ments in various parts of the country. A skilled entomologist at such a centre, with one trained assistant whom he might despatch to study local problems not far distant, would accomplish more than twice that number could on the border of the continent, whence the assistant must often travel many thousand miles to reach a field requiring investigation, and be able to remain there only a brief period. The state entomologists are not numerous enough to affect the question in the least. Illinois and New York alone support officers who are doing a really creditable work; and these great states, rich, populous, and fertile, would be insufficiently served, under this scheme, without the aid of their own officials.

This would require a doubled, perhaps a trebled, appropriation for the division. What of that? Its work should be measured, not by what it has been able to do with insufficient means, but by its inherent importance to the largest and most wide-spread industry in the country. A trebled allowance, multiplied a thousand-fold, would not equal the losses yearly sustained by agriculture, reasonably to be classed as avoidable by means which the study of their causes will reveal. The work of the division for the past six years has been admirable, as far as it has gone: it has gained the approval of those who know what scientific work is, and the appreciation of the great class who have seen its practical benefits. It is time to ask, and to grant, the means for a forward step.

RECENT GEOLOGICAL OBSERVATIONS IN THE CANADIAN NORTH-WEST TERRITORY.[1]

IN a former number of *Science* (i. p. 477) a note was given on some points relating to the glaciation of that part of the North-West Territory which occupies the angle between the eastern base of the Rocky Mountains and the 49th parallel. During the summer of 1883 the examinations necessary for the production of a proximately exact geological map, covering an area of over twenty thousand square miles in this district, have been completed, and the mapping of the contiguous area to the eastward has been begun. A number of new facts of geological interest have been brought to light during the prosecution of the work, a few of the more important of which it is proposed here briefly to mention.

In the article above alluded to, the great elevation at which Laurentian and Huronian erratics occur near the mountains was specially noted; and some of the greatest heights up to that time observed were stated as 4,200, 4,390, 4,660 feet, respectively, above the sea-level. In August last, however, several indubitable Laurentian bowlders, representing different characteristic varieties of gneissic and granitic rocks, were found at an elevation of 5,280 feet, at a point in the foot-hills about twenty miles north of the 49th parallel. The ridge upon which these occur lies within a few miles of the paleozoic rocks of the mountains, and, like many others in this vicinity, is evidently a slightly modified moraine, due to the local glaciers of the mountains. The bowlders are associated with many blocks derived from the neighboring mountains. They cannot, however, have come from the Rocky Mountains, as a tolerably complete examination of the range, between the 49th and 51st parallels, has confirmed the statement, previously made in a more general way, as to the absence of crystalline rocks in the constitution of the range: their origin must therefore be sought, with that of the immense profusion of similar erratics strewn over the neighboring lower country, to the east or north-east, in the great Laurentian axis.

In the Cypress Hills (latitude 49° 40′, longitude 110°), which constitute an isolated, high plateau of irregular form, Mr. R. G. McConnell has noted some interesting points connected with the limit in height of the drift and bowlder deposits. The western end of the hills is highest, and is flat-topped and regular in form; while the eastern and lower part has been worn down to an irregular, rounded, and rolling plateau, on which numerous Laurentian and limestone bowlders, resembling those generally scattered over the plains, occur. The highest point at which these were found is 4,340 feet above sea-level; while at 4,400 feet, and other points exceeding this elevation, no such erratics occur. From the observations first referred to, it is certain that this, though locally the upward limit of the glacial deposits, is surpassed by that of other places farther to the west; and it adds to the evidence already obtained, indicating an unequal depression of the plains in glacial times.

In these hills another very interesting discovery has been made by Mr. McConnell; viz., that of the occurrence of considerable outlying areas of an upper tertiary formation of miocene age, consisting, in large part, of rolled shingle which has been derived entirely from the harder rocks of the mountains. The peb-

[1] Communicated, in advance of publication of report, by permission of the director of the Geological survey of Canada.

ble-beds, or conglomerates, are frequently composed of stones several inches in diameter; and as they occur at a distance of over two hundred miles from their nearest possible source, and no signs whatever of ice-action appear, the problem of their mode of transport becomes a difficult one. A few vertebrate remains obtained from these beds appear to be referable to Brontotherium.

