

Although field mapping is vital to geology, answers to many problems can be found only by laboratory investigation. In the past few years much more adequate facilities have become available for such investigations. The new Geological Survey building in Ottawa, which was occupied in 1959, contains laboratories designed for many kinds of study, and research already under way and planned for the future will help greatly in extending the science of geology. Most of the problems studied are those that result from field mapping. For example, it is important to know the age of the rocks relative to each other, and in areas where rocks contain fossils the palaeontologist can provide such information. About half of Canada is underlain by such rocks, including those parts where petroleum and coal are likely to be found. Certain animals and plants lived only at specific times and their fossils can therefore be used to date the rocks. One of the first reports of the Geological Survey was based on knowledge of palaeontology and was concerned with the possibilities of finding coal in Upper Canada (southwestern Ontario). Logan pointed out that the fossils in the youngest rocks in the region were much older than those of the coal measures in the United States and England and for that reason searching for coal in that part of Canada would be wasted effort.

The other half of Canada, however, is underlain by rocks of the Precambrian Canadian Shield, which were formed in the early four-fifths of geological time. Life on the earth had not then evolved far enough to leave a fossil record by which the relative ages of the rocks can be ascertained. For these rocks, techniques have been devised to measure their age by the radioactive decay of minerals contained in them and the Survey is now systematically determining ages of rocks of the Shield by these techniques. In a few years the geological history of this vast period of time should be much better known.

Dating of the youngest materials—those not more than 35,000 years old—is done by measuring the radioactivity of carbon. A new laboratory is being set up to provide dates on such material of Pleistocene age from which will be learned the detailed story of the ice ages in Canada and, of particular interest to archaeologists, when prehistoric man came to North America and something of his subsequent migrations.

Geochemistry is a relatively new science of great potential use in mineral exploration. Isotopes of such elements as sulphur, oxygen and lead, and the distribution of these isotopes in rocks, are being carefully studied as a clue to the origin of rocks and of the ore deposits they contain. A radio-chemistry laboratory is being established so that isotopes obtained from nuclear reactors at Chalk River may be used to study diffusion of fluids and chemical elements in rocks, and how elements are taken up by plants. A recently completed geochemical study in Nova Scotia, however, appears to have much more immediate practical application. Much of the mainland of that province was covered by a systematic geochemical survey of stream sediments. The muds from the streams were analysed for lead, zinc and copper, and the amounts of these metals were indicated on a map by contours in much the same way as contours on topographic maps show elevations. The high spots indicated on the maps, however, are not hills but the places where there are concentrations of these valuable metals. It is expected that the concentrations in the streams are close to rocks containing deposits of the same metals and therefore that such maps will lead to the discovery of commercial deposits. The method is not limited to Nova Scotia, of course, and will be used in many other parts of Canada.

Improved techniques now make it possible to analyse samples of bedrock for valuable metals and other elements in the field at the same time as the regular geological mapping is under way. This will improve the quality and usefulness of the maps by showing the distribution of metals and other valuable materials; they will thus be of direct assistance to the prospector in his search for ore deposits.