CHARLES THOMAS JACKSON.

By J. B. Woodworth, Cambridge, Mass.

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Respectfully
Your Obt Servt.
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[Plate IV].

Charles Thomas Jackson, the first state geologist of Maine, Rhode Island, and New Hampshire, was born in Plymouth, Mass., June 21st 1805, the son of Charles Jackson, a merchant of that historic town by the sea, and Lucy Cotton, his wife.

To which of his parents, if to one more than to the other, the youthful Jackson owed his taste for scientific investigation and the grown man his genius for fruitful suggestion, it can not be stated with certainty; but it is believed that his ready memory was a gift from the Cottons.

Dr. Jackson's education and early training were of that liberalizing kind, gained in the attainment of medical lore, which has given to American science so many well-known names. Before the period of the professional scientific schools, an opening to the career of an educated naturalist and geologist was more largely through the study of medicine than by any other means. Medicine alone required at that time an acquaintance with laboratory methods in chemistry and an intimate knowledge of physiology or natural history. He began the study of medicine under the private tutorage of Drs. James Jackson and Walter Channing, who prepared him for entrance to the Harvard Medical school. He graduated as

A few typographical errors uncorrected. J.B.W.

doctor of medicine in the class of 1829, having received the Boylston prize for a dissertation on *Paruria Mellita.*

The young physician had already manifested his predilection for the inanimate world. It is stated that his interest in mineralogy was aroused, while staying in Lancaster, Mass., by finding the crystals of macle or chiastolite, which there abound in the glacial drift. Even before his graduation in medicine, he had in the summer of 1827 visited Nova Scotia with his friend Francis Alger, for the purpose of collecting minerals and making observations upon the geology of that province. He had also, partly for the benefit of his health, tramped through New York and New Jersey, with Baron Ledrer, McClure, Say, Lesueur, and Troost, men whose acquaintance was apt to foster an interest in natural history. In the summer following his graduation, again accompanied by his friend Alger, Jackson went in a chartered vessel to Nova Scotia to continue the examination they had already begun. The results of these excursions formed his first published work.

Evidently with the intention of fitting himself for a high place in the profession for which his tutors had prepared him, Jackson, in the fall of 1829, went to Europe. He studied medicine in the University of France, attending lectures in the Ecole de Medicine, the College de France, and the scientific lectures of the Sorbonne as well as those on geology given by De Beaumont in the Ecole Royale des Mines. With this distinguished geologist he formed a friendship which lasted many years.

In 1831 Jackson walked through a large part of southern Europe, visiting the principal cities. His route took him through Switzerland, Piedmont, Lombardy, Tyrol, Bavaria, and Austria. In Vienna he performed autopsies with Drs. John Fergus of Scotland and Johannes Glaisner of Poland, on about two hundred patients who died of the cholera in the hospitals of that city. Thence he went to Trieste, Venice, Padua, Florence, Rome, and Naples, at which latter place he witnessed an eruption of Vesuvius. Going thence to Sicily, he ascended Etna, and then made a study of the Lipari islands. While in France he had not neglected to examine the volcanic district of Auvergne.

Dr. Jackson returned to America in the same ship with

Morse, the patentée of the magnetic telegraph, to whom there is some reason for believing Jackson gave important help in his experiments. Once again in Boston, Jackson began the practice of medicine, but finding his services in demand as a chemist and mineralogist, he gradually and not against his inclination, entered upon a career in these pursuits. He is afterward said to have expressed some regret that he spent so much time in the study of medicine.

The report on Nova Scotia had already given Dr. Jackson a name as a geologist and mineralogist. The movement for geological surveys which had led to good results in several of the sea-board states came in due time to arouse public interest in the little known region of Maine. The attention of Americans was also called to the importance of the frontier of this state by the claim of Great Britain to more than ten thousand square miles of that tract, the cause of a dispute which was finally settled by the treaty of Ashburton in 1842. It served at the time, probably, to stimulate the legislature of Massachusetts to co-operate with that of Maine in the survey of the public lands owned by the former state in the latter's territory. As a reminder of the former dependence of Maine upon the Bay State, we find duplicate reports of the survey, which Jackson was now called on to make, addressed to the governors of these two States.

