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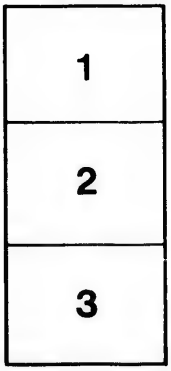

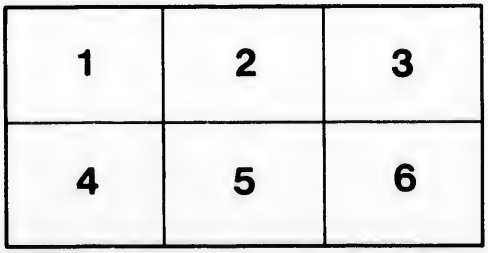

V.—*Note on the Triassic of the Rocky Mountains and British Columbia.*

By GEORGE M. DAWSON, D.S., F.G.S.

(Read May 25, 1883.)

The Triassic rocks of the West present themselves under two very dissimilar aspects, their eastern part consisting of red beds, chiefly sandstones, while on the Pacific slope the character of their material is much more varied; they include numerous fossils, and are evidently truly marine in origin. The most complete comparison of these two classes of deposits has been made by Clarence King in the 40th parallel region. The red beds are there found participating in the Rocky Mountain uplift, but have originally passed completely across the position of this range, and extend westward to the Wahsatch Mountains (longitude 112°) which here constituted the western shore of the sea in which they were deposited. The rocks are described by King as consisting generally of sandstones, the upper half being always of lighter colours than the lower, and intercalated more or less with beds of dolomite and gypsum. The lower part of the series is usually from brick to vermilion red, the upper part pale red and buff. The dolomitic and gypsum beds are local in character, but the latter sometimes reach forty feet in thickness of pure calcic sulphate.

In the Rocky Mountains, in this latitude, the Triassic is from 300 to 1000 feet in thickness but, on approaching the Wahsatch shore, thickens to 2000 or 2500 feet, and holds some conglomerates. Fossils are almost completely wanting.

In many other districts of the western States and Territories, the Triassic beds are developed with similar characters. As far east as the Black Hills of Dakota, they are described by Professor N. H. Winchell as maintaining a thickness of over 300 feet, and holding great quantities of white gypsum. They have been observed by Dr. Hayden in the mountains at the head waters of the Missouri, and in addition to the deposits of gypsum are in places impregnated with salt.

Returning to the 40th parallel region, and passing westward from the Wahsatch range, no Triassic beds are met with till longitude 117° 30′ is reached, at a distance of nearly 300 miles. The rocks of this period are there found to be represented by the Star Peak and Koissats groups of King, the former and upper subdivision consisting of fossiliferous limestones, with quartzites and slates, the latter of quartzites, argillites and porphyroids, the whole with an aggregate thickness of over 16,000 feet. Marine fossils are very abundant in some parts of the Star Peak subdivision, and are almost precisely similar in forms with those of the St. Cassian and Hallstadt beds of the Alps. The term Alpine Trias has consequently often been used in speaking of those rocks.

The red beds of the Rocky Mountain region clearly point to the conditions of deposition found in a shallow body of water, more or less completely shut off from the ocean or only in occasional and brief connection with it, while, for the most part, the sediments of the Nevada Triassic are, as unmistakably, such as might be produced under ordinary marine conditions in greater or less proximity to a coast line.

The distinction thus marked is clearly encountered much further south than the 40th parallel region, and it is with the purpose of tracing it to the north of the 49th parallel that the present note is presented.

Immediately to the north of the 49th degree of latitude, in the Rocky Mountains, about the South Kootanie Pass, the red beds are characteristically developed, with a thickness of about 300 feet. The upper portion of the section in this part of the mountains, is as follows, in descending order:—

Series H. Fawn-coloured flaggy beds, seen only at a distance, but from their appearance and analogy with Series F, probably thin-bedded dolomitic sandstones and limestones. Throughout 100 feet.

Series G. Beds characterized by a predominant red colour, but including some thin, greyish layers and dolomitic sandstones. The whole generally thin-bedded. Ripple marks sun-cracks, impressions of salt crystals. 300 feet. Passes gradually down into

Series F. Fawn-coloured flaggy beds of dolomitic sandstone and limestone, with more red sandstone layers, which are especially abundant toward the top. 200 feet.

