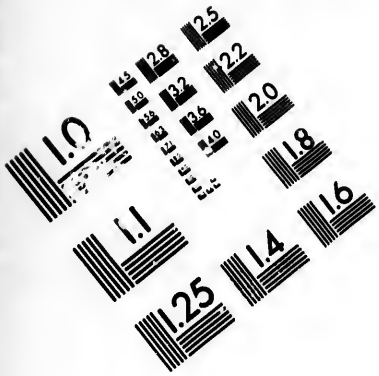

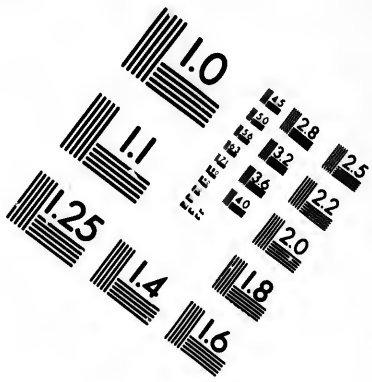

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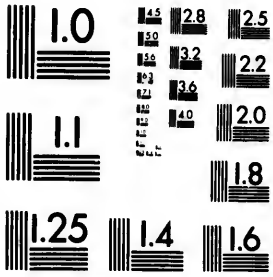

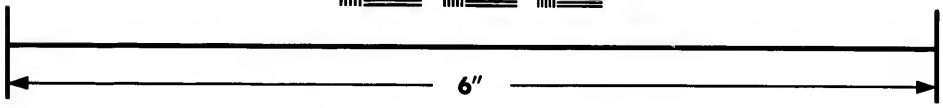

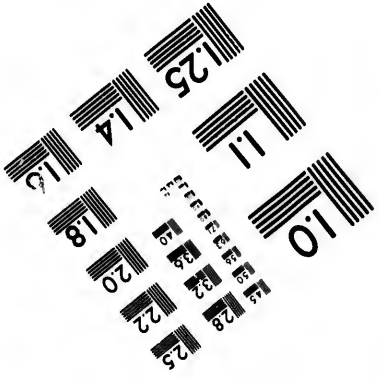

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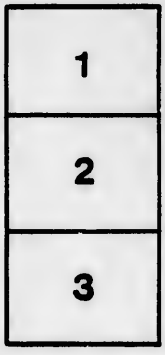

[From the American Journal of Science, Vol. XXXVIII, August, 1889.]

ON THE EARLIER CRETACEOUS ROCKS OF THE NORTHWESTERN PORTION OF THE DOMINION OF CANADA.

By George M. Dawson,
Assistant Director Geological Survey of Canada.

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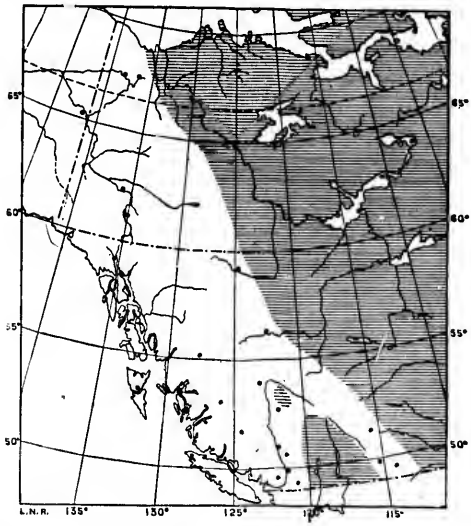
Art. XIV.—*On the Earlier Cretaceous Rocks of the North-western portion of the Dominion of Canada;* by George M. Dawson, Assistant Director Geological Survey of Canada.