Jackson spent the years 1837-1839 in this work. Without maps for most of the area, other than those made by himself, he traversed the country on lines intended to afford him an idea of the dominant features in the topography and geology. His reports set forth the places he visited, the sections he studied, and the names of the owners of the quarries and prospective mines whom he either discouraged or helped by his advice as the circumstances seemed to him to warrant. We find him making a careful study of the intersection of dikes to determine their relative ages, and entering upon generalizations with regard to the systems of intrusion. Everywhere he was on the outlook for some economic advantage which might accrue from his labors to the state, showing in this the peculiar trait of the American geologist under the employ of the public. Many details were recorded evidently for some future use, the author not disdaining to present them because

they did not lead up to some conclusion which it was his endeavor to maintain. "Let us then" he states, "carefully record all facts which we discover, and look confidently forward for some useful result."

It was not without some exhortation that the people of Maine were induced to continue the appropriations long enough to complete the cursory survey which Jackson planned to perform. Among other inducements, there were lectures on geology given before the legislature, of which reports appeared in the Kenebec Journal for 1838. In fact he appears to have experienced the usual tribulations meted out to a state geologist.

This state has been surveyed once since Jackson's time, but our knowledge of its geology is much less complete than is that of many thousand square miles of western wilderness.

Jackson had scarcely brought to a finish the survey of Maine before he was engaged by a committee appointed by the legislature of Rhode Island to undertake a geological and agricultural examination of that state. Two thousand dollars were appropriated for the purpose of defraying the costs. The contract was made in April, 1839, and on May 25th 1840, the manuscript of his report was tendered for publication. One thousand copies of the report were issued, being the first and last official account of the natural resources of the Island state.

From an examination of the report it appears that Jackson made long excursions out of Providence, visiting the principal towns and traversing the important rock groups so as to obtain general cross-sections of the area. The knowledge he thus gained of the geological distribution was fairly accurate. The Carboniferous rocks were separated from the crystalline and igneous rocks on the west and several minor subdivisions in these latter were introduced upon the map. It is only within recent years that geologists have recognized in the "primary" rocks of this report infolded patches of probably Carboniferous rocks.

Everywhere, Dr. Jackson came in contact with the people as was his wont in the examination of Maine. His report is a digest of his journeys with the elaborated results of his analyses of the minerals and soils of the state.

It was his method to give strictly scientific as distinguished from economic geology in the introduction of his reports. It will be worth our while to examine the introduction of the Rhode Island report somewhat at length, since the author has brought together there some of his concepts of the theory of geology.

It is clear from a perusal of this chapter that he was not an advocate of biological methods in geology. His predilection for chemistry and mineralogy manifestly made geology for him a mineralogical rather than a stratigraphical science, and the peculiarly crystalline character of the rocks of New England fostered this view of geology. "It must be evident," he states, "to any one conversant with modern geological works, that they are frequently very deficient in correct mineralogical descriptions of the rocks, while great stress is laid upon the accidental fossils, which they contain. Zoological and botanical characters are certainly of great value and importance, but they are not so decisive, respecting the age of a deposit, as the order of superposition of strata and the mineralogical composition of the rock itself." We shall see presently how he was misled by his reliance upon mineralogical characters and through the setting aside of the plain evidence of recognizable fossils. But we should judge him in this matter by the standard of "the forties" when the system of Werner had yet its advocates among the highest in the ranks of geological science.

