British Columbia Department of Mines and Petroleum Resources
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$10 – 15 concentrate $30 apatite

PHOSPHATE OCCURRENCES IN BRITISH COLUMBIA

Phosphorus is essential to all life and is, therefore, one of the main elements required to be supplied to plants in fertilizers. The sources of the phosphate for fertilizers are either primary deposits of the mineral apatite, $Ca_3(F \cdot Cl)(PO_4)_3$, or phosphorite, a phosphate-bearing marine sedimentary rock containing secondary phosphatic material derived from the apatite of igneous rocks or from bones, marine life, or guano. Phosphorites provide the bulk of the source rock used in the world today.

A few occurrences of rocks containing appreciable apatite have been reported in British Columbia and phosphorites of considerable extent have been found. The phosphorites were investigated by L. Telfer (Ref. 1) for Cominco and his description of them, that appeared in Volume 36 of the Transactions of the C.I.M.M. in 1933, is the only report of any length that has been published. The following notes have been taken almost completely from the report by Telfer.

Sedimentary phosphate-bearing rocks are found in southeastern British Columbia over a considerable area that extends from Fernie east to Alberta and from the United States border north to the headwaters of the Elk River. Although areally extensive the phosphate zones are thin and low in grade and to date none has proved commercial.

The phosphate is found at five different stratigraphic levels: in shales of the lower part of the Mississippian Banff-Exshaw sequence; in the upper part and top of the Pennsylvanian-Permian Rocky Mountain Formation; at the base of the Triassic Spray River Formation; at the base of the Jurassic Fernie Group; and in the Rock Creek Member of the Fernie Group.

In the Banff-Exshaw sequence the phosphate occurs as scattered dense black nodules and narrow fine-grained oolitic seams in the black shales of the lower part. Telfer describes a typical section 2 miles north of Crowsnest as follows: at the base is grey Devonian limestone overlain by 23 feet of black shale, followed by 0.6 feet of nodular phosphate (37.4 per cent $Ca_3P_2O_8$), then 1.7 feet of black shale (6.7 per cent $Ca_3P_2O_8$), and finally 0.6 feet of oolitic phosphate (50.8 per cent $Ca_3P_2O_8$). This, with minor variations, is stated to be representative of the phosphate zone for 20 miles north and south of Crowsnest. Near Fernie, however, only a few nodules and narrow stringers of phosphate are present in the same shales.

The Rocky Mountain Formation has been correlated with the Phosphoria beds which are the commercially important rocks in the Western phosphate field of the United States. In Canada, unfortunately, the beds are much thinner and lower in grade than south of the border and so far have not proved of economic value. The

lithology of the formation varies somewhat from place to place and the phosphate varies within the rocks. Telfer distinguished four types of occurrences. (1) Phosphatic sandstone--usually the upper few feet of the formation is stained black by phosphate material that cements the sand grains. The rock contains 5 to 10 per cent $Ca_3P_2O_8$. This type of occurrence is widespread and is present in the Corbin-Crowsnest area. (2) Nodular--throughout the area the top 100 to 200 feet of the formation commonly contains phosphate nodules that make up 10 to 25 per cent of sandstone beds which may be as much as 20 feet thick. The nodules, one-quarter inch to 4 inches in diameter, are black, hard phosphate rock containing up to 70 per cent $Ca_3P_2O_8$. Occurrences of this sort have been noted north of Corbin, at Crowsnest, west of Fernie, and in the Flathead River area. (3) Massive--in some places, such as near Hosmer and west of the Elk River at Michel, dense, black, basaltic looking phosphate forms a bed a few inches to 2 feet thick underlying a chert-quartzite bed, as much as 60 feet thick, which forms the top of the formation. This is often associated with and may grade into a nodular type deposit. (4) Oolitic--fine-grained oolites, averaging 0.3 millimetre in diameter, mixed with angular quartz grains occur in a thin sandstone bed and stringers 75 to 120 feet below the top of the formation. West of Fernie a bed 1 1/2 feet thick is interbedded with sandstone and shales under a 75-foot layer of chert and quartzite that forms the top of the formation. Near Hosmer, the phosphate forms stringers in sandy shale for 150 feet below the chert. Price (Ref. 2) noted a fifth mode of occurrence in the upper part of the Rocky Mountain Formation in parts of the MacDonald Range, where brecciated, dense, light grey dolomite is partly cemented by very fine-grained purple apatite.

