

including the depletion of the richer ore reserves. The successful application of many new and improved metallurgical processes has made possible the economic development of less accessible, medium-grade and finally low-grade mineral deposits.

The mineral and metal needs of World War II gave stimulus to the development of research facilities by federal and provincial governments, universities and the mining industry. This capacity, applied initially to the war effort, has become an essential part of present-day operation in Canada's growing role as a producer and supplier of world markets in competition with expanding mineral production in a number of other countries.

Uranium

Uranium mining in Canada originated indirectly from the radium industry which developed on the eastern shore of Great Bear Lake at Port Radium in the Northwest Territories. In 1933, Eldorado Gold Mines commenced production of radium and silver from a rich pitchblende deposit in this area, using a process developed in the Mines Branch laboratories. The operation continued until 1941 when the mine was closed. In 1942, with nuclear uses of uranium becoming important to the war effort, the mine was taken over by a Crown company, Eldorado Mining and Refining Limited, and by 1944 the company was producing a uranium concentrate using gravity methods.

Early in the atomic energy program it was apparent that the necessary increase in uranium production would require more efficient extraction processes. In 1945, the Mines Branch of the now federal Department of Mines and Technical Surveys began securing new staff for its Radioactivity Section which had responsibility for the development of processes for the treatment of uranium-bearing ores. By 1949 this group had developed a satisfactory sulphuric acid leaching process for the Port Radium gravity concentrate tailings. The next work undertaken by the Radioactivity personnel was test work on the Beaverlodge ores from Eldorado Mining and Refining Limited which have a higher carbonate content than those at Port Radium. The problem was solved by use of sodium carbonate-sodium bicarbonate solution leaching methods. In 1953 the first samples from the Gunnar Mine in Saskatchewan were received for testing. The same year, samples from the vast deposits in the Elliot Lake area were submitted. Successful processes were developed by use of an acid leach followed by the introduction of ion exchange for the purification of solution prior to precipitation. This resulted in production of high-grade concentrates which were required to meet contract specifications.

The peak of uranium production was reached in 1959 when 31,784,189 lb. of uranium oxide valued at \$331,143,043 were produced, and uranium led all other metals in value of production.

Eldorado Mining and Refining Limited refines uranium at Port Hope, Ont. The company produces uranium metal and uranium compounds of consistent quality and the highest purity. Through its facilities and those of associated companies, the metal can be supplied in the form of machined ingots and forged, rolled and cast shapes, and completely fabricated fuel elements. Uranium-dioxide fuel elements of ceramic grade can also be supplied. However, only a small percentage of the uranium concentrate from Canadian mines is refined at Port Hope. Most of it is shipped from the mines direct to the United States and the United Kingdom. Canadian contracts with the United States Atomic Energy Commission will terminate in 1966 and it is estimated that annual uranium production will have declined to 2,200,000 lb. by that time.

Of increasing interest is the research on non-nuclear uses of uranium being conducted by the Mines Branch in co-operation with Eldorado Mining and Refining Limited. This project was undertaken in 1959 to help close the gap between Canada's uranium production capacity and the reduced demand that will occur on the termination of United States contracts. The results of this research have shown considerable promise in the use of uranium as an alloying agent to improve fatigue strength, stress corrosion resistance and elevated temperature strength of certain commercial steels.