It was in the case of the Rhode Island Carboniferous that Dr. Jackson gave way to the prevailing misconception of the meaning of metamorphism in its application to the problem of time. From the fossils contained in the coal measures, he inferred that the beds were of fresh-water origin, "either from lakes or from the estuary of some ancient river," an opinion which the writer believes abundantly confirmed by the most recent studies in this area. He recognized the likeness of the flora of these rocks to that of Pennsylvania and Nova Scotia and to the Carboniferous plants of New Brunswick, England and France, yet he rejected this evidence in fixing the age of the beds. "From the fossils alone," he writes, "a geologist would class the graywacke rocks of Rhode Island with the secondary formations, and make them identical with the coal

measures of England; but it will be difficult for any one who examines the order of superposition and the structure and composition of the rocks themselves to support such an opinion."

The Carboniferous rocks in the area in which he studied them present strong schistose and gneissoid phases, in places quite as well marked as in the region of his primary group. Crystals of garnet, andalusite, ottrelite, magnetite, and other metamorphic minerals, the most significant of which were observed by him, distinguished the matrix of these plant-bearing strata in a marked way from the coal fields of the standard sections. Because they were metamorphosed, he believed the rocks to be older than the Carboniferous of Europe. Had he seen the Massachusetts extension of these rocks, he would have found less evidence of this change.

But whatever bias Jackson may have displayed in crediting to mineralogic features values which he denied to biologic evidence as indices of relative age, he evinced a keen sense of the local geologic conditions. His understanding of the structure of the highly folded and metamorphosed rocks of the Carboniferous in Rhode Island has for half a century been little improved on by others.

He seems to have considered a numerical division of the groups of strata preferable to "any of those fanciful names" which took the place of Werner's Transition series. "It is evident," he adds to this expression of his choice, "that the names Cambrian and Silurian proposed for certain groups in England, will never be regarded in this country, as appropriate terms for our rocks." The old name was good enough for him, and so he wrote, "I therefore adhere to the name Transition as originally applied."

Though primarily an investigator, Jackson was at the same time and in his own way a teacher. The introductions to his reports are brief text-books of the science as he understood it. Even the pedagogical question of the order of presentation of geologic phenomena is debated with the reader, and in opposition to the then prevalent practice of English geologists of beginning with the phenomena of to-day and going downward in the rock history, he insists on the advantage of the ascending order, inasmuch as it sets forth the antecedent circum-

stances of each succeeding series of sediments and products of change.

Like Noah Webster, he made use of his wanderings in the rural districts to disseminate his views, and while one thus attempted a reform in the spelling of New England the other sought to improve the relations of men to the earth.

This report like the others from his pen was addressed to the people in language which they understood. His was not the task of the geologist detailed to report upon an uninhabited terrane, who writes for readers who know the area surveyed only through the medium of the printed page and the topographical map. His report could convey no description of the landscape to those mostly interested in it, for they knew it better even than he did. It was in the economical and agricultural side of his investigations that appreciation was to be bestowed on his work. The vast resources of the West were not yet made known. The soils and bog ores of New England still presented possibilities for agriculture and for industries which led the small landowner to entertain hopes which the succeeding years of national exploration and discovery have ever since proved false.

His Rhode Island report is embellished with some of the lore of the country folk. Just as Herodotus upon his entrance into Scythia was shown, among the curiosities of that country, the footprint of Hercules near the Tyras, so Jackson on going into Rhode Island had pointed out to him as the natural wonder of the land the Devil's foot-prints on the sandstone-gneiss ledges near Wickford, pits of differential weathering which remain to this day the common knowledge of the Rhode Island-born. Not to have incorporated this legend would have rendered the report of the state geologist incomplete.

In his geological work, Jackson saw everywhere the effects of igneous causes. He attributes the tilting of strata at Miantonomah hill near Newport to subterranean fire. He notes the crystals of magnetite in the paste of the conglomerates at Purgatory and regards their occurrence "as an absolute proof of the agency of fire, which has fused the cement and crystallized the oxide of iron." Once only do we find him tripping in his field observations in this survey. The wave-washed chasm in the conglomerate ledge at Purgatory, he makes the

site of a dike, "a small portion only remaining in the south end of the rent, to attest its former presence." The chasm, it has since been determined, is undoubtedly due to the removal of more finely jointed rock lying between master joints in the conglomerate.

