ART. XLVII.—*On the Use of the Name "Catskill"*; by JOHN J. STEVENSON.

TWO years ago, the writer* urged that the series of beds included within the Catskill and Chemung periods, should be grouped into one period, the Chemung, with three epochs, the Portage. the Chemung and the Catskill. Since that time Prof. Hall† has presented in detail the results of his later studies in the Catskill region, and Mr. N. H. Darton‡ has published a brief synopsis of work done by him for Prof. Hall in the same region. These papers supplement and confirm the previous notices of work done by Prof. Hall, as given by him§ from time to time in his official reports and elsewhere. In closing his paper, Mr. Darton suggests that "Catskill" be applied to the Upper Devonian as the name for the whole

* Stevenson, The Chemung and Catskill (Upper Devonian) on the eastern side of the Appalachian basin. Vice-President's address before Amer. Assoc. Adv. Sci.. vol. xl.

† Hall, Bulletin Geol. Soc. of Amer., vol. iv, p. 8. Unfortunately only a reference to the paper is given with a brief statement respecting the discussion. The paper has not been published.

‡ This Journal, vol. xlv, 203–209.

§ Hall, 28th Ann. Rep. of Regents on the State Museum, 1876, p. 15: Science, 1880, p. 290; Fifth Ann. Rep. of State Geologist, Assembly Doc. No. 105, 1886, p. 11. In this last the true relation of the Oneonta sandstone to the underlying Hamilton and the overlying Chemung was stated and illustrated by a section.

period and that its use as the name of an epoch be discarded; this, in view of the new light thrown upon the subject by his paper. Mr. Darton has presented the conditions in the Catskill Mountains with great clearness and he has increased our stock of knowledge by the addition of details which fill up the gap for a portion of the southern border of New York, but the writer cannot see that any light has been shed upon the general problem of relations, which was not shining when the Address, already referred to, was prepared two years ago.

The making of names for local groups of rocks, if one wish to employ them, is simple enough; they may refer to some physical character, to the distribution of some fossil or to the locality itself. But to find a name for a vast formation is far from simple. The problem is to give some definitive appellation to a series of rocks covering or underlying many thousands of square miles, showing variations in lithologic characters and in thickness, in the distribution or even in type of animal or vegetable life. A name based wholly on paleontological grounds would be misleading; equally so would be one similarly based on lithologic characters. Evidently the only recourse is a geographical term referring to some locality, where one may find as nearly as may be, an average of all conditions shown in the areas available for study. No name should be given until after careful comparisons, that a wrong typical locality be not selected.

A single instance may be mentioned as illustrating the difficulty. The term "Umbral," applied by H. D. Rogers to the upper division of the Lower Carboniferous, being unacceptable, that group received from the 2d Geological Survey of Pennsylvania the name of Mauch Chunk Red Shale. This name answers well for the northeast corner of Pennsylvania, in the vicinity of the anthracite region, but it is found less and less applicable as one recedes from that region toward the southwest and southwardly along the easterly outcrop line; for sandstones, limestones and shales of different types are found; soon the limestones become important; eventually in the Virginias they predominate and the Mauch Chunk shales become an insignificant feature of this group, which represents the Chester and St. Louis, with part at least of the Keokuk of the Mississippi valley. Long ago, W. B. Rogers gave to this series the name of Greenbrier Group; on Greenbrier River of West Virginia the shales of northeastern Pennsylvania and the limestones of southwestern Pennsylvania are found developed to their greatest extent. This naming proves to be defensible on paleontological grounds as well—in almost every instance, careful stratigraphical and careful paleontological work come out closely in accord.

This case is very similar to that in hand. The problem is to give a name to the series of rocks between two sufficiently well defined limits, the Hamilton below and the Pocono above. The series in all its parts is practically persistent for fully six hundred miles along its easterly outcrop, from within a few miles of the Tennessee border through Virginia, Maryland, Pennsylvania and New York into the Catskill Mountains. Sections taken at short intervals show remarkable resemblance in detail, remarkable uniformity in the more important beds until within a short distance of the New York line, where the lithologic features hitherto characterizing only the highest members of the sections extend lower and lower until, in the Catskill Mountain region, they become almost equally characteristic of the lowest members. As the writer has shown for northern Pennsylvania along the State line by comparison of sections made by White, Ashburner and Sherwood and, as was shown by Hall and now also by Darton for southern New York, the same condition is observed in coming eastward toward the Catskill region. Recognizing this condition, but seeming to regard its discovery as new, Mr. Darton says:

"As the Catskill in its type region comprises Portage and Chemung, my proposition now is to discontinue the use of Catskill as a coördinate formation term and use the term Catskill group to include the Portage and Chemung formations, the latter extending to the base of the Lower Carboniferous. I believe the Chemung and Portage are formations distinctly separable over a wide area, but Chemung and "Catskill" as formations are only separable by a lithologic distinction, which progressively varies several thousand feet in stratigraphic position in the extension of the beds across southern New York."*

This is now no mere strife about words; possibly were the name to be given *de novo*, the case might be different. But this is no beginning; the three groups, Portage, Chemung and Catskill have been recognized for forty years; they are recognizable as separate in an immense area, compared to which the Catskill Mountain region of New York is utterly insignificant. A lithologic distinction between Chemung and Catskill was not the basis on which the groups were separated in the typical locality of the latter, which is Susquehanna County of Pennsylvania† and no such distinction can be used with safety. That feature, however, was used in other localities, by Vanuxem himself as well as by other observers, in order to determine equivalence. This test led to Prof. Hall's placing of the Lower Chemung near Blossburg, Pennsylvania, into the Old Red Sandstone and therefore to regard the

* Darton, loc. cit., p. 209.