According to Price, the base of the Spray River Formation in the Flathead and Fernie map-areas is marked in some places by a dark phosphatic sandstone bed up to 15 feet thick. This bed unconformably overlies sandstone and cherty dolomite of the upper part of the Rocky Mountain Formation.

The phosphate at the base of the Fernie Group is in an oolitic rock at Fernie, Crowsnest, and in the Flathead area and in a chert conglomerate in other places. At Crowsnest a section 4.7 feet thick consisting of four layers averaged about 45 per cent $Ca_3P_2O_8$ and a similar six-layer section at Fernie, 12.7 feet thick, averaged 27 per cent $Ca_3P_2O_8$.

Part of the Rock Creek Member, 150 to 250 feet above the base of the Fernie Formation, is a 5- to 20-foot thick phosphatic sandstone that contains many belemnites. This bed assays 7 to 35 per cent $Ca_3P_2O_8$.

In the period 1925 to 1934, Cominco made an extensive study of the phosphate bearing rocks. The company opened up three small exploratory underground mines and excavated numerous trenches. The mines were the Lizard, on Lizard Creek, 1,200 feet above and 5 miles west of Fernie; the Crow, on Alexander Creek, about 2 miles northwest of Crowsnest station; and the Marten, just east of the old railway, 5 1/2 miles south of McGillivray station. Some rock was shipped to Trail for experimental work but no commercial production was attempted. In 1964-1965 the Crow mine was reopened

to obtain rock for more tests but was again closed. In all, approximately 5,000 tons of phosphate rock was mined. During the initial exploratory period, Cominco gained Crown-granted rights to the phosphate mineralization underlying large areas through the Phosphate Act which was then in force but has since been repealed. The company, however, still retains these rights.

Since 1964 there has been a renewal of interest in the Phosphate possibilities of the area and numerous claims have been located. Between 1964 and 1966 Western Co-operative Fertilizers Ltd., drilled and stripped a large area on the hilltop just north of Lodgepole Creek 4 miles above its junction with the Wigwam River. The same company prospected a large block of claims between Lodgepole Creek and the Flathead River. Crowsnest Industries and Crowsnest Pass Coal Company located and examined many claims in the Elk River Valley north of Fernie and southeast of Lodgepole Creek. Cominco carried out further exploratory work in the Elk Valley. Other claims have been located south of Corbin.

The following maps and reports deal with and show the distribution of the phosphate-bearing rocks in southeastern British Columbia:

1. Phosphate in the Canadian Rockies, by L. Telfer, The Transactions of the Canadian Institute of Mining and Metallurgy, Volume 36, 1933, pages 566 to 605.

2. Geological Survey of Canada, Paper 61-24, Fernie Map-Area, East Half, by R. A. Price, 1962.

3. Geological Survey of Canada, Map 14-1958 in Paper 58-5, Beehive Mountain, by D. K. Norris, 1958.

4. Geological Survey of Canada, Map 1-1959, Flathead, by R. A. Price, 1959.

5. Geological Survey of Canada, Map 11-1960, Fernie Map-Area, West Half, by G. B. Leech, 1960.

6. Geological Survey of Canada, Memoir 336, Flathead Map-Area, by R. A. Price, 1965.

7. British Columbia Department of Mines, Bulletin 33, Geology of the Crowsnest Coal Basin, by C. B. Newmarch, 1953.

8. Minister of Mines, B.C., Annual Reports: 1929, pp. 298, 447; 1930, pp. 244, 377; 1931, p. 141.

9. Bulletin of the American Association of Petroleum Geologists, Volume 43, No. 3, 1959, pages 644-645.

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