Jackson even extended his views of igneous causes to the explanation of gneiss, thus anticipating the conclusion though not offerring the basis for it, which later investigators have worked out with the aid of the microscope. He regards gneiss in one stage of his work as the rapidly cooled crust of granite. Mica-schist he admits may be of metamorphic origin, that is in the Lyellian sense. In explaining the amphibolite of the pre-Cambrian area of Rhode Island, he states, "I am of the opinion that it derives its occasionally stratiform structure from an admixture of argillaceous slate rock through which it was elevated, or that the hornblende rock has partially fused and assimilated the superincumbent slates." But here he appears to have taken a hint from De la Beche, who held to a similar hypothesis.

In common with the elder Hitchcock, Jackson recognized in southern Rhode Island a group of clays and sands older than the very latest drift phenomena, but he included with these deposits the extensive sand-plains which occur about Providence. Under a mistaken notion as to their origin, these beds were referred to the Tertiary period. It is now known that the sands and clays pertain to a succession of glacial deposits, the Columbia and succeeding deposits of the Pleistocene.

In the matter of geological forces, he was not strictly a Strabonian. In speaking of the disintegration of rocks, he considers "the causes formerly in action vastly more energetic than they are now."

The Rhode Island report was not yet completed when Dr. Jackson was appointed state geologist of New Hampshire, Sept. 10th, 1839. By the law which authorized this appointment, provision was made for one assistant, "who shall be a skillful analytical and experimental chemist." To this office J. D. Whitney was appointed in December, 1840, and served in the laboratory that winter. Subsequently other assistants were employed. Although Jackson and Whitney parted com-

pany at about this period of their careers, we shall find them shortly engaged in succession in the same geological field: and however much they may have differed eventually in opinion, it is worthy of remark that Jackson chose Whitney to be his first official assistant in his geological surveys.

The four years from 1839 to 1843 were given to this survey, the final report appearing in 1844. Annual reports were made, the form of which is preserved in the final monograph. The title of this work bears the characteristic of the author's aim in the added words "with contributions towards the improvement of agriculture and metallurgy." The introductory chapter is, like that of the Rhode Island report, interesting reading to the student of American geology. In it Jackson frees himself from the details of minerals and rocks as such and the localities in which they occur, in order to discourse upon the principles of geology, its nomenclature, and upon the relation of the rocks of New Hampshire to the standards of the European column.

Neither at this early period nor later in his writings does he appear to have become involved in the intricacies, either pro or con, of the Taconic question. This is probably for the geographic reason that his field of investigation lay mainly to the eastward of the area studied by Ebenezer Emmons. Yet Emmons found his Taconic system in Rhode Island and also in Maine. From the latter state, he describes *Nereites jacksoni*, "a name," he states, "conferred from respect to my esteemed friend, Dr. C. T. Jackson." It appears also that Jackson in later years, as at the time his field work was done, was not interested in questions of chronology.

With singular conservatism, he retains in bold type in the New Hampshire report, the Wernerian "Transition" group as the best term in his opinion for rocks denominated Cambrian and Silurian by Sedgwick and Murchison. Yet there is nothing of intolerance or a wish to suppress their views. He gives their names place in the text and protests against their use rather than refuses to employ them. He strengthens his arguments advanced in the Rhode Island report, and remarks "that we must regard these terms as merely provisional; for we cannot discover any relationship between rocks formed ages anterior to the creation of man, and the tribes who in com-

paratively modern times, happened to dwell upon the surface; nor can it fail to strike one as absurd, that the rocks forming a large portion of this continent and that of northern Europe should be called after the former inhabitants of a small tract of country in England and Wales. We object," he adds, "to the introduction of mere local names into general geology, and would prefer a numerical arrangement, when it can be generally agreed upon by the scientific men of Europe and America. It will be better to adhere to the old groups, primary, transition, secondary and tertiary, since these are universally understood and convey with sufficient accuracy the ideas of their arrangement, while each group may be subdivided at pleasure, into as many strata as contain peculiar fossils."