† Vanuxem in Assembly Doc. No. 50. 1840, p. 381.

Holoptychius beds of Tioga County, Penn., as Catskill, whereas they lie but little above the Lower Chemung Conglomerate (Allegrippus of White), which, in Susquehanna County of Pennsylvania is at 1000 feet below the Montrose sandstone (Honesdale Sandstone of White), while in south central Pennsylvania along the easterly outcrop, the bed is fully 2000 feet below the Montrose sandstone. And the use of this lithologic test has been the cause of confusion and annoyance ever since.

The objections to the use of the name Catskill for the whole series are so strong as to render it certainly unwise if not altogether wrong; and they apply equally to the proposed disuse of the term to distinguish a subordinate formation.

That the Catskill Mountain region is not the typical area of the Catskill Group has been mentioned. It was there that Mather* found his "Catskill Mountain Series," which included all the rocks of the Catskill region from the Lower Carboniferous Sandstone of H. D Rogers down to the bottom of the Marcellus, so that it comprehended the Hamilton, Chemung and Catskill as well as part of the Pocono. Vanuxem† used the term "Catskill Group" in his final report to designate the summit rocks of the Devonian, the group to which he had given the name of Montrose sandstone in the fourth annual report.‡ The distribution of the group as given in the final report differs little from that given in the annual report, but in the former the Oneonta sandstone is taken as the equivalent of the Montrose sandstone. The series was taken to be the same with the Old Red Sandstone of Prof. Hall§ which rests in the Chemung Group.

In spite of Vanuxem's error in the final report, that of identifying the Oneonta with the Montrose sandstone, it is doubtful whether any geological term has ever been applied to a better defined group than that made by Vanuxem in the fourth annual report, to which he gave the name of Catskill in his final report. The Montrose sandstone is a thoroughly well marked horizon, obscure only in the exceedingly restricted area of southern New York: it is traceable without difficulty in the sections along the eastern outcrop from northeastern Pennsylvania to many miles beyond New River in Virginia. Its variations in northern Pennsylvania westward are well shown in the sections obtained by I. C. White and in southern Pennsylvania westward in the sections obtained by Stevenson.

The Catskill of Vanuxem is distinct also in its history; its distribution is very different from that of the Chemung; it is

* Mather, Assembly Doc., No. 150, 1841, pp 77–82.
† Vanuxem, Geology of New York, Part III. 1842, p. 12.
‡ Vanuxem, Assembly Doc., No. 50, 1840, p. 381.
§ Hall. Assembly Doc, No. 50, 1840, p. 452.

local. In southern Pennsylvania near the Maryland line its whole thickness of 3700 feet disappears within less than 60 miles westward from the eastern outcrop; in northern Pennsylvania it has practically disappeared before Blossburg in Tioga County has been reached; in southern New York, it should not reach beyond Chemung County. It must not be understood that this means that red rocks disappear; red rocks occur far below the Montrose at many places, so that rocks of "the Catskill type," as Ashburner termed them, appear at many localities west from the line of Catskill disappearance. The Chemung extends far to the west beyond the last traces of the Catskill and is easily recognized in western Pennsylvania and in Ohio.

The Catskill is as well defined as any group in the Devonian column; it is impossible, therefore, to discard the name as one designating a subordinate division of a series, the essential unity of which appears now to be conceded as fully as is the unity of the Hamilton or Niagara. The question still remains, however, does this Catskill portion so present the characters of the whole series as to justify the application of its name to the whole Upper Devonian period?

It is impossible to answer this question in the affirmative, for were the name so employed, it would give an erroneous impression respecting the conditions prevailing in by far the greater part of the Appalachian basin during most of the immense period represented by the Portage, Chemung and Catskill. It must be remembered that the Catskill Mountain region is not the typical area of the group which Vanuxem named "Catskill." The Catskill Mountain region, far from being the typical area of anything, has always been the area of doubt and dispute. Mather's too hasty gathering in of the red beds and Vanuxem's error respecting the relation of the Oneonta to his Montrose sandstone produced uncertainty for more than a third of a century and led to error in adjacent regions. The work in Pennsylvania did much to prepare the way for reconciliation of the facts which seemed to be at variance; but Prof. Hall's recognition of the relations of the Oneonta* sandstone removed the mystery and made everything distinct.

