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JOHN MASON CLARKE (1857–1925)

WITH the passing of John Mason Clarke, of Albany, on May 29, 1925, the world has lost not only one of its leading paleontologists, but one of its great men of all science. No paleontologist excelled him in discernment of the morphology of invertebrate Paleozoic fossils or in knowledge of the Devonian of North and South America; no philosopher has ever seen more clearly the lessons that these fossils teach or expressed them in more beautiful diction.

Clarke was born in the beautiful lake resort of Canandaigua, New York, on April 15, 1857. He was of old American stock, with the best of traditions. His father, Noah Turner Clarke, one of the pioneers of Naples, New York, and for fifty years teacher and principal in the academy at Canandaigua, was a descendant of the William Clarke who settled at Dorchester, Massachusetts, in 1663, and became later one of the founders of Northampton. His great-grandfather was a member of the Continental Congress and fought throughout the Revolutionary War. His mother was Laura Mason Merrill, of Castleton, Vermont, a descendant of the Mayflower Company, and of Governor Jonathan Trumbull, of Connecticut.

Clarke's love for nature was inborn, and from his earliest boyhood he was interested in the rocks around his home. His first geology in school he got from his father, who then sent him in 1873 to Amherst, where he came under the inspiration of that devoted teacher, B. K. Emerson. He was given the bachelor's degree in 1877, at the age of twenty. The following two years he assisted his father at the Canandaigua Academy, teaching Latin, mathematics and geology, using Dana's text-book in the last-named subject. In 1879–1880 he returned to Amherst as assistant to Emerson. During the school year 1880–1881, he taught in the Free Academy at Utica, where James D. Dana and G. H. Williams had preceded him. Through Emerson's efforts he was in 1881 appointed to teach geology and mineralogy at Smith College, holding this position until the close of the school year 1883. He was then given leave of absence to study toward a doctorate at Göttingen, under Professor von Koenen, and here he spent parts of two years. Returning to Smith in October, 1884, he remained there until the spring of 1885, when he became lecturer on geology, zoology and German at the Massachusetts Agricultural College. Then followed some months of waiting, spent at Canandaigua, where he continued to work on the Upper Devonian (mainly the Naples fauna), a study begun in the summer of 1877 and intended as his dissertation at Göttingen. Out of employment, he appealed for work to James Hall, whom he had known since 1878. His persistence was rewarded when, on January 2, 1886, he became assistant to the man who was then the master paleontologist of the country. From that day until his death, Clarke was connected with the Geological Survey of New York, rising to the position of state paleontologist in 1898, and in 1904 to that of state geologist and paleontologist and director of the state museum and of the science division of the education department. From 1894 on he was also professor of geology and mineralogy at the Rensselaer Polytechnic Institute in Troy.

Clarke is survived by his wife, formerly Mrs. Fannie V. Bosler, of Philadelphia; by Noah T. Clarke, a son by his first wife, who was Mrs. Emma Sill, of Albany; by two stepdaughters, Mrs. Edith (Sill) Humphrey and Miss Marie Bosler, and a stepson, Mr. Frank N. Sill. Of his brothers and sisters there remain Miss Clara Mason Clarke, who, with Mr. S. Merrill Clarke, a former editor of the New York *Sun,* is still living at Canandaigua; Rev. Lorenzo Mason Clarke, pastor of the First Presbyterian Church in Brooklyn; and Mr. William B. Clarke, managing editor of the Baltimore *American.*

Clarke had a brilliant, alert and well-trained mind. He was elegant in manner and dress and eloquent in speech. As a hard worker he quickly became a prodigious producer of excellent paleontologic and stratigraphic results. Ambitious, perhaps unduly suspicious at times, strong in likes and dislikes, he was also quick-tempered, though he usually had all these traits under good control. In temperament he was a lover of the worth-while and beautiful in nature and in art, and these inborn qualities, with his wide experience, enhanced his ability and eloquence and made him a collector of antique ceramics and furniture and historian of the fisher-folk of Quebec. The same qualities also are reflected in the unusual character of the splendid museum which he developed.

