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LOWER MESOZOIC PHOSPHOROUS SIDERITES IN HIGHWOOD AREA

INTRODUCTION

The latest iron concession granted by the Alberta Department of Mines and Minerals in Iron Prospecting Permit No. 15 in townships, 15, 16, and 17, Range 5, West of 5th meridian was issued to G. C. McCartney and Associates of Toronto in the autumn of 1954.

Iron Prospecting Permit No. 15 covers and area of 19,840 acres in the Highwood River area about 55 miles south-southwest of Calgary and 25 miles southwest of Turner Valley. It lies along the summit of Highwood range of altitude over 8,000 ft. for four and an half miles north of Highwood Gap where flows the river of that name, and seven miles south of it.

The area has been geologically reconnoitered by Dawson (1886) and geologically mapped by Rose (1919), Allan (1920) and by Allan and Carr (1947, and Carr's thesis, 1946), and Douglas (1950).

The writer has not examined the iron occurrence (s) in the area but in the meantime he can say on the basis of his preliminary study of three sacks of specimens from the area sent by Dr. McCartney that the showing consists of phosphorous siderites. The iron showings there are to be examined for the Council in 1958.

Notes will also be given below on the previous work done in the area with reference to other indications of iron that may be worth following up, even if they were described mainly as features of scientific interest, as well as possible occurrences of the same siderite horizons in a northern part of the Rockies around the Nordegg and Jasper areas.

ACCESSIBILITY

The Highwood River valley is easily reached by a good all-weather road running from High River to the east on the No. 2 Highway. Another good road built and maintained by the Eastern Rockies Forest Conservation Board running north and south between Kananaskis and Coleman passes the Highwood Gap on the west and connects with the High River road.

CURRENT STUDY OF SPECIMENS

The three bags of specimens sent to the Council weighed about 50 pounds each and consist megascopically ofheavy and dense dark bluish-gray argillite-like materials. It however c contained largely carbonites as a representative fragment from each sack effervesced copiously on treatment with hydrochloric acid.

Study under the microscope of thin section of a representativa sample from e ach sack showed that the material contained just over 50% of fine, densely-packed grains of siderite; the presence and dominance of this mineral was confirmed by x-ray powder diffraction methods. The associated minerals are dolomite (approximately 20%) somewhat ferrous; lesser quantities of calcite; and crypto-crystalline apatite (loosely called collophane) often in the form of oolites layered with shells of secondary hydrous iron oxide, plus small amounts of quartz and an unidentified ferromagnesian mineral. No other phosphate minerals could be recognized under the microscope, but it is too early in this investigation to ruleout their presence. The collophane seems to contain sulphur as well as flourine.

Photomicrographs

(or camera lucida drwgs).

Plate —

Fig. — Photomicrograph of Highwood River phosphorous siderite ore —

(Note similarity to siderite mudstone, Cwm Afon. Glam. (Coal Measures), Fig 38, Plate VIII, Hallimond, 1925)

Fig. — Photomicrograph of Pocaterra Cr oolitic iron ore etc

The results of the chemical analyses done to date are given below: (Compare with analyses of English siderite ironstones, Kalliwand 1923, p. 33, [illegible])

Sample No.	61	62	63
Total iron as Fe_2O_3	35.85%	36.60%	34.88%
SiO_2	11.10%	11.44% (?)	14.04% (?)
P_2O_5	2.80%	2.74%	2.71%
CaO	13.09%	12.82%	13.75%
MgO	4.30%	4.37%	3.87%
Loss on Ignition	25.67%	26.15%	25.50%

~~The silica analyses have not been carried out yet on account of the special furnaces so required being presently tied up on other projects.~~ The determinations of carbon, sulphur, and fluorine are to be carried out shortly to help in defining any other phosphates that might be present.

The age of the formation whence came the samples cannot be determined because 1) the locations where they were cut are not known to us; 2) no fossils other than "bone" are present; and 3) there is still some uncertainty re the relative ages of the rocks mapped as Lower Cretaseous (Kootenay or Blairmore), Jurassic, or Triassic. Some of the ferruginous sandstones and carbonates mapped as being in each of these periods might actually belong to the same formation, whichever it might be in the lower Mesozoic. The samples might have come from the thick ferruginous carbonates of Spray River (Triassic) age mapped by Allan and Carr of this Council, 1946, which extend through the central axis of the Permit- areas No. 15 for its entire length of nearly 12 miles. This formation ________ 2 dark brown like ______ fragments in the three samples and when ______ have the same dark bluish-grey cast. It is probably well exposed on both the steep north and south sides of the Highwood Gap.

OTHER INDICATIONS OF IRON IN HIGHWOOD AREA.

(a) Sphaerosiderite (see pp. 68–69, Hallimond, 1925).

