NOTES ON THE CRETACEOUS OF THE BRITISH COLUMBIAN REGION. THE NANAIMO GROUP.

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Art. XXIII.—*Notes on the Cretaceous of the British Columbian Region.—The Nanaimo Group;* by George M. Dawson.

In Bulletin No. 51 of the United States Geological Survey, (1889) by Dr. C. A. White, on Invertebrate Fossils from the Pacific Coast, Part III is devoted to the discussion of lower Cretaceous fossils from the Vancouver Island region; and the name 'Vancouver group' is proposed for the formation from which these are derived. Dr. White writes:—"Although this formation is paleontologically equivalent, at least in large part, with the Chico portion of the Chico-Téjon series of California, as has been indicated by Meek, Gabb, Whiteaves and by Professor Whitney, I propose to use the name Vancouver group as a local name for those strata which occur in the Vancouver Island region; and still retain the name Chico group for the California strata, which the geologists of that State applied to them."* On meeting with Dr. White's proposal for the adoption of the term 'Vancouver group,' as above stated, I wrote

* Op. cit., p. 33.

to him pointing out that the name had, unfortunately, already been used by me in the publications of the Geological Survey of Canada, to designate the Triassic rocks of the same coast region,* and ventured to suggest that if a local name for the equivalent of the Chico group in the Vancouver Island region is considered requisite, it might be termed the *Nanaimo group*. No general name had, so far as I am aware, been given to the strata in question, previous writers (and more particularly Mr. Whiteaves, by whom a larger proportion of the fossils have been described) thinking it sufficient to refer to them as an extension of the Chico.

Dr. White promptly and cordially replied to my communication, approving of the proposed change of name, and the present note is written primarily at his suggestion in order to prevent possible confusion in the nomenclature.

To more clearly define the strata to which the name Nanaimo group may at present be applied, it is necessary to state that the whole of the large collections examined by Mr. Whiteaves (and doubtless also those of other writers) have been derived from the lower subdivisions of the local section, which, according to the late Mr. James Richardson, is as follows in the Comox and Nanaimo fields respectively:

Comox.	feet.	Nanaimo.	feet.
G. Upper conglomerates	320		
F. Upper shales -------	776		
E. Middle conglomerates	1,100	G. to C. sandstones Conglomerates and shales	3290
D. *Middle shales*-------	76		
C. *Lower conglomerates*	900		
B. *Lower shales*--------	1,000	B. *Shales* ------------	660
A. *Productive Coal-measures* ----------	739	A. *Productive Coal-measures* ----------	1360

As stated by Mr. Whiteaves, no characteristic fossils have yet been found in the three higher subdivisions of the Comox section (E., F. and G.) nor in subdivisions C. to G. inclusive of the Nanaimo section,† and while all the subdivisions are conformable, it is thus the lower parts of the sections alone, including about 2,020 feet at Nanaimo and 2,715 feet at Comox, which are known to correspond more or less perfectly with the Chico group. These are printed in italics in the above table. In the publication just alluded to, Mr. Whiteaves further states, that there was, at the time he wrote, no positive evidence to show whether the upper portions of these sections were Cretaceous or Tertiary, and this statement still holds good. It is therefore quite possible that some at least of the higher subdivisions may represent the Téjon group of Califor-

* See particularly Annual Report Geol. Survey, Can., 1886, p. 10 B.
† Mesozoic Fossils, vol. i, pp. 94, 185.

nia, or the recently proposed Puget group of Washington,* both of which Dr. White is inclined to regard as equivalent in a general way to the Laramie.†

While referring to the Puget group, it may be added that a considerable tract of low land about the mouth of the Fraser and extending northward to Burrard Inlet, is underlain by rocks which though as yet only partially examined, appear with little doubt to correspond to that group, with which they are geographically connected and so far as known lithologically identical. Mr. A. Bowman has ascertained that these strata are at least 3000 feet in thickness, and, like those of the typical area of the Puget group, they hold carbonaceous matter and more or less lignite-coal at many different horizons.

I may also take the opportunity to note, in this connection, that throughout the entire Cretaceous period as represented on the littoral of British Columbia, there is evidence of a transgressive extension of the area of sedimentation from north to south, the local base of the Cretaceous being found at successively higher stages in the system to the southward. Thus, of five stages into which the Cretaceous of the Queen Charlotte Islands is divided, the three highest only have been found resting on the pre-Cretaceous rocks of the northern part of Vancouver Island. In the Comox and Nanaimo fields, the local base of the Cretaceous corresponds approximately to the highest observed beds of the first-mentioned locality, and in northern Washington, the still higher Puget group occurs in very great mass and apparently almost to the exclusion of the Cretaceous proper, or marine Cretaceous as distinguished from the Laramie. Though further investigation may disclose small areas of older Cretaceous rocks, occupying the deeper hollows in the much-eroded surface of the pre-Cretaceous land, these can scarcely be such as to invalidate the general features as now understood and above outlined. Coupled with this gradual southward encroachment of the Cretaceous Sea, is no doubt the fact that the principal coal-bearing horizon, beginning at the north in the earlier Cretaceous (about the horizon of the Gault) is found at Comox and Nanaimo near the base of the Nanaimo group (representing the Chico) and in Puget Sound in the Puget group, which as already noted may, according to Prof. Newberry and Dr. White, be equivalent to the Laramie.

We have yet, however, much to learn respecting the physical history of the Cretaceous period in the British Columbian region; and in view of the above facts relating to the littoral of the Province, it remains in particular to explain the occur-

* This Jour., vol. xxxvi, 1888.

† Bulletin of the U. S. Geol. Survey, No. 51, pp. 12, 54.

rence of the earlier Cretaceous rocks which at no great distance inland run parallel to the basin occupied by the Nanaimo and Puget groups.* It appears possible that an elevation of a part of the Cretaceous sea-bed bounded to the westward nearly by the present line of the Coast Ranges of British Columbia, may have occurred after the deposition of the earlier strata. The tract of land thus produced, or added to that previouly in existence, may have served as the chief source of supply of the later sediments and more particularly of the massive estuarine beds of the Puget group, in accounting for which Dr. White finds some difficulty.† Such a supposition would also be in accord with the absence, so far as known, of any rocks referable to the Laramie throughout the entire region eastward to the Rocky Mountains proper, within the limits of British Columbia.

Geological Survey of Canada, Ottawa, Dec. 18, 1889.

* Cf. this Jour., vol. xxxviii, p. 121.

† Bulletin of the U. S. Geol. Survey, No. 51, p. 57.