## SPECIAL ARTICLES

### WHAT DOES THE MEDINA SANDSTONE OF THE NIAGARA SECTION INCLUDE?[1]

MOST geologists will agree, if stated as an abstract proposition, that a primary essential of any system of formational nomenclature is stability. In concrete examples, however, geologists display a marvelous facility in forgetting the importance of such stability or in ignoring any rules which might bring it about. This is well illustrated by the present status of the term Medina sandstone. In papers which have been read before the Geological Society of America during the last two years not less than three distinct meanings have been given to this term. The inconvenience of using any unit of measure which fluctuates in length from year to year would be no greater than that of using formation names for the geologic scale, which may differ by hundreds of feet in the thickness of beds included, according to the date or the individual author concerned. One can, of course, and in the present chaotic state of geological nomenclature generally does, in using a formation name, indicate whether he accepts Wm. Jones's or John Brown's definition of the formation. He may too have recourse to the booklets of formation names issued at intervals by some surveys, and ascertain what is the most fashionable length during the year in which he is writing for the formation in question. While these are possible and at present apparently necessary methods of indicating what one means when using a formation name, surely it would be better to adhere to a standard definition as we do for such terms of measure as foot and meter. Such a standard definition of a formation, of course, in no way precludes its subdivision as the progress of knowledge concerning it may dictate, accompanied by new names for the new sub-units. In the case of names which seldom reappear in the literature the inconvenience of changing meaning is comparatively small, but fluctuation in the meaning of such a term as Medina sandstone which occurs in most text-books on geology and in innumerable geological papers must lead to endless confusion. During the last decade a number of papers, perhaps the majority of those dealing with the Silurian of western New York, have made the term Medina include only the 100 feet of beds which are chiefly sandstones immediately preceding the Clinton; the others have included these and 1,100 feet of red shales below them as well in this formation.[2] Some inquiry into the reason for this wide diversity of usage and suggestions regarding the limitation of this term which the rules of nomenclature seem to indicate appear to be in order.[3]

These rather surprising fluctuations in the thickness of the Medina sandstone in the same section began with Grabau's[4] and Chadwick's[5] proposals to restrict the name to the upper 100 feet of Hall's Medina sandstone, the lower 1,100 feet being named the Queenston shale by Grabau. In raising the question whether there were good grounds for restricting the term to the upper beds to which the sandstone is almost wholly confined, and giving to the lower shaly portion a new name, we are confronted by two subsidiary questions. (1) Is it ever permissible or desirable to restrict or redefine the name of a formation? (2) Was the Jas. Hall usage of Medina sandstone which Grabau's proposal supplanted identical with the application given the name by Vanuxem, who first used it? Examples both of contraction and expansion of the original meaning of formation names might be cited from the papers of various geologists. Whether the practise is approved or censured, there is abundant precedent for emendation of the original meaning of geologic names.

Before considering some of the conditions under which in the writer's judgment emenda-

[1] Published with the permission of the Director of the Geological Survey of Canada.

[2] Bull. N. Y. State Mus., No. 114, p. 10.

[3] The writer wishes to acknowledge the privilege of examining before preparing this paper a manuscript by Dr. E. O. Urich which treats, among others, the question here discussed.

[4] SCIENCE, Vol. 27, April 17, 1908, p. 622.

[5] SCIENCE, Vol. 28, September 11, 1908, pp. 346–348.

tion is desirable we may revert to the second question. Vanuxem[6] introduced the name Medina sandstone into the literature in 1840, applying it to beds "called in former reports the red sandstone of Oswego." A much fuller description of the Medina sandstone was given by Vanuxem in 1842.[7] The formation is fully described in this report from exposures occurring in the Third District of New York to which Vanuxem's work was officially confined at that time. The name Medina which was given to it was taken, curiously enough, from a town about 100 miles west of the western limit of Vanuxem's field of work. Whether we consider the type section to be at Medina or in the third district where the particular section and exposures of the formation described are located, we must go to the latter region to discover just what is included in the term Medina sandstone. It is stated by Vanuxem to include sandstones lying between the Clinton above and the Oswego sandstone below. It is noteworthy that Vanuxem's definition of Medina contains no reference to shale. All of the occurrences of the Medina sandstone which he described in the third district are described as sandstone. The Medina as later defined by Jas. Hall[8] in western New York is mainly a shale formation comprising the 100 feet of sandstone just below the Clinton together with several hundred feet of red shale lying between this sandstone and the Oswego sandstone. The explanation of this apparent discrepancy between the two definitions appears to lie in the fact[9] that the upper or sandstone part of Hall's Medina extends considerably further to the east than the lower or shaly part. If Hall's lower Medina (Queenston of Grabau) does not extend as far east as the section described by Vanuxem then the original definition of Medina includes only the upper part of the beds ascribed to it by Hall, or that part to which this name is restricted by Grabau. Should this inference prove to be true, then Grabau's usage of Medina is really a return to the original meaning and not a restriction of it. In this case then it will be in order to consider whether any good reason can be offered for following the usage of Jas. Hall which makes the term include some hundreds of feet of beds which Vanuxem's definition excluded.

