## MINERAL DEPOSITS NEAR KINGSTON, ONT.*

By M. B. Baker.

It has been frequently stated that there is probably no other area of equal size, which has produced such a variety of economic minerals as has that contiguous to Kingston, Ontario. Within fifty miles of this city there has been produced from time to time the following products: Mica, phosphate, graphite, gold, arsenic, copper, iron, lead, zinc, barite, talc, corundum, feldspar, quartz, actinolite, molybdenite, fluorite, pyrite, building bricks, lime, cement, building stone and road metal.

It is a fundamental principle of economic geology that all metalliferous as well as other constituents of rocks have been derived ultimately from the interior of the earth, have been brought to or near the surface through igneous activity, and have there suffered, as a rule, further concentration by natural processes, to become of economic value. With three periods at least, of igneous activity proven in pre-Cambrian times, namely, the Laurentian, the Algoman, and the Keweenawan, it is not surprising that these rocks should carry economic deposits of considerable variety and substantial value.

### Feldspar.

Among the intrusive rocks in the Kingston area are the pegmatites of late Algoman age. These are found cutting the large main masses of Algoman granite, as well as the earlier Laurentian and Grenville series. They are very coarse grained as a rule, so much so that their chief constituents, feldspar and quartz, are mined separately in large quantities. This is only possible where these dikes cut gneisses, in which case they yield a beautiful feldspar carrying 13 per cent. of potash. These dikes have generally a pink colour and are very coarse grained. Most of this feldspar is mined about Verona and Bedford, on the Canadian Pacific railway, and is shipped from there to the United States, to be used for glazing white earthenware dishes, lavatory equipment, terra-cotta tiling, electric insulators, reflectors, etc. The quartz is shipped to the Niagara peninsula for use in the various silicon combinations, so largely manufactured there. A more recent use of the second grade of feldspar is for the extraction of its potash for the manufacture of artificial fertilizers. This industry may be considerably developed in the near future.

Where Algoman dikes cut Grenville crystalline limestones, they are no longer pink, but white or bleached, and do not show the constituents segregated into masses fit for mining; but, on the contrary, exhibit the most intimate mixture of their quartz and feldspar. Much of it is actually graphic granite, where the most pronounced intergrowth is evident. The feldspar in this case is no longer the potash-rich orthoclase and microcline, but is a pale to white oligoclase, which carries about 6 per cent. of potash and 3.5 per cent. of soda. From these facts it is clear that the Algoman pegmatites are of economic value where they cut gneisses, but are of no worth where they cut the crystalline limestones. This fact should prove instructive to prospectors in the search of additional supplies of feldspar in this and adjoining areas.

### Mica and Phosphate.

Southeastern Ontario has long been known as an important producer of amber mica. In the "Geology of Canada," issued by the Geological Survey of Canada in 1863, reference is made by Sir William Logan to the occurrence of mica in this region. On page 796 is a brief statement of important mica occurrences in Ontario, and the paragraph closes with this statement: "It appears probable that by further exploration in this region, and in Grenville, sufficient quantities of mica could be obtained to supply a large demand."

All early reports of mica occurrences speak of its association with phosphate, and the phosphate industry flourished long before the mining of mica was carried on. In 1868 apatite was mined by the Rideau Mining Company in North Burgess township, and was shipped to Germany. It then brought seven dollars per ton. In 1871 apatite was discovered in the township of Loughborough by H. G. Vennor. Mica then began to be mined as a by-product in the phosphate industry. It was not, however, until after 1890 that there was any appreciable demand for mica. Of the great amount that had been mined in the phosphate industry, and thrown on the dumps, only a very small portion of the choicest sizes procured a market.

After 1890 both mica and phosphate found sale for a while, but the placing of the easily mined phosphates of the southern States on the market soon stopped the sale of the harder and more costly phosphate of southeastern Ontario. The mica industry continued to grow, however, and has been a valuable one ever since. It is not the writer's intention to deal in detail with this industry, a monograph, No. 118, having been issued by the Department of Mines, Ottawa, in 1912, which is full of information for those who wish it in detail. There are certain points, however, regarding the origin of mica and phosphate deposits that do seem worthy of note here. The detailed mapping of this area gave the writer an opportunity to study, and aid in deciding, some much debated points as to the origin of phosphate and mica deposits in pre-Cambrian rocks.

It is probably natural that the first theories of origin suggested for phosphate should be organic, and early Canadian geological literature assigns this theory. Vennor, G. M. Dawson, Fielding, Davidson, J. W. Dawson, and Harrington claimed that the phosphate deposits were derived from organic remains, originally present in the sedimentary gneisses and limestones in which they are now found. History repeats itself, and, as in all similar discussions, an exactly opposite view was soon put forth by other geologists. Quite in contrast with the organic theory was the theory that these deposits were of purely igneous origin. This theory has been supported by Selwyn, Bell, Ells, Coste, and others.

Coste sums up the matter thus: "We believe we have gathered year after year strong and clear evidence to show that not only our deposits of iron ore in Archean rocks, are of eruptive or igneous origin, but also that our deposits of phosphate are exactly similar, and have also the same origin."

Two theories more opposed in character, could not have been put forth to explain the same phenomenon, but there was considerable evidence for each, and from the study of individual deposits, it would be almost possible to prove either theory. The writer, after mapping this area geologically, saw certain relationships which show that both of these theories are partially correct, but that a combination of the two is necessary to account for the deposits satisfactorily. Certain essential ingredients were present in the sedimentary rocks as claimed by the first school; while certain other ingredients were introduced by the igneous activity, and the aqueo-igneous combination produced the results now found.

* Extracts from a report published by the Ontario Bureau of Mines.