In the Report of Progress of the Geological Survey of Canada for 1872–73, the late Mr. James Richardson first described an important series of rocks occurring in the Queen Charlotte Islands, which Mr. E. Billings, on paleontological grounds, in an Appendix to the same report, characterized as probably lowest Cretaceous or Upper Jurassic. A further and

more detailed examination of these rocks, was subsequently made by the writer, of which the results were given in the Report of Progress for 1878–79; and in 1884, Mr. J. F. Whiteaves published a full account of the fossils collected, and reached the conclusion that the series (which is a very thick one) extended from about the horizon of the Gault upward to approximately that of the Lower Chalk.* The name "Queen Charlotte Islands Group" was proposed for the most fossiliferous member of the section (C), and it was further found that no distinct paleontological line could be drawn between this and two underlying members of the section, D and E.† These three lowest subdivisions of the Cretaceous section of the Queen Charlotte Islands, are here therefore referred to collectively, for purposes of description, as the Queen Charlotte Islands formation.



In reporting upon that portion of the Rocky Mountain range proper, which is included between the parallels of latitude of 49° and 51° 30′, the writer described the occurrence there of a very massive earlier Cretaceous formation, holding coals, and characterized by a peculiar flora,‡ which was examined and described by Sir J. Wm. Dawson. These Cretaceous rocks it was proposed to name the Kootanie series or formation.§

* Mesozoic Fossils, vol. i, part 3. † Trans. Royal Soc. Can., vol. i, sec. 4, p. 85.
‡ Annual Report, Geol. Surv. Can., 1885.
§ By Sir J. Wm. Dawson at the annual meeting of the Royal Soc. Can., May, 1885. Science, vol. v, p. 531. Trans. Royal Soc. Can., vol. iii.

The purpose of the present note is to call attention to certain facts recently developed respecting the equivalency of the Queen Charlotte Islands and Kootanie formations and to the importance of the earlier Cretaceous rocks of which they are representatives, over great areas of the western and extreme northwestern portion of the continent. These facts possess particular interest at the present time from their analogy to those lately developed by Mr. R. T. Hill respecting a similar earlier Cretaceous formation in the southwestern region of the United States.*

The region in which the Kootanie was first recognized as a distinct lower portion of the Cretaceous, embracing that portion of the Rocky Mountains above defined, with the adjacent foot-hills, has a length of about 140 miles with a width of forty miles or more. The Kootanie formation here constitutes a great part of the area of the several Cretaceous troughs or infolds and comes to the surface as well in several or many places in the foot-hills to the east. The Cretaceous rocks of this part of the mountains are known to extend upward from the Kootanie so far as to include the base of the Laramie. The thickness of the upper members of the series has not been ascertained, but that of the Benton (possibly including part of the Niobrara) is about 1400 feet, while the maximum known thickness of the lower part of the series, referable to the Dakota and Kootanie, is about 11,950 feet. Of this thickness, over 7000 feet is shown by its fossils to belong to the Kootanie, while the line between this formation and the Dakota remains to be drawn in a series of beds above, from which no fully distinctive fossils have been collected.†

In the report for 1885, above cited, it is stated that one of the characteristic fossil plants of the Kootanie had previously been found in northern British Columbia, at a distance of 580 miles to the northwestward of the part of the Rocky Mountains there under description. The flora of the Kootanie was characterized as Lowest Cretaceous and placed on approximately the same horizon with that of the Queen Charlotte Islands formation (more particularly of subdivision C., of that section) by Sir J. Wm. Dawson.‡

Up to this time no recognizable fossils other than plants had been obtained from the Kootanie, but marine mollusks have since been discovered by Mr. R. G. McConnell in beds which are (at least locally) at the very base of the formation and which underlie the principal plant-bearing beds by at least several hundred feet. These are referred to in Mr. McCon-

* See this Journal, vol. xxxiii, p. 291; vol. xxxiv, p. 287; vol. xxxvii, p. 282.

† Though fossil plants apparently referable to the Dakota have been found in the higher beds, in two places.