With this commendable project, not however without a leaning towards the Wernerian mineralogical school, Jackson was throughout consistent.

In not one of the three New England states on which he by priority of his surveys had the privilege of placing rock names of his own choosing did he leave a local designation or fasten a system of stratigraphy differing from that previously known. His reason for not applying rock names seems to have depended more upon his ideal of a geological nomenclature than upon doubts in regard to the identity of important groups. It is somewhat remarkable to note him working in this manner, refraining at every step from a practice, which his contemporaries west and south of the Hudson were following, mainly with success in New York state. But the conditions differed vastly on the opposite sides of this river. There was little incentive in Jackson's environment to make out a time scale for the rocks. The gnarled and topsy-turvy stratigraphy of eastern Massachusetts may afford a birth-place for a James Hall, but it will not rear him. He must be transplanted while young and impressionable to a region of more orderly rocks than that of Hingham. Jackson's mind responded to a terrane in which chemical, mineralogical, and structural questions predominate over the clearer facts of vertical succession, as presented west of the Taconic range.

In view of the complexity of New England geology and of the time at his disposal for the elucidation of the intricate

problems of geological succession which have since come to light in this field, it must be admitted that the course pursued by Dr. Jackson in these state surveys was on the whole wisely chosen. To have attempted to make out a standard section with local names in accordance with the plan pursued in the neighboring states of New York and Pennsylvania at this time or a little later would have proved disastrous. It was in a later period and in other minds that there grew up in this region, while the schistose structure was still regarded as akin to stratification, a classification of rocks whose ruins have hardly yet been cleared away in the search for the true order of events in this field. Jackson in New Hampshire as in the other states studied by him was seemingly content with setting forth the economic facts of his discoveries, and on the whole the task of the modern geologist in New England is made the easier by Jackson having denied himself the Edenic privilege of giving names to things. The right man in the right place and at the right time may bring out a standard classification for a state, a country, a continent, or for the world. But an attempted system of this character, failing of adoption, locks up voluminous and often valuable reports under the rusty keys of a cumbersome and unknown terminology.

Though a laboratory habitué, Jackson was particularly at this period an active field worker, and allowed no trifling barrier to stand in the way of his field inquiries. It was in the progress of the New Hampshire survey that he dove to the bottom of a pond to find beneath the mud a deposit of iron ore whose presence was suspected there. This and other incidents of travel and simple adventure are written down in his report as interlarding to the technical results of his researches.

In 1847, Jackson was appointed U. S. geologist to report upon the public lands in the Lake Superior region. After spending two field seasons in this work, he resigned, for reasons best known to himself and the then unfriendly authorities in Washington. In the company of Hon. David Henshaw, ex-secretary of the Navy, he had previously made a visit to this district while employed in the New Hampshire survey and found copper. He did his share in opening up this great copper region. There was incredulity in the East in regard to this

store of native copper. In a letter to the editor of Silliman's Journal, after noting a fifty-ton lump of copper, Jackson adds, "Those who were surprised that I recommended working mines for native copper, should come and see and they would believe."

Important as were the economic results attained in this field by his labors, his views of the geological structure and of the succession, if properly understood at the present day, are not in accord with the most recent results obtained in that field. Foster and Whitney succeeded to the work in the copper region. They set aside the theoretical work of Jackson, and in turn their views have been displaced by later investigators. Such has been the history of progress in other fields.

In the reaction from the doctrine of Werner concerning the basaltic rocks, the geologists of the middle years of the century just closing were largely blind to the evidence of igneous rocks which were not intruded but spilled out over the surface in the form of contemporary sheets. The enormous lava flows of the Keweenaw peninsula were regarded by Jackson as intrusive rocks capable of elevating the sandstones with which they are associated. It is only within recent years that the essential flow character of the trap masses in the upper portion of the Connecticut valley has been recognized. If Jackson made a mistake in this matter, he has had able company in the years that have passed. The age of the red sandstones on the north side of the peninsula still depends upon local evidence of unconformity. Jackson seems to have considered the rocks of Triassic age, agreeing with Marcou; later he expressed some doubt. Now the rocks are placed by the U. S. geological survey between the lower Cambrian and the Huronian. But Jackson in later years thought that our red sandstones might be of very different ages. It is not probable that he attached much importance to the question of age of the Lake Superior sandstones. There, as in New England, it was the economic geology which interested him mostly.