He has shown that the Oneonta sandstone, instead of resting on the Chemung, is the base on which it rests, is, in fact practically, the eastward prolongation of the Portage. Mr. Darton's section from Broome County of New York eastward shows the same thing.

* Hall, Fifth Ann. Report of State Geologist, Assembly Doc., No. 105, 1886, p. 11.

The constancy of the conditions within the Catskill Mountain area from the very beginning of the Upper Devonian made the relations of its rocks to those of other regions very perplexing. As Prof. Hall has shown, even before the close of the Hamilton, the conditions became unfavorable to animal and vegetable life and favorable to the formation of red beds; and these conditions, with rare interruptions, continued until the end of the Devonian. But as one recedes from the area of the Catskills, he finds that these conditions did not begin alike early everywhere* and that the horizon at which red rocks become a marked feature, varies stratigraphically not less than 3000 feet; and the upper limit of animal life varies even to nearly 4000 feet, there being localities where some molluscan forms were able to sustain themselves amid the red beds at the very top of the section.

But this was no hap-hazard variation. The writer has shown that the conditions beginning so early in the Catskills of New York, spread toward the south and west slowly but steadily until at the close of the Devonian, they prevailed along the easterly outcrop to beyond the New River in Virginia and westward to the limits already given as those of the Catskill. The characteristic fossil of the Oneonta sandstone (Portage) in New York is the *Amphigenia*, commonly thought to be a freshwater form. As the conditions favorable to the existence of this mollusc extended, the geographical distribution must have become greater, so that there was no reason for surprise when, in 1881, the writer discovered that form near the summit of the Montrose sandstone in southwestern Pennsylvania, several thousand feet above the Portage, its horizon in the Catskills.

But these conditions spread very slowly; Mr. Darton's section from Broome County eastward in New York exhibits the changes observed previously in northern Pennsylvania by I. C. White and in southern Pennsylvania by Stevenson. So slowly did they spread, that for a very long period, lasting almost to the end of the Chemung, as limited above by Vanuxem, they had reached southwestward to barely 75 miles within Pennsylvania and westward but little further—an utterly insignificant area when we remember that the whole series has been examined along the easterly outcrop for 500 miles further southwestwardly and that, by means of the oil-borings and the successive anticlinals, the section is familiar to the southwestern limit of Pennsylvania; while the tracing along the northern line of Pennsylvania and the southern line of New York is sufficiently simple. Southwardly in Pennsylvania, one comes quickly to sections showing fossiliferous beds in the

* Stevenson, loc. cit.

lower portion; each succeeding section in that direction shows the fossiliferous portion extending higher and higher, until in Huntingdon County, the whole mass below the Montrose sandstone, 4,675 feet thick, is more or less fossiliferous—the fossils being most abundant in beds near the top of the column. In southern Virginia, however, the change is more noteworthy, for there within Roanoke County, the writer in 1890 found Chemung forms far up in what is unquestionably the Catskill. Going westwardly, one finds the matter equally clear, the fossiliferous beds occurring higher and higher, while the whole mass diminishes in thickness; so that before western Pennsylvania has been reached Chemung fossils are present at the top of the section, the Montrose or Catskill having thinned out and disappeared.

So then, the "Catskill condition" existed within a very circumscribed area until the close of the Chemung epoch; but for some reason, the area was enlarged greatly during the Catskill. Red beds, it is true, had made their appearance at many localities long before that time, but, for the most part, they are insignificant features in the sections. It is sufficiently clear that to apply the name Catskill to the whole series of rocks would be to apply a term which would be misleading, as it refers to a locality exhibiting characteristics wholly or almost wholly absent from most or all of the section in nine-tenths of the area in which the series can be studied within the Appalachian region.

Of course, there are objections to the use of the term "Chemung" for the whole series; not much of the Catskill portion is present in the immediate region where the Chemung was studied by Hall in 1839. But undoubtedly there is a remnant of that group there, so that representatives of all three divisions of the series can be gathered under the name. The only objections to the use of the name are such as apply to the use of any geographical term; but the reasons favoring its use far outweigh any objections which may be offered.

In probably nine-tenths of the area in which this series is exposed within the Appalachian basin, the Chemung, that portion below the Montrose or Catskill of Vanuxem, is the important portion of the series; it is the persistent portion, with certain beds which are traceable directly over almost the whole region outside of the Catskill Mountain area; whereas the Catskill is not the persistent portion, occupying as it does only the long trough rudely parallel to the Blue Ridge from southern New York to very near the Tennessee line, as already defined. More than that; the fauna, termed Chemung by Hall in New York is typical of the whole section below the Montrose sandstone and in Virginia passes even into that por-

tion of the section. Catskill is simply epochal but "Chemung" carries with it the conception of those physical and biological characteristics which mark the great closing period of the Devonian.

Chemung, therefore, and not Catskill is the epoch whose name should be applied to designate the whole group, while Catskill must be retained in its original signification only.

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