It is proposed here, however, to consider the question on the assumption that the application of the name Queenston to the shaly, and Medina to the sandy part of Hall's Medina was an emendation of the original usage. We may first consider in doing this some of the circumstances which may justify or necessitate emendation of formation names. Under the rules of nomenclature formulated by the United States Geological Survey for the guidance of its members it is stated that "each formation shall contain between its upper and lower limits either rocks of uniform character or rocks more or less uniformly varied in character, as, for example, a rapid alternation of shale and limestone."[10] The application of this rule to the sediments included in Hall's Medina would not permit the use of the name in a formational sense, since the upper hundred feet and the beds below are entirely diverse in character, the latter being almost entirely a red shale, and the former chiefly a sandstone terrane. This lithologic difference between the upper and lower terranes, however, would not necessarily militate against the use of Medina in the group sense. It is in this sense that the name has been used lately by the N. Y. State Geological Survey[11] and by the U. S. Geological Survey.[12] There is, however, another and very serious objection to using the term in the group sense. Until recent years the upper and lower divisions of the Medina were supposed to represent the basal part of the Silurian. No

[6] Geol. Rept. New York, 4th Ann. Rept. of the Geol. Surv. of the 3d Dist., 1840, p. 374.

[7] Geol. of N. Y., Pt. III., 3d Dist., 1842, pp. 71–74.

[8] Geol. of New York, Pt. IV., 1843, pp. 34–57.

[9] Handbook New York State Mus., No. 19, Table 2, 1912.

[10] 24th Ann. Rept. District U. S. G. S., p. 23, 1903.

[11] Handbook 19, 1912.

[12] Folio U. S. G. S., No. 190, 1913.

fossils have ever been found in the Queenston division in Western New York, but the discovery of fossils in these beds in Canada has led geologists who are familiar with the evidence to agree that they belong in the Ordovician system.[13] The fossils which have been found in the Queenston near Collingwood, Ontario,[14] place the Richmond age of the Queenston beyond question. The fauna of the upper Medina, however, as has long been known, places it in the Silurian. It is reported by Williams[15] that evidence in the shape of mud cracks at the top of the Queenston indicate a stratigraphic break between the Queenston shale and the succeeding sandstone which is the Whirlpool member[16] of the Medina. The Medina sandstone of Hall in either the group or formation sense therefore holds the anomalous position of including terranes which are not only unlike in physical characters, but which belong in different geological systems and are, moreover, separated by a disconformity. If beds can be properly kept in either the same formation or group which are so wholly unlike as the Queenston shale and the Medina sandstone of Grabau and which belong in distinct geological systems, then the terms formation and group have no value or definite meaning whatsoever in geology. It is a case where the growth of knowledge has made it impossible logically to hold to the earlier usage of Hall. In the light of present knowledge a restriction of the term so that it will not overlap systemic boundaries appears to be the only feasible method of employing it. Grabau's emendation of Hall's usage accords with the pronounced lithologic features which distinguish the upper 100 feet of the Niagara section from the beds below, and also with the later knowledge concerning the systemic relations of these beds. This application of the term Medina, which includes the Whirlpool sandstone as its basal member and the Thorold quartzite as its uppermost member, is the usage which the writer believes should and will prevail. The new name Albion which was introduced by the writer in the Niagara Folio[17] is synonymous with Medina as emended by Grabau. The latter term is therefore entirely superfluous and should be dropped from the literature.

Professor Chas. Schuchert's recent important discovery, that much of the "Clinton" of the old reports of the Canadian Geological Survey lies entirely below the base of the New York Clinton, must be taken into account in any revision of the Niagara section. Beds in this section which have shown a fauna too meager to encourage special study heretofore, and a lithologic differentiation too slight to appear to merit discrimination as separate members or minor lithologic units have taken on new significance and importance through the work of Schuchert, Parks and Williams in the region west and northwest of the Niagara section. One of these beds contains in the Ontario peninsula a rich and partly undescribed fauna which has been referred to by Schuchert[18] and Parks[19] as the Cataract fauna. The examination by the writer of a number of sections holding this fauna in connection with a review of the Niagara section has convinced him that all of the terranes associated with the Cataract fauna are represented in the Medina of the Niagara section. These have been given individual or member names in recognition of their physical and faunal contrasts by Dr. M. Y. Williams.[20]

[13] Grabau, A. W., SCIENCE, Vol. 22, 1905, p. 529; Bull. 92, N. Y. State Mus.; SCIENCE, Vol. 27, 1908, p. 622. Ulrich, E. O., *Bull. Geol. Soc. Am.*, Vol. 22, 1911, pl. 27.