Before passing from this phase of Dr. Jackson's work, it should be stated that he was appointed one of the state geologists of New York by governor Marcy, but resigned. He had also been called upon in planning the work of that survey.

Jackson's work as a state geologist came to an end with the first half of the century. Thence forward we find no abate-

ment of his interest in the science, though his work is more limited in its scope, being mainly mineralogical and chemical. His work in mineralogy was of a character to link his name in one way or another with several minerals. Masonite which he named and described in the Rhode Island report is regarded by Dana as an impure substance and is referred to chlorotoid. It was rather his own fault than professor Whitney's that Jackson's name is not borne by one of the Lake Superior minerals. Jacksonite was proposed by Whitney for a supposed hydrous prehnite from Keweenaw Pt. and Isle Royale. Dr. Jackson, with his accustomed method of procedure in such cases subjected this mineral to analysis and found that it was lacking in the requirement of water, a conclusion with which Dana concurred.

Jackson appears to have been the first to observe the occurrence of tellurium and silenium in America. He was also the first to report amazon-stone (1859). His geological inquiries led him into the field of mineral genesis, and we find him boldly demanding a deepseated origin for substances then thought by many to be due to the selective action of organic life. Phosphate of lime, he argued, is not necessarily of organic origin, since it is found in igneous dikes. For the same reason he concludes that phosphorus is an element in the interior of the globe.

Perhaps his most important work in mineralogy was economical in its character. The emery mines of Massachusetts remain a monument, hollow and inverted, it is true, to his acumen in this field of research. As he himself states, this locality was found by Dr. H. S. Sears, but it was Jackson's part to develop the real value of the locality. From the minerals already known there, he inferred the existence of emery and found it. Up to that time, a London banking house controlled the only workable deposits of this variety of corundum, those of the Grecian archipelago.

His exploitation of the lean ore bands of New England deserved better success to himself and to land owners than have accrued in the years since traces of metals were discovered in this area. Numerous were the rumored occurrences of tin, gold, and other useful ores which he diligently ran down and investigated in hopes of their proving of industrial impor-

tance. Few of these finds proved little more than a stimulus for further search.

Dr. Jackson was a fairly good naturalist of the old school. Neither zoölogist nor botanist, he was an observer of animals and plants in life, to say nothing of his stewing and cooking them in his beakers and condensers after they were dead for the sake of the information they would then afford. Witness his observations upon the bream, the ale-wife, the sand-sharks of Nantucket, the Spongilla in the Brookline reservoir, the pink water-lily, the studies of the habits of the beaver, and the notes on the giant Sequoias of the Sierras. But he was particularly acute in the detection of mineral matter, largely because he was forever analyzing. He found traces of manganese in the waters of the middle of lake Superior; he found fluorine in the bony scales of certain fishes; and before the discoveries of Berzelius, although he did not name it, he detected humic acid in the soils of Rhode Island. Sometimes his discoveries were of more than scientific interest, as was that of emery just described in the still worked mines of Chester, Mass.

Almost disdaining to trust to fossils in the correlation of the stratified rocks, particularly where metamorphism was present, he was a constant collector of fossil fishes and other forms met with in his field work. He even described several species of Palæoniscus. Some of the Deep River fossils described by Ebenezer Emmons, in his North Carolina report were collected by Jackson.

