CANADA
DEPARTMENT OF MINES
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CRIPPLE CREEK
ALBERTA

(MAP AND DESCRIPTIVE NOTES)

BY

O. A. ERDMAN

OTTAWA
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Illustration

Stratigraphy

Cambrian. The oldest exposed rocks in the map-area (1) are of Upper Cambrian age. Several hundred feet of these strata are represented on the northeast side of the First Range, north of Ram River, and a few hundred feet appear on the northeast side of the First Range, near the south edge of the map-area. The contact between the Cambrian and the overlying Devonian rocks was placed at a lithologic break about 300 feet above the top of a trilobite and bryozoa zone, where yellow-buff weathering, dense, bedded dolomite is in contact with overlying, massive, brown, saccharoidal dolomite. The fossil-bearing zone is about 250 feet thick, and is underlain by ribboned, yellow-buff dolomite, similar to that above the fossiliferous beds. The trilobite-bearing rocks are dark massive limestones, glauconitic near the base, and oolitic near the top. A few feet of limestone-pebble conglomerate is present near the oolitic limestone.

Devonian. The Devonian rocks (2) comprise 2,250 feet of strata, and consist mainly of massive, brown, porous, saccharoidal dolomite and calcareous dolomite, interbedded with grey, coarsely crystalline dolomite. A stromatoporoid and gastropod zone occurs near the base, and brachiopods were found at intervals throughout the succession. At the base of the Devonian strata is 650 feet of massive, saccharoidal dolomite and calcareous dolomite, overlain by 750 feet of chiefly porous, coarsely crystalline dolomite, with two interbedded bands of dark brown, fossiliferous, saccharoidal dolomite. Above this is a 650-foot section of mainly brown, saccharoidal dolomite, interbedded near the base with thin beds of yellow-green sandstone, and, apparently, correlative with the saccharoidal dolomite of Alexo map-area to the north. The saccharoidal rocks grade upward into 200 feet of thin-bedded and massive limestone, very fossiliferous near the top, and including the *Spirifer whitneyi* fauna of Alexo map-area. Immediately overlying this fossil zone is 15 to 23 feet of black, fissile, non-calcareous shale, with about 4 feet of black, cherty material at the base. This horizon marker is persistent, and is in sharp contact with both the fossiliferous Devonian beds below, and with brown weathering, platy Banff shales above. No diagnostic fossils were found within the shale, but fossils of Upper Devonian age were found in beds in contact with the black chert. The shale unit is believed to represent the Exshaw formation.

Banff Formation. The Banff formation (3) is 650 to 700 feet thick. The basal 130 feet is platy, brown weathering, shaly limestone, and is overlain by about 270 feet of bedded, dark limestones, containing nodules and bands of darker chert. Above this, in turn, lies about 275 feet of massive and bedded, grey, fossiliferous limestone, becoming more platy and shaly toward the top. The contact with the Rundle is not everywhere sharp.

Rundle Formation. The thickness of the Rundle formation (4) ranges from about 900 feet, on the northeast side of the First Range, to 1,035 feet, in the centre of this range in the southern part of the map-area. The formation consists of massive and bedded, grey and brown dolomite and limestone, porous in the central part of the formation, and containing chert near the top. Its contact with the overlying Spray River formation is at the base of a thin, flat-pebble conglomerate. The Rundle is poorly fossiliferous.

Spray River Formation. The Spray River formation (5) varies in thickness from about 575 feet, on the northeast side of the First Range, to about 1,200 feet, southwest of the range. It is composed

essentially of thin-bedded, platy, chocolate-brown weathering sandstone, with a few feet of calcareous beds about midway of the section. Linguloid and pectenoid fossils are present in the lower half of the formation, northeast of the First Range.

Fernie Group (Jurassic) and Nikanassin Formation (Lower Cretaceous). The Fernie group could not be subdivided in the field from the overlying Nikanassin formation. No complete sections of the combined formations (6) are available, because of repetition by folding, but their aggregate thickness southwest of the First Range is believed to be at least 1,500 feet. The basal 200 or 300 feet are black shales lying in sharp contact with the Spray River formation, and containing ammonites of late Lower Jurassic age. The rocks overlying the black shales are mainly carbonaceous shales and dark grey to black sandstones, grading upward into buff weathering, bedded and crossbedded sandstones. Coal seams as much as 3 feet thick occur in the Nikanassin beds.