After five summers' work in the field, Clarke began to show results, and his first papers appeared in 1882. They have to do with a rare living molluscan genus, and with rare Crustacea, phyllocarids and barnacles from the New York Devonian. Arthropods were, therefore, his first love among fossils, and they always had for him a dominating interest. In these papers he burst upon the scientific world, as it were, as a full-fledged descriptive paleontologist, since they show nothing of the beginner; even then he wrote well in a clear and direct fashion that, however, as yet showed none of the quaintness of phrase-making, love of strange words and power of embellishment and atmosphere so characteristic of his later writings.

With Clarke's appointment to the New York Survey, his career as a paleontologist and stratigrapher was assured, and from his head and hand there came a continuous stream of the best kind of geologic publications, the great bulk of which were issued by his native state. As yet there is no completed list of his works, but Nickles's "Geologic Literature of North America" gives 192 titles. He must have to his credit more than 250 notes, papers and books, but even this statement does not indicate the volume of his work. A provisional tabulation shows upward of 9,000 pages of printed matter, in which he is godfather to 125 new genera and 865 new species.

Clarke was born on Devonian rocks, and they ever remained the magnet of his endeavors. "The work of a geologist is preeminently what his environment makes it." The strongest pulls were those exerted by the Devonian of New York, southeastern Quebec and Brazil, but he was also attracted by that of Germany, Maryland, Falkland and Argentina. At least one half and probably three fourths of his total output has to do with the paleontology, stratigraphy and mapping of this period. He long ago became one of the two greatest world authorities on the Devonian, the other being Emanuel Kayser, of Germany. Clarke's study of the Upper Devonian faunas of Iberg in that country was written at Göttingen while a student of Von Koenen, and it was at this time that he became acquainted with Kayser. His loyalty to these two teachers of his is shown in his contributions to their *Festschriften:* "Evidences of a Coblenzian invasion in the Devonic of eastern North America" to that of Von Koenen in 1907, and to that of Kayser eight years later, "Conceptions regarding the American Devonic."

The milestones in Clarke's scientific career as shown in his writings are twelve in number. Four of these have to do with stratigraphy and faunal studies (1, 3, 5, 6), three with the morphology of fossils (2, 4, 8), three with the philosophy of fossils (7, 9, 11) and two with history (10, 11). It is not possible here adequately to analyze the significance of these works, and all that can be done is to list them. They are as follows:

(1) The Hercynian question (1889, 1891).

(2) An introduction to the study of the genera of Paleozoic Brachiopoda (with Hall) (1893–1894).

(3) The stratigraphic and faunal relations of the Oneonta, Ithaca and Portage groups in central New York (1897).

(4) A memoir on the Paleozoic reticulate sponges (with Hall) (1898).

(5) The Naples fauna in western New York (1899, 1904).

(6) Early Devonic history of New York and eastern North America (1908, 1909).

(7) Address of the president of the Paleontological Society (1911).

(8) The Eurypterida of New York (with Ruedemann) (1912).

(9) The philosophy of geology and the order of the state (1917).

(10) James Hall of Albany (1921).

(11) Organic dependence and disease (1908, 1921).

(12) L'Île Percée, the finial of the St. Lawrence, or Gaspé Flaneries (1923).