Jackson's scientific life for over a quarter of a century following the period of his active duties as a state geologist, is an integral part of the history of the Boston Society of Natural History, and the records of this institution afford a valuable commentary on his ready information in various departments of natural science. Elected vice-president of the society in 1847, and declining on account of impaired health to be made president in 1870, he was a faithful attendant on the meetings of this organization during this long period; and was quite as often in the president's chair, as was the duly elected officer to that post. Here Jackson brought the discoveries of his field and laboratory work and the ripened conclusions of his earlier geological inquiries, finding among his

hearers Louis Agassiz, Jeffries Wyman, T. T. Bouvé, T. Sterry Hunt, and numerous younger men, among whom the names of LeConte, Shaler, Niles, Hyatt, and others are recorded in the reports of these meetings.

On these ocassions, Dr. Jackson was ever ready with questions and remarks elicited by the papers of others, when his own abundant labors were not the subject of discussion. The store of his ready information and the range of his interests and investigations are shown by the list of his remarks published in the biographical notes appended to this paper.

To the geologist, the records of these gatherings afford a clearer insight into Dr. Jackson's views on many questions than do his special works upon areal geology. His idea of the origin of elongated pebbles in conglomerates through the shaping action of waves on a beach, his general denial of belief in the glacial theory of professor Agassiz, his disavowal of the derivation of igneous rocks through the fusion of sediments in the ultra-stages of metamorphism, are conclusions which find a place in these proceedings along with the propositions and rejoinders of his able associates. From time to time he made more important contributions to the publications of the society.

Dr. Jackson did not always push his theories of geological phenomena to the fullness of conclusion and statement which would enable us at the present day fully to understand them. He had too many irons in the fire to do as he would with all of them. Here and there, as in the chance remarks of many of the older geologists, we find the germs of theories which have since been prominently advocated. In discussing the joints of the Roxbury conglomerates, near Boston, he anticipates Crosby's elaborated thesis, by suggesting that earthquake shocks might have been the cause of the phenomena. He pointed out a criterion for distinguishing ice-borne from water-transported detritus, the first remaining coarse up to the limit of distribution, the second decreasing in size of the particles as the distance from the original source increased. This point has since been made out in the study of glacial phenomena in the Alps.

Although an advocate of deformation of the crust by the agency of internal heat, he put forth the idea which in its

thoroughly qualified form we know as the doctrine of isostasy. He recognized the effect of the shifting of load through denudation. He supposed that when the difference of level had become sufficiently altered to be adequate to overcome the resistance of the earth's crust a paroxysmal elevation might take place, with all the phenomena of an earthquake, as happened in China in 1834.

Occasion has already been found for referring to his methods of correlating strata. In all this and what follows, we must remember that immense strides have been made in the understanding of this problem within the lifetime of the younger geologists. Jackson simply reflected the methods of others when he was led by a question to state that he "had sought carefully for impressions of rain drops" in the Lake Superior sandstones, "for the purpose of identifying the age with that of the Connecticut River sandstone, but in vain."

Metamorphism, if we may accept most of the references he makes to the subject as embodying his views, is the result of igneous action. Yet he thinks hot water under ocean pressure a satisfactory explanation of the making of the anthracite of Pennsylvania. His explanation of gneiss has already been referred to. He did not regard water of crystallization in igneous rocks as proof of their original sedimentary condition. Fragments of slates in the granites of the White Mountains, he thought to be an occurrence irreconcilable with the view that the igneous rock was melted down sandstone and slate. His conception of igneous rocks was that which is held by the modern petrographer. Jackson believed thoroughly in the intrusive origin of these rocks. He saw in them no signs of a previous clastic texture or stratified condition.

Jackson's laboratory was a well known place. It was one of the first if not the first of chemical laboratories in this country to receive students. His reverend friend, Dr. Bartol, who was a frequent visitor there, tells an anecdote of the place. "One day," so Jackson told him, "a countryman came in with a handkerchief full of those yellow blocks called iron pyrites, saying he had found a gold mine on his farm, and would not take no for an answer. The patient chemist held some of the little cubes in his shovel over a blazing fire till

the sulphur was disengaged, and then, putting the smoking mass under the farmer's nose, asked him what that smelt of. '*Hell*,' was the somewhat hasty reply."