Cadomin Formation. The Cadomin formation (7) is exposed in only a few places in the map-area; a total thickness of 125 feet was measured in lower Lynx Creek. The formation consists largely of conglomerate with about 40 feet of sandstone near the upper part, and a few feet of carbonaceous, sandy shale near the base. The conglomerate is composed of pebbles of quartzite and chert, as much as 3 inches in diameter, embedded in a quartzitic matrix.

Luscar and Mountain Park Formations. The names employed for these formations (8) have been retained in the same sense as in the map-areas to the north a.d northwest, but no lithological subdivision was practicable in the field. An estimated aggregate thickness of about 1,450 feet was obtained on lower Lynx Creek. The rocks are mainly sandstones and shales. They are carbonaceous in the lower part (Luscar formation) and contain coal seams as much as 4 feet thick; the upper part (Mountain Park formation) consists of greenish sandstones and shales in which little or no coal was observed. Conglomerate occurs in minor quantity, and the contact with the overlying Blackstone formation is at the base of a bed of chert pebble- or cobble-conglomerate.

Blackstone Formation. This formation (9) is calculated to be about 1,100 feet thick, but owing to the extent of its deformation no precise figure could be obtained. The rocks are predominantly dark, fissile, marine shale, weathering rusty in places. Limy bands and concretions, a thin, cream weathering, bentonitic bed, and fish remains occur within the lower half of the formation. Inoceramus labiatus is an abundant and diagnostic fossil within the central few hundred feet.

Bighorn Formation. The sandstones of the Bighorn formation (10) form excellent ridges in the area northeast of the First Range. The thickness of the Bighorn varies from 300 feet, on the east side of the map-area, to 375 feet in the northwest part. The formation consists of a lower sandstone member about 100 feet thick, a middle sandy shale member 150 to 200 feet in thickness, and an upper sandstone member 40 to 75 feet thick. The lower member is grey weathering, rubbly, siliceous sandstone, locally conglomeratic, and contains the type fossil Inoceramus capulus. The upper sandstone member is platy, and may be crossbedded and ripple-marked. Cardium pauperculum and, in most places, Oxytoma nebrascana, are present in the upper part of this member.

Wapiabi Formation. The Wapiabi formation (11) is about 1,900 feet thick, and consists of marine shales, more sandy and less fissile than those of the Blackstone formation. The lower contact, with the Bighorn formation, is sharp, whereas the upper contact, with the Brazeau formation, is transitional. Scaphites ventricosus is the most

abundant fossil in the lower part of the formation, but Inoceramus umbonatus and Baculites cf. codyensis are common. The upper 200 feet or more of the Wapiabi are gradational into the Brazeau formation, and the contact with the latter is placed at the base of a persistent but thin conglomerate. Fossils near the upper contact include a variety of Tancredia americana, and species of Tellina, Dosiniopsis, Cardium, Baculites, Ostrea, Lophidiaster?, and Anomia, identified by F.H. McLearn of the Geological Survey.

Brazeau Formation. The Brazeau formation (12) consists of sediments of continental origin overlying the marine Wapiabi rocks. About 3,900 feet of Brazeau beds are present in a large basin traversed by Cripple Creek. These consist of massive, green weathering, maroon, coarse-grained sandstones, with interbedded green and brown, rubbly shales. Volcanic ash and carbonaceous beds are present. The basal conglomerate is from 2 to 5 feet thick, and contains well-rounded, highly polished pebbles, generally less than one-half inch in diameter. Conglomerate zones as much as 25 feet thick are present within the lower 800 feet of the formation. On Cripple Creek, a 1-foot bed of hard, pale green tuff is exposed about 1,500 feet above the base of the formation on the northeast limb of the structure. Fossil plants were observed about 2,600 feet and 3,200 feet above the base, and are associated with fossil amber blebs, thin coal stringers,and soft, yellow, bentonitic beds. A coarse, massive sandstone containing concretionary "cannon balls" marks the upper limit of the exposed Brazeau formation in the map-area. The fossil plants, as determined by W.A. Bell of the Geological Survey, indicate an age more probably synchronous with some part of the Edmonton than with pre-Bearpaw, Belly River time.