Finely ooolitic siderite was found by Carr (1946) on Highwood river, and one and one-half mile above the mouth of McPhail creek and five miles west of Iron Prospecting permit-area No. 15. It occurs in a lenticular bed in the Blairmore formation 175 feet below the top and is fairly heavy. The oolites have a radial structure and resemble the sphaerosiderites described in Great

Britain (Spencer, 1925) they have two main sets of concentric bands. According to Carr, "The lower band consists of very finely crystalline siderite and makes up from one-half to two-thirds of the diameter of the oolite. The outer zone is much more crystalline, with the individual crystals distinguishable under the microscope. The contact of the two zone is quite regular and is marked by a very narrow brown line". There is another brown band, irregular but generally circular in the inner zone about three-quarters of the radius from its centre. Otherwise the inner zone is usually light grey in colour, unless stained by iron oxide. The average diameter of the oolites as far as could be ascertained in their ____ is about 0.8 mm. Adjacent oolites frequently interfere with each other during their development.

A few small orgular grains of quartz are present in the oolites. Partially oxidized pyrite cubes were always seen within the inner zone and very seldom in the outer zone. They are either concentrated near the centre of the oolite or distributed near the brown band or scattered haphazardly through the inner core.

Carr noted that the groundmass is very fine-grained and resenbles devitfrified glass, Quartz grains similar to those in the oolites are present. "Finely divided carlnate is quite abundant. Minute green rod-shaped crystals occur in the groundmass." It seem to this writer that these green rods would be apatite.

(b) IRON AT POCATERRA CREEK

Carr (1946) stated that siderite is apparently present in the lower part of the Kootenay formations in the map-area as very dark brown, orange-yellow weathering bands. No specific areas of this deposition seems to have been mentioned by him in his thesis. However, in his collection os specimens in the Council museum is a specimen of an oolitic iron sandstone in contact with a piece of coal labeled as "Kootenay coal seam north of Pocaterra Creek". Judging by the location of the Kootnay formation on Allan and Carr's map of the Elbow area and from the designations of coal occurrences there this occurrence seems to be near the base of the western slop of Elpoca Mountain. A thin section of Carr's "oolitic iron" specimen is being prepared.

The writer while driving through this area from Kananishis en route to Coleman last year noted in passing a dark-brown weathering formation which seemed from a distance to be carbonates, but they would well be shales or fine-grained sandstones. along the west flank of the Misty Range between the west slope of Elpocs Mountain and Highwood. To the writer this formation seemed to rest directly against the Paleozoic carbonates of the Misty range and to be less than half a mile from the road along Pocatera creek. He had the impression that the thick dark brown formation was the Spray River formation of Triassic age(beginning of Mesozoic).

c) Siderite in Wapiabi formation

Another specimen from Carr's 1946 collection in the Council museum was marked siderite, Wapiabi formation.which is in the Upper Cretaceous time scale. The writer could find no mention of this occurrence in either Carr's thesis or the report by Allan and Carr on the Highwood-Elbow area. This specimen is hard and shaly, and shows no brown colors at all. It might be an unweathered part of an ironstone nodule, which is very common in the Wapiabi formation. A thin section is being prepared from this specimen. The Wapiabi formation occurs only in the southwestern portion of the map-area, west of Highwood river.

d)m Sheep River iron occurrences

The Sheep River iron occurrences are just off the northeast corner of the map area and will be described in the Ferruginous Shales section as an example of paint shales. They were fonnd by Allan (1920 and 1921) to be non-commercial

Age of Highwood Iron Occurrences.

Since he started the present study of Highwood iron occurrences, the possibility has occurred to him that some of the formations mapped as Blairmore, Kootenay, Fernie and Spray River might have been confused with one another. Even so, recent workers as Allan and Carr stated (1947) that whether the age of the Kootenay is Lower Cretaceous has "long been in doubt"; The Blairmore formation in the Highwood-Elbow area is correlated with the Blairmore formation in the foothills and the Crowsnest Pass largely on the basis of lithology (instead of largely on fossil evidence), while the poorly preserved, fre sh-water fauna in the limestone horizon corroborates the lithologic evidence; in the Fernie beds, the lowest fauna found "are new, and hence cannot yet be used for correlation, but the fauna is probably Lower Fernie and the upper bed of that formation which also contains may safely be assumed to be Upper Jurassic in age" and "possibly (correlates) with beds which have heretofore been mapped as basal Kootenay in other parts of the foothills of southwestern Alberta"; and "the age of the basal clastics and phosphatic limestones (mapped as Spray River) are in doubt .... the inclusion of the clastic and phosphatic beds in the Spray River formation in the Highwood-Elbow area is based on the physical evidence .... the Spray River formation is only sparsely fossiliferous and the fossils are rarely well-preserved" but Allan and Carr found also that "on the basis of fossils .... the brown weathering carbonates and strata to the base of the (Spray River) formation are correlated with the Sulphur Mountain member of the Spray River formation."