‡ Trans. Royal Soc. Can., vol. iii, sec. 4, p. 20.

nell's report,* and the identity stated, on the authority of Mr. Whiteaves, of three forms with species of the Queen Charlotte Islands formation. Mr. Whiteaves' subsequent detailed study of these fossils fully confirms and further carries out the correspondence between the two faunas, as explained by him in a report now in process of publication.† Thus the very important fact is established of the existence of an identical earlier Cretaceous horizon on the West Coast, and in, and even to the east of, the eastern range of the Cordillera System.

Turning now to the portion of the Cordillera region which intervenes between the above-mentioned widely separated localities, including that part of British Columbia to the south of the 56th parallel of latitude, we find there further evidence of the same great earlier Cretaceous formation.—The Iltasyouco beds (probably 10,000 feet in thickness) holding a fauna which was originally regarded as Jurassic, are now definitely referred to the Queen Charlotte Islands formation.‡ Further, the association of *Aucella Mosquensis*, var. *concentrica*, with the fossils of the last-mentioned formation in its typical locality, with the recent discovery by the writer of the same form, in great abundance, in beds of identical age in the northern part of Vancouver Island, leads Mr. Whiteaves to the belief that this species may be regarded as a characteristic one of the same general horizon.§ This view of the taxonomic value of the *Aucella* involves the conclusion that certain rocks in which it is the only abundant fossil, and for which provisional local names have been used in different parts of British Columbia, should likewise be regarded as representing inland extensions of the Queen Charlotte Islands formation, a conclusion in complete harmony with the stratigraphical and lithological evidence. The rocks referred to include the Tatlayoco Lake beds (7000 feet), Jackass Mountain beds (5000) and Skagit River beds (4400 or more) to which may be added (though as yet on little evidence other than lithological) the Nechacco series and the Cretaceous rocks known to hold coal on the upper part of the Skeena River.‖ To the south, in the vicinity of the West Coast, this earlier Cretaceous formation is doubtless represented by certain members at least of the Shasta group of California and Oregon.

In connection with the Yukon Expedition, in 1887 and 1888, important new observations bearing on the extent of the earlier

* Annual Report, Geol. Surv. Can., 1886, p. 17 D.

† Forming, part 2, Contributions to Can. Paleontology.

‡ Mesozoic Fossils, vol. i, p. 258.

§ A conclusion explained at length in the forthcoming publication by Mr. Whiteaves already referred to.

‖ These rocks may be found described in the reports of the Geological Survey of Canada as follows: 1875–76, p. 253, 1876–77, p. 90, 1877–78, p. 105 B., 1879–80, p. 102 B.

Cretaceous rocks have been made. At Rink Rapid, on the Lewes River (lat. 62° 20′ long. 136° 10′) and at Lake Labarge, further up on the same river, the writer found fossiliferous Cretaceous rocks which Mr. Whiteaves regards as probably also the same in age as those of the Queen Charlotte Islands formation.* Mr. McConnell has, further, discovered fossils belonging to the same fauna on Rat River (Rocky Mountains, lat. 67° 10′), on Porcupine River (lat. 67° 28′ long. 137° 47′) and on the main Pelly or Yukon River (lat. 65° 15′, long. 141° 40′). The characteristic *Aucella* above referred to is, however, the only species represented in two of these localities.