[14] Foerste, Aug. F., *Ohio Naturalist*, Vol. 13, 1912, p. 47.

[15] Paper read before the Geological Society of America, January, 1914.

[16] Name proposed by A. W. Grabau, *Jour. Geol.*, Vol. 17, 1909, p. 238.

[17] This name was suggested to the writer by the U. S. Geological Survey Committee on geologic names, but since in a Federal bureau suggest and command are convertible terms the writer may reasonably disclaim any responsibility for its use as well as for the usage of Medina there employed.

[18] Paper read before Geological Society of America, January, 1913.

[19] "Excursions in Southwest Ontario," Guide Book No. 4, pp. 127, 134.

[20] Paper read before meeting of the Geological Society of America, January, 1914.

Any detailed discussion of the lithologic and faunal characteristics of these several terranes will be omitted from this paper since Dr. Williams will publish this data at an early date. These are indicated in the section given below which includes all of the formations cut by the Niagara Gorge.

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|---|---|
| Silurian. | Lockport dolomite.<br>Undifferentiated dolomite.<br>Gasport limestone.<br>De Cew limestone.[21]<br>Rochester shale.<br>Clinton formation.[22]<br>Irondequoit limestone.<br>Walcott limestone.<br>Sodus shale.<br>Medina formation.<br>Thorold sandstone.<br>Grimsby sandstone.[21]<br>Cabot Head shale.<br>Manitoulin beds.<br>Whirlpool sandstone. |
| Ordovician. | Queenston shale. |

E. M. Kindle

[21] Name proposed by M. Y. Williams in paper read before the Geological Society of America, January, 1914.

[22] The term Clinton has been made to include in certain publications, among them Folio 190 U. S. G. S., the Rochester shale in addition to the beds hitherto known as Clinton. Until satisfactory evidence has appeared however, for such revision of the meaning of an old and well-established name there appears to be no reason for seriously considering either this proposed expansion of the term upwards or its expansion downwards as one geologist proposes. Frequent tinkering with the meaning of well-established names is not likely to serve any useful purpose. When revision of a name does appear to be required it should, in the writer's opinion, be accompanied by a full statement of all the evidence in the case and ample time for its discussion should be given before it is accepted. Such evidence has not appeared in this case.

## NOTES ON A SHEEP THYREOID EXPERIMENT WITH FROG TADPOLES

At the time of the publication of Professor J. F. Gudernatsch's paper on thyreoid feeding experiments with the tadpole I was working with some tadpoles and having some extra ones I tried a short but similar experiment. I used

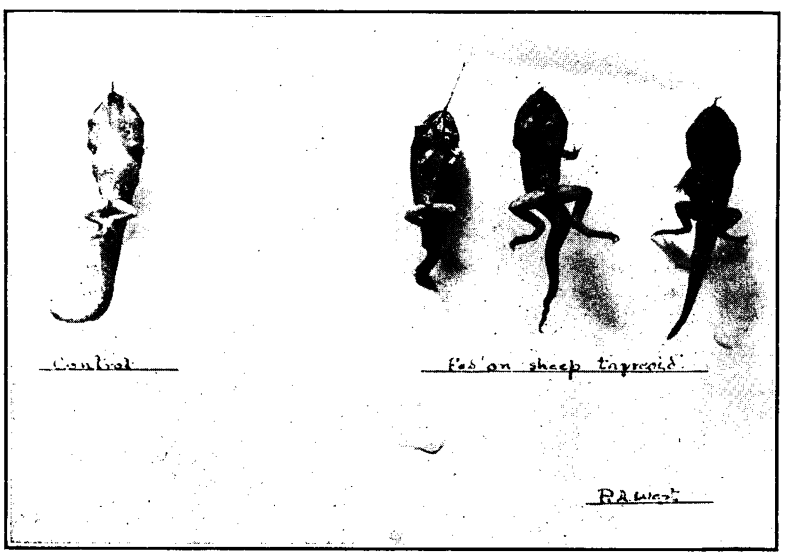


Fig. 1.

the large bull-frog tadpoles which had lain over one winter. The hind limbs had begun to develop and even to joint. They were divided into two lots, the one for control and the other for experiment. The experimental