In the early summer of 1900 Clarke was not well, and he needed an outdoor change, and one that would take him away from his scene of action. At that time, he and Schuchert were involved with H. S. Williams in the controversy as to the boundary between Silurian and Devonian, and the New York State Survey and the U. S. National Museum arranged to send both of them to see the most perfect sections of these two periods, those of the eastern Maritime Provinces of Canada. Together they visited the coast of Arisaig, then Dalhousie, Percé and finally Gaspé. Soon Clarke told Schuchert that he had found in Gaspé the hobby that he had long been looking for—a land of quaintness that reminded him somewhat of Scotland, the Old Red, and Hugh Miller, the land of fish, both fossil and recent. In the end Clarke got this entire Devonian problem to work out. The geological results, his *magnum opus*, were published in his two-volume "Early Devonic History of New York and Eastern North America," in 1908–1909. Summer after summer Clarke returned to Gaspé, and in the course of time he became the protector of its seabirds and the historian of this land discovered so early by Jacques Cartier, his affection for it finding expression in "Sketches of Gaspé" (1908), "The Heart of Gaspé" (1913), and "L'Île Percée" (1923). This is a side of Clarke little known to geologists, but one that endeared him to the simple *habitants* of the peninsula.

Gaspé also aroused in Clarke an interest in ceramics, and he published a number of articles on this subject, the most important of which are "English gold lusters" and "The Swiss influence on the early Pennsylvania slip decorated majolica," both privately printed at Albany in 1908.

Clarke's strong historical sense is again seen in his placing of memorial tablets. This began in 1901, when he and a few others placed on the home of Ebenezer Emmons in Albany a tablet commemorating the fact that in this house in 1838–1839 was started the American Association for the Advancement of Science. In 1908 he placed one in Letchworth Park along the upper Genesee to commemorate the first geologic work done by James Hall in western New York in 1839–1843. Five years later, through his efforts, Logan Park was set aside in Gaspé, and here he unveiled before the geologists of the Twelfth International Geological Congress a bronze tablet memorializing Sir William Logan's first field work in eastern Canada. In 1915, at the meeting of the state geologists, a memorial tablet was placed on Hall's private museum in Beaver Park in Albany. The grandest memorial of all, however, was to be unveiled this coming autumn in front of the old Albany Institute—a large bronze statue of Joseph Henry, the first secretary of the Smithsonian Institution, who was a native of Albany. Clarke started the movement for this memorial in 1916, raising $25,000, and he was to have made the unveiling speech; the chairman of the committee which was in charge of the ceremonies has since stated that it had been his intention to make the occasion also the apotheosis of Clarke himself.

Clarke was always much interested in the welfare of the city of Albany. Here he did much to rehabilitate the Albany Institute, one of the oldest scientific societies of the country, and had been its president for many years at the time of his death; helped and cheered on the good work of the ladies of the Dana Natural History Society; had been a trustee of the Dudley Observatory since 1916; and was on the local (and national) council of Boy Scouts, where he arranged for the Mayflower Medal to be awarded each year to the scout having the best knowledge of the local history.

Clarke's championship of the cause of scenic beauty is exemplified in the case of Niagara Falls. The "Menace to Niagara," due to the threat of the power companies to take away, if not all, at least much of the beauty of the falls, was long seen coming, and the fight against it culminated in the New York Assembly in 1904. Clarke stood out against this menace, and in public addresses and otherwise pointed out that "the conservation of Niagara Falls is a question of public morals," since about 800,000 tourists visit the Falls each year and their number demonstrates "how closely the interest of the whole world is focused on Niagara, for these visitors are representatives of every nation. How many hundreds of thousands will seek out Niagara when the world learns that the Delilah of commerce has shorn it of its glory? Will they traverse the seas to behold the wonders of a breakfast-food factory or any other industrial triumph? These are everywhere; Niagara is unique." This battle was won, and a treaty has been made with

Great Britain by which the water of the Falls is kept under reasonable control.