Structure

The rocks of the map-area have been strongly deformed by folding and faulting. The folds are generally asymmetrical, with steeper northeast-dipping limbs, and the faults are mainly southwest-dipping thrusts. Rocks of Fernie to and including the Blackstone formation are relatively closely folded and much contorted in comparison with underlying and overlying strata. The Palaeozoic rocks are mainly monoclinal, and are repeated by faulting, but compressed folds do occur in them adjacent to the thrust faults. Folding in Bighorn beds is progressively more intense from the northeast corner of the map-area toward the southwest. The culmination of a faulted anticlinorium north of Lynx Creek exposes Nikanassin rocks at the core. A broad syncline in the northwest part of the map-area, north of Ram River, exposes Brazeau strata, but the syncline loses its identity toward the southeast, where closely folded Wapiabi beds make their appearance.

Much of the response of the rocks to stresses has been accomplished by faulting, and it is believed that many more minor faults are present than have been mapped. The Bighorn beds in the northeastern part of the map-area have been repeated by numerous small thrust faults, which were possible to map because of the thin and distinctive formation involved. A large thrust fault transects the map-area from the northwest corner, and has a maximum stratigraphic throw of about 5,000 feet in the east-central part of the area, where Luscar or Mountain Park strata on the southwest are in contact with those of the Brazeau formation on the northeast. A major fault crosses Ram River about 2 miles east of the gap of the First Range. The stratigraphic throw at Ram River is nearly 6,000 feet, but decreases both to the northwest and southeast. The fault plane is apparently folded, as in Ram River Valley a window or lower Brazeau and upper Wapiabi rocks, exposed by erosion through the fault plane, is faulted against Nikanassin beds on the northeast and those of the Spray River formation on the southwest.

Another major thrust fault lies on the northeast side of the First Range, and has thrust rocks as old as Cambrian against those as young as late Lower Cretaceous. The stratigraphic throw along this fault both in the southeast and northwest parts of the map-area is between 5,500 and 6,000 feet, but is as little as 1,500 feet south of the gap of Ram River.

A prominent fault lies within the First Range and has repeated part of the Devonian, all of the Banff and Rundle, and part of the Spray River formations in the south part of the map-area. The stratigraphic throw varies from about 1,000 feet in the northwest to nearly 3,000 feet at the south border of the map-area. The repetition of the resistant, massive, Palaeozoic rocks by this fault has resulted in a much greater width to the range than would have been the case had the range been faulted only on its northeast side, as is typical of the outlier Palaeozoic ranges to the northeast.

Economic Geology

Several hundred feet of Devonian dolomites and limestones exposed in the First Range exhibit good porosity. In places calcite crystals line vugs or large pores. A light grey, chalky weathering, porous section of dolomite was observed at 350 to 550 feet below the top of the Rundle formation at the south border of the map-area. In places the pores are lined with a yellow marl, but none of the dry, black hydrocarbon, present in the upper part of the Rundle formation in Alexo and Saunders map-areas, was seen. A white, porous, cherty, coquina-like dolomite about 20 feet thick occurs in the Spray River formation on the northeast part of the First Range.

The map-area is not favourable for oil structures because of the close folding and the great amount of faulting. An anticline about 20 miles long extends for about 4 miles across the northeastern part of the map-area, terminating in Alexo map-area to the north and in Fall Creek map-area to the east. Moderately low dips prevail on both limbs of the structure, and no major faults are known to the northeast. However, the width of the anticline within the map-area is less than 2 miles. Bighorn and upper Blackstone rocks are exposed along the axis of the anticline. No closure is indicated.

Coal seams occur in both Nikanassin and Luscar formations, and small stringers were observed in the Brazeau formation. The seams are as much as 4 feet thick in the Luscar, and 3 feet in the Nikanassin. A sample of Luscar coal, collected on a tributary of lower Cripple Creek, analysed by the Bureau of Mines, Ottawa, yielded 14,000 B.T.U. per pound, gross, as received. A sample of Nikanassin coal, collected near the west edge of the map-area, yielded 12,150 B.T.U. under similar conditions. The estimated present reserve in the map-area, based on coal seams 3 feet or more in thickness, within 2,000 feet of the surface, and dipping less than 50 degrees, is about 6,000,000 tons.