Series E. Amygdaloidal trap. 50 to 100 feet.

The last mentioned immediately overlies the compact bluish limestone of Carboniferous age, and, with the exception of the interruption caused by this contemporaneous sheet of volcanic matter, the whole of the series are conformable and pass gradually each into the next.

The conditions indicated are, in Carboniferous times, a somewhat deep sea gradually shoaling. The occurrence of an important volcanic outbreak, and shortly thereafter the more or less complete closure of the communication of this area with the ocean and the formation of the Triassic inland sea.

Westward from this region similar beds may be traced by information supplied by Mr. H. Bauerman, for about forty miles, but beyond this point they have nowhere been observed in British Columbia. Northward, along the main range of the Rocky Mountains, I have observed them for about fourteen miles only, beyond the 49th parallel. They were not seen by me in the Crow Nest Pass, in latitude 49° 30′, nor anywhere along the eastern base of the mountains from this point to the Bow Pass (latitude 51°) or in that pass. Neither have they been noted by Dr. Hector in any part of the Rocky Mountains to the north of the Bow which he traversed, or by Dr. Selwyn in the Yellow Head Pass. While, therefore, the evidence so far adduced is purely negative, it would appear that the Triassic inland sea in this longitude found its northern shore not far beyond the 49th parallel, and probably never extended west of the Selkirk and Gold Ranges of Central British Columbia.

Still further north, however, we meet with evidence of a more decided character. For, on the upper Pine and Peace Rivers, on the eastern flank of the mountains, a series of blackish shales and argillites, sometimes calcareous, occur, and hold characteristic Alpine Trias fossils. Beds containing similar forms are found in a number of places to the west of the Gold Range in British Columbia, and it is probable that the Triassic ocean, in the latitude of the Peace River, extended completely across the Cordillera belt eastward. No mountain boundary occurs between this region and that first described to the south, but a tract of probably low land must have separated these two areas in the Triassic period.

In the Queen Charlotte Islands Triassic rocks, holding fossils of the same strictly

marine character, are largely developed, and they also occur with abundant molluscous remains in the northern part of Vancouver Island. In the southern part of the interior of British Columbia, not far west of the Selkirk and Gold Ranges, rocks also occur unconformably overlying the Carboniferous series, from which a few fossils, with little doubt, belonging to the same Alpine Trias fauna have been obtained; and it is further probable that—as in California—the greater part of the auriferous shales are attributable to this or the succeeding Jurassic series.

In the Queen Charlotte Islands, Vancouver Island, and on the mainland of the province, however, the Triasic series is largely composed of rocks of volcanic origin, some of which have been lavas while others are agglomerate or ash beds, made up of fragments of igneous material, more or less perfectly stratified. These are mingled with schistose and slaty rocks, and in some places with massive bluish lime-stone, deposited during periods of tranquillity; and it will require the most careful and systematic examination to completely separate this from the underlying strata. I have little doubt that the so-called 'porphyroids' of King's Koipato group indicate an extension of similar volcanic activity over the 40th parallel region to the south.

A word may be added with reference to the climatic conditions implied by the Red Beds of the interior. The basin in which they were formed has not only been pretty completely cut off from the ocean, but the rate of evaporation of its waters must have been normally in excess of that at which they were re-supplied by precipitation or drainage from neighboring lands. It is probable that at that time, as at the present day, westerly winds prevailed in this part of the northern hemisphere, and, if the North Pacific Ocean then existed, these would carry, as they do now, an abundance of moisture and afford a copious rainfall on the west coast. As the land barrier of the inland sea to the west cannot have been of very great width, it must have been of such height as to cause the almost complete desiccation of these oceanic winds by precipitation before they reached the area occupied by the Triassic Mediterranean: and this old mountain range, must, in British Columbia, have occupied nearly the position of the Selkirk and Gold Ranges of to-day, at a time when the Rocky Mountain region proper was still a flat expanse of Palæozoic rocks.

To the north, at the present time, between the 54th and 56th parallels, the Gold Range almost completely disappears, and it is through this gap that the Triassic ocean must have flowed eastward to the upper Peace River country and, perhaps, much farther east—though the Cretaceous, and Laramie beds, occupying the flat country, render it impossible to trace its deposits in that direction.