The State Cabinet of New York had its origin in 1843, but it can not be said to have amounted to much until James Hall was placed in charge of it in 1866. In 1904 Clarke was made director of the science division and of the New York State Museum, the successor to the State Cabinet. Three years later Clarke helped in the planning of the State Education Building, which was completed in 1913. In the autumn of that year the State Museum began to move into its new quarters, the entire upper floor, with 60,000 square feet of space. One half of this is devoted to geology and paleontology, an expansion that brought about an increase in the staff and a modernization of the grand collections. The opening of the building took place on December 29, 1916, before the assembled geologists, who were addressed by Theodore Roosevelt. New York now has the best state museum in America, with the finest array of highly significant Paleozoic fossils. From the paleontological side, in fact, it possesses one of the world's most valuable collections, containing upward of 7,000 type specimens, and constituting a mecca to which all students of the older Paleozoic come for inspiration and interpretation. Here also are to be seen most artistic and lifelike restorations of Ordovician, Silurian and Devonian marine assemblages, and this type of teaching had its culmination last February, when Clarke placed before the public a restoration of the Gilboa Devonian forest, a living picture of the first flora to clothe Mother Earth. The New York State Museum is beyond question Clarke's greatest monument.

The philosophy of Clarke's paleontologic studies is to be found mainly in three of his papers, namely, his address to the Paleontological Society as its first president (1911); "The philosophy of geology and the order of the state," being the presidential address to the Geological Society in 1916; and "Organic dependence and disease," published in 1921. His conception of what the life of the past should mean to the living human world may be summed up as follows:

"Paleontology is . . . the most far-reaching of all the sciences. In it lies the root of all truth, out of it must come the solution of the complex enigmas of human society." The great significance of evolving life as seen throughout the geologic ages came to Clarke from his studies of the earliest phases of the parasitic or dependent conditions of life—a study of mutual organic associations that led to commensalism, sessility and finally to parasitism. These modes of life involve "the essential abandonment of normal direct, upright living and the benefactors thereby are types of life which Nature has cast out and aside as hopeless. . . . Individual and locomotive independence, it would seem, has been the major function and prime determining factor in the progress of life. . . . All progress in life, as reckoned in terms of man, has come through independence and through those lines of animal life in which independence has been maintained at any cost. . . . Rescue of dependents is therefore not a part of the scheme of Nature, except through the exercise of intelligence."

On the other hand, the communal life of the social insects shows that "socialism and communism have been tried out and found wanting, and Nature holds conspicuously before the eye of the State the warning that they have nothing either for the growth of the spirit or the progress of the intellect."

"Nature makes for the individual," and this truth "is registered on the tablets of the earth. . . . Over and over again the dominant race has started on its career as an insignificant minority struggling for its existence against an overburden of mechanical and vital obstacles, armed only with specific virtues which have little by little fought their way into the foreground, and by so doing consummated their upward purpose. . . . The majority is purely numerical, while wisdom and truth may rest with the minority. . . . The voice of the people is not the voice of God."

The paleontologist, looking at the record of life on the earth, says to the state: "Be intelligently guided in the treatment of hereditary community parasites, defectives, congenital or confirmed misdemeanants, whatever the form of degeneration may be, by recognition of the presumption that in so far as they can not be physiologically corrected, they are abandoned types in which there lies little hope of repair."

Of "honors which beautify and crown success," Clarke had many: was elected to membership in numerous scientific and historical societies in this country, Canada, England, Germany, France and Russia; made an Immortal in the National Academy of Sciences in 1909; elected vice-president of the Geological Society of America in the same year, and its president in 1916; made first president of the Paleontological Society in 1909; awarded the Prix de Léonide Spindiaroff by the International Geological Congress in 1910 for his geologic work in Gaspé; awarded a gold medal by the Permanent Wild Life Protection Fund (1920), the Hayden Gold medal of the Philadelphia Academy of Natural Sciences (1908), and the Thompson Gold Medal of the National Academy of Sciences (1925); received an honorary Ph.D. degree from the University of Marburg in 1898, that of Sc.D. from Colgate in 1909, Chicago in 1916 and Princeton in 1919, and that of LL.D. from

Amherst in 1902 and from Johns Hopkins in 1915. According to letters from Professor Barrois, of the University of Lille, a further honor was soon to have been his through election to fellowship in the French Academy.