Brief notes will be given below on pertinent parts of the lower Mesozoic formations beginning with the oldest one as described by different workers, where iron deposits might be present.

(a) Spray River formation of Triassic Age

In the region to the south from the International boundary to the Crowsnest Pass area the lower part of the Spray River formation is usually black shale while the upper part consists of either siliceous shale on the west (inside British Columbia) calcareous shale (Telfer, 1933). But over most of Highwood-Elbow area the formation which is 360 feet at one point on the west flank of Highwood Range "consists of brown to reddish-brown weathering, dark grey, fine-grained, silty and sandy carbonate rocks, with fissile shales towards the base, and relatively coarse clastic beds at the base."

(Allan and Car, op. cit.). At the head of Picklejar creek were the formation is 360 feet thick, the brown-weathering silty carbonates band in beds one-half to four feet thick, is 180 feet thick, but they thicken on the west to possibly 700 feet. Gypsum is present and sometimes abundant in some of these beds besides a little quarts. In the Mount Head area adjoining on the east the ~~weathering~~ Spray River formation is similarly dark-brown weathering sandy carbonates for the most part (Douglas, 1950).

In the Berland River area and Pierre-Greys Lakes area almost 50 miles north of Jasper village in the front range of the Rockies, the Spray River formation consists mostly of about 1000 feet thickness of "a succession of hard, grey, very thin bedded, slabby, reddish-brown weathering siltstones and sandstones, which become calcareous toward the top." (Irish, 1949;) These strata occupy large areas of the mountain blocks in the range. However, the Whitehorse limestone member, also of Triassic age, on top of the formation weathers not brown but a cream colour.

The Spray River formation varies in thickness as follows: from 300 feet at the International boundary through 1700 feet near Fernie, B.C.; possibly as much as 800 feet thick in the Highwood-Elbow area and 900 feet in the adjoining Mount Head area; from 1500 to 3000 feet at Banff; 500 to 2500 feet at Jasper; to 1000 feet at Berland river.

The Berland River region is accessible by a good road from Entrance on the C.N.R.

b) Fernie Formation of Jurassic Age

The only ferruginous features in the Fernie formation seen in the Highwood-Elbow and Mount Head areas are, starting from the bottom, thick beds of black fissile shale with orange-weathering limestone concretions in its upper hundred feet ; grey sandy shales with ironstone nodules; and, on the top, about 90 feet of light brown weathering, brown-grey cross-bedded sandstone with lenses of hard, dark grey, yellow-weathering sandstone. The Fernie formation in these two areas may be as much as 1,000 feet thick; it is rarely well-exposed and is usually severely crushed (Allan and Carr, 1947; Douglas, 1950). In the Crowsnest Fernie, and Banff areas the Fernie formation is essentially a series of soft black shales containing in its base a phosphate bed (Telfer, 1933). In the Foothills belt to Mountain Park the Fernie included (upper) black shales and (lower) thick cherty sandstones or siliceous shales.

In the Nordegg area, the phosphate in the Fernie shale about 150 to 250 feet above the base, is high in iron. Weathered specimens show, according to Telfer, beautiful iridescent colourings on the surface due to a thin film of iron oxide.

The Fernie is generally poorly exposed in the Front range of the Rockies north of Jasper. No highly ferruginous features were noted in either in the Fernie black shales in the Berland River area, except for numerous concretionary ironstone bands, or in the overlying Nikanassin sandstones with shale, which formation had been regarded as Upper Fernie but is now called Lower Cretaceous (Kootenay-equivalent) (Irish, 1948).

c) Kootenay Formation of Lower Cretaceous Age

In the Highwood-Elbow area the Kootenay formation consists of a series of interbedded shales, siltstones, and sandstones with minor amounts of coal, ironstone, conglomerate, and cannel. They are up to 2400 feet in total thickness and are generally brown to black, due to iron oxides and carbonaceous matter.

Throughout the area the lower part of the Kootenay formation consists of soft shales and "hard, dense, yellow-weathering sideritic siltstone, in massive beds up to two feet thick, are especially characteristic. The shales vary from blacky to fairly fissile, and from brownish grey to black. The more carbonaceous shales are usually the more fissile". ~~(Carr (Allan~~ (Allan and Carr, 1947)

d) Blairmore Formation of Lower Cretaceous Age

No reference can be found in the detailed descriptions of the Blairmore formation on the area by Allan and Carr or by Douglas to the presence of oolitic siderite (sphaerosiderite) figured and described by Carr in his 1946 thesis as covering from a thin nodular bed at Highwood river, near McPhail creekmouth at a point 175 feet below the top of the formation. Nor could any mention of any ferruginous features be found in their descriptions of the Blairmore that might point to the occurrence of commercial iron.

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