

greatly disorganized the pre-glacial drainage patterns, resulting in the numerous lakes, muskegs and irregular stream patterns of many localities, particularly in the Shield. Glacial deposits obscure bedrocks in most places except in the higher parts of mountains and in certain parts of the Shield where glacial scouring was more pronounced than deposition. Elsewhere outcrops are scattered, generally forming less than 10 p.c. of the surface, or are completely lacking in areas many miles in extent.

The geological processes outlined above accounted in one way or another for the raw materials of Canada's mineral industry, which includes the production of the 'fossil' fuels—coal, petroleum and natural gas. Metals are won from deposits containing metal-bearing minerals. Non-metalliferous products such as asbestos, gypsum, sand, gravel and building stone are derived from deposits of minerals like asbestos, or from beds of sedimentary rock as in the case of gypsum, or from rocks like limestone or granite as in the case of building stone, or from unconsolidated sediments like gravel, sand or clay. Coal is formed by alteration of beds in which leaves and other woody material accumulated between layers of typical sediments. Petroleum and gas resulted mainly from the fats of the innumerable organisms that inhabited the seas of former times, which became trapped in sediments. The fats decomposed slowly to form oil and gas which migrated through pores and fractures in unconsolidated sediments or sedimentary rocks to accumulate in places where geological structures were favourable and where impermeable strata overlay in such a way as to prevent escape of oil or gas. Most metal deposits are found in ancient mountain-built areas where igneous and other processes were once active, and which have been eroded deeply. Some non-metalliferous minerals, such as asbestos, are found under analogous conditions and others occur mainly in relatively undisturbed sedimentary rocks. Coal, oil and gas are found only in accumulations of sedimentary rocks younger than Precambrian because suitable organisms were absent before the Palaeozoic era. Coal may be present in much-disturbed or undisturbed areas, but oil and gas are found only in moderately disturbed or undisturbed sedimentary rocks because much disturbance permits their escape.

The Canadian Shield.—The Shield is a complex assemblage of Precambrian rocks that, as a whole, represent at least five-sixths of the long duration of geological time. Most of the rocks have been subjected to more than one and in some cases several periods of orogeny, resulting in intricate structures, intense metamorphism, widespread igneous intrusions, and alteration of much ancient sedimentary rock to granite and related material. Orogenies probably occurred at many more times than suggested by the chart on p. 4, but the records of such early events are fragmentary. These complexities, combined with the absence of fossils, which facilitate the correlation of strata younger than Precambrian, hamper interpretation of the geology of the Shield. Nevertheless, progress has been accomplished and methods developed in Canada have been applied to Precambrian shields of other continents.

Because of the size of the Canadian Shield, attempts have been made to divide it into geological or structural 'provinces'. The latter are based on the general directions of structural trends and on age determinations that supply estimates of the dates of orogenies, metamorphism, or igneous intrusions. Several schemes of this kind have been suggested but final agreement on names and boundaries must await further field studies and additional age determinations. A simplified and tentative classification is illustrated by the map on the following page, which also summarizes age determinations by the Geological Survey of Canada to June 1959. According to this plan the Shield is divided into five provinces which, from northwest to northeast, are called Slave, Churchill, Superior, Grenville, and an unnamed one which in other schemes is called Labrador. Some geologists consider that a separate division called Ungava may lie north of the Superior and east of Hudson Bay, and some add another province called 'Arctic Islands' to include the part of the Shield found at and near Baffin Island. More complicated schemes subdivide the provinces into sub-provinces. The Superior and Grenville provinces contain the classical areas where the first geological investigations in the Shield were undertaken. They are, therefore, described in slightly greater detail than space permits for the other provinces.