The various widely scattered observations above enumerated, now enable us to state, that a great earlier Cretaceous formation, beneath the horizon of the Dakota, is more or less continuously developed over a vast tract of country, the eastern edge of which lies to the east of the present line of the Rocky Mountains from the 49th parallel to the Arctic Ocean, and which is represented to the west as far as the vicinity of the mouth of Fraser River, the Queen Charlotte Islands, and in the Yukon Valley beyond the 141st meridian, in the interior of Alaska. Its existence may also be traced on the Alaskan Coast to the peninsula of Aliaska, in longitude 160° 31′ or farther.† It is impossible at present to define precisely the eastern margin of this formation, as in the area of the Great Plains sections are very seldom cut down to the base of the Cretaceous. From what is known, however, it appears probable that this line lies not far to the east of that of the Rocky Mountains, leading to the inference that some causal connection of an orogenic kind may exist between the eastern limit of these very massive Cretaceous accumulations and the position of this eastern member of the Cordillera. There is, however, in the southern interior of British Columbia, an extensive tract which includes the Selkirks and associated ranges, in which no Cretaceous rocks have been met with, and which it would appear, on this and other grounds, has been a land area throughout the Cretaceous period and a mountain system antedating those of the Rocky Mountains proper, the Coast Ranges of British Columbia and the Cascades of Oregon and Washington, in the flexures of which ranges Cretaceous rocks are involved. It is further probable that other yet undefined insular areas existed in the Cordillera region to the north and west, but the evidence now available shows, that to the north of the 54th parallel, in both the Triassic ("Alpine Trias") and Cretaceous periods, the Pacific spread eastward in a more or less

* Annual Report, Geol. Surv. Can., 1887, pp. 146 B., 159 B.

† By collections made by Mr. W. H. Dall and others as detailed by Dr. C. A. White in Bulletin U. S. Geol. Survey, No. 4, 1884.

connected manner completely across the present position of the Cordillera belt.*

In the Queen Charlotte Islands, massive conglomerates immediately overlie that part of the section which has been referred to as the Queen Charlotte Islands formation. These, it has been suggested by Mr. Whiteaves, represent the horizon of the Dakota, and this reference is there strengthened by the fact that the conglomerates (2000 feet in thickness) are in turn overlain by shales holding *Inoceramus problematicus*. This occurrence of conglomerates appears, however, to have more than a local significance, for similar conglomerates are now known to occur in the same (overlying) position relatively to the earlier Cretaceous fauna in the northern part of Vancouver's Island, on the Lewes River, in the upper part or at the summit of the Tatlayoco, Jackass Mountain and Skagit series previously referred to, and are again found to overlie the Kootanie formation in the Rocky Mountains, forming there a portion of the thickness of beds between the Kootanie and Benton and consequently in all probability referable to the Dakota.

The constant or very frequent appearance of such massive conglomerates at or about the Dakota horizon, may fairly be taken to represent the initiation of an important and general subsidence, which seems to correspond as closely as possible with that referred to by Mr. Hill as the second great Cretaceous depression. It must be added, however, that in the northwestern portion of the continent, this second subsidence was not so profound as that described in the Arkansas–Texas region, and was interrupted, in the area of the plains, by at least one well-marked brackish-water and land epoch, represented by the Belly River and Dunvegan series of rocks.

The earlier Cretaceous rocks, here more particularly referred to, and named in widely separated portions of their extent the Kootanie and Queen Charlotte Islands formations, are again clearly analogous to Mr. Hill's Comanche formation, with which they have the same upward limit, and like it extend downward far beneath the base of the Cretaceous of the Interior Continental Plateau. In comparing the earlier Cretaceous rocks of these two portions of the continent, however, we find that though a distinct unconformity exists between the summit of the Comanche and base of the Dakota of the southwestern region of the United States, no such physical break is yet known as between the Kootanie or Queen Charlotte Islands formations and the Dakota; while the very great thickness of these formations, so far as it goes, may be regarded as tending

* Cf. on Triassic, Trans. Royal Soc. Can., vol. i, sec. 4, p. 144. Annual Report Geol. Surv. Can., 1885, p. 161 B.

