf of St. Lawrence and Hudson Bay. The results of all gravity measurements are available in a new gravity map of Canada on a scale of