A study of John M. Clarke's works shows clearly that he was one of the greatest paleontologists of his time and one of the geniuses of science, "standing on the mountain-top and catching the first rays of the rising sun," pregnant with new views of nature. But an intimate knowledge of his life also reveals that his path to eminence was hewn out with much labor among his beloved fossils, taxing to the full the many-sided equipment that was his from home, college and environment.

Charles Schuchert,
Rudolf Ruedemann

SOME MATHEMATICAL ASPECTS OF COSMOLOGY

(*Continued from page 99*)

There are many more postulates that are worthy of discussion, but let us suppose that they have been read by title, and that our system of postulates is complete. Everything else that happens in our cosmology must be in harmony with them, for they are esthetic propositions and are not to be profaned with evidence. Evidence and experience are dealt with by *hypotheses,* which include all those statements which we usually call the laws of nature. Perhaps the most fundamental and the best verified of all hypotheses is Newton's law of gravitation, and yet the Neumann-Seeliger proposition, which we have already mentioned, shows that our mathematical formulation of it can not be rigorously true, since it conflicts with our system of postulates. The statement that the effects of a displacement of a body are perceived at distances, however remote, instantaneously is quite likely to be in conflict with any serious system of postulates. Newton's formulation is delightfully simple, and its predictions are almost perfect, but I should very much prefer to think that at distances sufficiently great the attraction of any body whatever is rigorously zero, rather than merely very small. However that may be, we must not push Newton's law "to the limit"; nor, indeed, are we justified by evidence in pushing any physical law "to the limit."

Similarly, the inverse square law enables us to compute in an entirely satisfactory manner the attraction of an electrically charged surface for an oppositely charged particle, provided the particle is not in the surface. If the particle is in the surface the situation is mathematically indeterminate. We escape this evil consequence by a hypothesis of fine structure, so that what is a mathematical surface for some purposes is not at all a mathematical surface for others. Again we must not push the law of attraction to the limit. Perhaps a theory of fine structure could be made to account for the complete disappearance of gravitation at distances sufficiently great. However fine the structure may be, eventually it becomes too coarse for gravitation to act.

A second conflict with our postulates is found in the law of radiation, which, again, is an inverse square law. We have already seen that if this law were rigorously true the entire sky would be as bright and as hot as the disk of the sun. The evidence is squarely against it. Relative to such a situation the sky is very dark and cold, and we must admit that the law is not rigorously formulated. But radiation is energy, and energy can not disappear into empty nothingness. It was this difficulty which led me some ten years ago to make the hypothesis[38] that radiant energy can and does disappear into the fine structure of space, and that sooner or later this energy reappears as the internal energy of an atom; the birth of an atom with its strange property of mass being a strictly astronomical affair. Indeed, with an infinite sequence of physical units, no smallest one and no largest one, each an organized system of smaller units, and none eternal, one can hardly escape the hypothesis that energy runs up and down the entire sequence, and that on the whole as much energy is ascending as is descending.

The rate at which radiant energy is being absorbed in space, and consequently the rate at which atoms are being formed, must be very small relative to the standards of a physical laboratory. Trigonometric parallaxes show that there are only six or seven thousand stars within 100 light years of the sun, while estimates for the entire galaxy run from one to two billion. The distance of most of the stars must be great as compared with 100 light years. Assuming the rate of loss of energy to be proportional to the distance travelled, we find that the radiant energy decreases according to an exponential law, and since the reliable distances are certainly very great the rate of loss must, with equal certainty, be very low. But if this loss is only one per cent. in one hundred light years, the Andromeda nebula is at a distance of less than 50,000 light years instead of 1,000,000 light years as at present estimated.

There is nothing particularly strange about the idea that atoms, or electrons, are formed from

38 *Astrophysical Journal,* July, 1918. See, also, *Scientia,* January-February, 1923.