rather to favor a belief in continuous sedimentation. Further, that while the base of the Comanche is described as equivalent to the Purbeck and Wealden, or lowest beds of the European Cretaceous, Mr. Whiteaves finds no evidence in the mollusks of even the lowest beds of the Kootanie and Queen Charlotte Islands formations of a horizon below that represented by the Gault in Europe. This can scarcely be regarded as divergent from the previous definition of the age of the same formations by their contained fossil plants, as the lower Cretaceous flora may be expected, from European and Asiatic analogies, to extend upward to the top of the Neocomian, between which and the Cenomanian the Gault may be said to be a transitional formation. The question, however, of the precise systematic position of these representatives of the earlier Cretaceous of the northwestern province of the continent, is one apart from that of their interrelation and general correspondence, which alone it is at present intended to point out. Finally, it may be noted, that while these formations mark the occurrence of a first Cretaceous subsidence in the northwestern portion of the continent, this subsidence has there been neither so great nor so continuous as in the case of the Comanche, a fact shown by the generally coarse, clastic character of the rocks, the comparative absence of limestones and the occurrence of beds of coal.

In this note it has been possible merely to outline the more interesting general results so far arrived at with respect to that part of the Cretaceous which underlies the Dakota horizon in British Columbia and in the western portion of the Northwest Territory. For details, some of which have important bearings on the general question, reference must be made to the various publications which have been cited and to forthcoming reports of the Geological Survey of Canada in which the facts more recently obtained will appear at length. The subjoined table presents in a diagramatic form the relations of the various formations above referred to, together with that of some overlying portions of the Cretaceous, not here specially alluded to, but which occur in the same region.

Geological Survey of Canada, April 20, 1889.

EXPLANATION OF MAP, p. 121.

The principal known localities of occurrence of the Earlier Cretaceous rocks, are indicated by the black dots. Nearly all of these represent places from which characteristic fossils have been obtained.

The eastern extension of the Pacific Ocean in the earlier part of the Cretaceous period is approximately shown by that of the unshaded part of the map.

TABLE ILLUSTRATING THE RELATIONS OF THE EARLIER CRETACEOUS FORMATIONS OF BRITISH COLUMBIA AND OF ADJACENT PARTS OF THE NORTHWEST TERRITORY.

Queen Charlotte Islands.	Comox, Vancouver Island.	Mainland of British Columbia.	Yukon District. (North of 60th parallel.)	Rocky Mountains Proper. (Between 49° and 51° 30′.)	Southern Alberta.
	Upper conglomerates, 320′ Upper shales, 776′ Mid. conglomerates, 1,100′ Middle shales, 76′ Lower conglomerates, 900′ Lower shales, 1,000′ Productive coal meas., 739′		Laramie of Lewes R.	Laramie (base).	Laramie, 5,750′
A. Upper shales and sandstones, 1,500′	(*Local base of Cretaceous.*)		(Intermediate formations probably represented, but not recognized.)	Pierre (including Fox Hill) Belly River. Benton (possibly with part of Niobrara, 1,400′).	Pierre (incl. Fox Hill), 830′ Belly River, 910′ Lower dark shales, 800′
B. Coarse conglomerates, 2,000′		Tatlayoco beds (7,000′). Nechacco beds (6,000′), Skeena beds, Skagit beds (4,400′ or more), Jackass Mt. beds (5,000′). All sandstones and quartzites, with shales, and generally coarse conglomerates ab've. "Porphyrite" series of Iltasyouco 10,000′ (probably passing up into above) of Tatlayoco, and possibly of Nechacco and Skeena.	Conglomerates of Rink Rapid, etc.	Dakota, apparently represented in part by coarse conglomerates, and including on Crow Nest Pass, 2,200′, of volcanic ejectamenta.	Dakota (probably).
C. Lower shales and sandstones (with coal), 5,000′				Kootanie formation, 7,000′ or more. Sandstones, shales, etc., with coal.	(*Local base of Cretaceous.*)
D. Agglomerates, 3,500′			Fossiliferous shales and sandstones, on Rink Rapid, L. Labarge, etc.		
E. Lower sandstones, 1,000′					
(*Local base of Cretaceous.*)		(*Local base of Cretaceous.*)	(*Local base of Cretaceous.*)	(*Local base of Cretaceous.*)