It may be mentioned, in this connection, that the discovery of these tertiary pebble-beds to some extent tends to modify statements previously made, respecting the origin of somewhat similar shingle-deposits of later date in this vicinity. The transport of a portion, at least, of the quartzite shingle immediately underlying, and apparently attached to, the bowlder-clay, may have occurred in the miocene period, and its denudation and rearrangement been effected in early glacial times. Of the older formations in this part of the north-west, the following classification has been adopted: —

Laramie.	Porcupine-Hill beds. Willow-Creek beds. St. Mary River beds.
Cretaceous proper.	Fox-Hill sandstones (inconstant). Pierre shales. Belly-River series. Dark shales, supposed to underlie the above.

The subdivisions of the Laramie appear to be of local importance only, but are useful in the region here specially referred to, on account of the very great thickness of that formation. The upper part of the Belly-River series evidently represents the pale, sandy beds which occur on the Missouri in a similar position with reference to the Pierre; and the latter holds coal or lignite at the base in this district, as described by Prof. E. D. Cope on that river. In 1881 the lower portion of the Belly-River series, characterized by yellowish and brownish tints, was found to be highly fossiliferous, and to hold shells like, and in some cases conspecific with, those of the Judith-River group. In consequence of this fact, some doubt was felt in accepting the evidence of the apparent stratigraphical position of this portion of the series; and a re-examination of the district was made with the object of deciding this point. The result of this further investigation has been, however, to confirm the views first held by much additional stratigraphical evidence, which cannot here be detailed, and, further, to prove the existence in the upper or pale beds of the Belly-River series of a molluscan fauna of the same kind with that characterizing the yellowish beds above referred to. The sections are such that no doubt could at any time be entertained with regard to the relative positions of the Pierre and the pale beds.

The composition of the cretaceous, here found to obtain, is thus brought into exact parallelism with that clearly proved in the Peace River country (Report of progress, 1879–80), where a similar important estuarine series, with Laramie-like fossils, follows the Pierre in descending order. The fossils of the Belly-River series have not yet been critically examined; but their resemblance to those of the Judith River is so complete, that I am strongly inclined to revert to Messrs. Meek and Hayden's original views respecting the stratigraphical position of the latter beds,[1] and to suggest, though with some hesitation, that the species figured on plates 37–39 of Meek's work on the cretaceous and tertiary fossils of the Upper Missouri, as from a peculiar local development of the Fox-Hill group, have really been derived from beds underlying the Pierre. One at least, of these fossils (Mytalus subarcuatus), has been found in our district in this position.

The occurrence, among the paleozoic rocks of the portion of the Rocky Mountains between the 49th parallel and Bow River, of extensive cretaceous areas on both sides of the main watershed, is an interesting addition to our knowledge of the range, and important because of the contained coal-seams, which vary in character from bituminous and coking coals to anthracite. A coal of the latter class, containing eighty-six per cent of fixed carbon, was found last summer in the valley of Cascade River, on the Upper Bow; and mining operations have already been commenced on it. The trough of cretaceous rocks is here comparatively narrow, and the beds very sharply folded.

Space will not permit any detailed notice of the investigation of the paleozoic rocks of the mountains. It may be stated, however, that the limestones appear, for the most part, to be of Devonian age, and are very variable in thickness. One measured section on the Crow-Nest Pass showed a thickness of ninety-six hundred feet. They are unconformably underlain by a great series of slaty and quartzite rocks, from which no fossils have yet been obtained in place. On the evidence of detached fossiliferous fragments, they are, however, provisionally referred to the Cambrian, and closely resemble, lithologically, those of this age in the Grand Cañon of the Colorado.

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[1] *Proc. acad. nat. sc. Philad.*, 1857, p. 114.