Jackson was a genius. He had the inventive faculty; the habit of incessant investigation; the capacity of getting tangible, fruitful results; and the ability to suggest successful expedients to others. Geologists think of him as a geologist. He had other callings. At the end of his manual of Etherization of 1861, we find his card.

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Be Beaumont* wrote of him in 1852 as "bien connu par ses travaux sur la geologie de plusieurs parties de l'Amerique du nord et plus celebre encore par son important decouverte de l'Etherization." In the public garden at Boston is a statue erected to the discoverer of the use of ether as an anæsthetic in surgery; but no name is inscribed thereon. That blank marble tells nothing of the mental anguish and of the closing days of the rival claimants for the honor which the distinguished author of the Pentagonal Network unqualifiedly gives to his friend Jackson. The arguments of the famous "ether controversy" are not germane to this sketch of Jackson, the geologist. Jackson, it should be stated, was a claimant for priority of the discovery. The French academy of Sciences awarded him the honor. There were other claimants, Morton and Wells. It is stated that Dr. C. W. Long, a physician in Georgia, performed surgical operations by the use of sulphuric ether four years before it was employed in Boston. Some of the writings on this subject of dispute are given in the appendix.

Dr. Jackson occasionally gave lectures on geology, as at Lexington in 1855. These were generally delivered from carefully prepared manuscripts. From the manuscript of one of these lectures, we learn his views in regard to design in the

* Notice sur les Systemes de Montagnes, p. 702.

world. "From an attentive study of the structure of the earth," he states, "we cannot fail to discover that it has been made after a preconceived plan, and that the highest wisdom is manifested in the adaptation of the world to the uses of man."

Scientific work mainly occupied the attention of Dr. Jackson until 1873. Then his active mind gave way. The recovery for which his friends hoped never came; and on the 28th of August, 1880, after seven years of suffering, Dr. Jackson died in a department of the Massachusetts General Hospital.

Dr. Jackson is described by those who knew him as an enthusiastic person, a ready conversationalist, even eloquent in his speech, and fond of telling stories. His friend, Dr. C. A. Bartol, whose church Jackson attended, says of him that he "was simple as a child and veracious like the sun." The controversies in which he became involved brought out his fighting qualities. "He was a man," states Dr. Bartol, "whose self-respect did not allow him to waive his own claim, and of course his attitude could not please those who were inclined to reduce them to the lowest point."

He is remembered as a rather large man, who might be seen in his laboratory absorbed in work and unmindful of his personal appearance. The portrait reproduced in this sketch represents him as a young man. In a photograph taken later in life, the head appears more massive, the shoulders squarer; the beard covers more of the cheeks; the physiognomy exhibits more firmness and something of complacency, for despite disappointments, Dr. Jackson received recognition and honors for the share he had in the use of anæsthetics in surgery.

Dr. Jackson was a member of numerous learned and scientific societies in his own country and abroad. The plain title page of his Rhode Island report makes known that the author is a Fellow of the American Academy; Member Geol. Soc., France; Memb. of Imperial Min. Soc., St Petersburg; Memb. Boston Society Nat. Hist.; Cor. Memb. Acad. Nat. Sci., Phil.; Lyseum Nat. Hist., N. Y.; Albany Inst.; Nat. Hist. Soc., Montreal; Providence Franklin Soc.; Hon. Memb. Maine Inst. Nat. Sci. He was also a member of Amer. Assoc. Geol. and Nat., of which organization he was chairman in 1845-46. Later he became Chevalier de la Legion d'Honneur; Caviliere dell Or-

dine dei S. S. Maurizio e Lazzaro: Ritter des Rothen Adler; Knight of the Turkish Order of the Mejidich. Numerous other scientific and medical societies sought to honor him with membership in their organizations.

Dr. Jackson was married to Miss Susan Bridge of Charlestown, Mass., on the 27th of February, 1834. Three sons, two daughters and his wife survive him.

BIBLIOGRAPHY OF DR. C. T. JACKSON.

The following list includes such references as the author has been able to find. A few chemical analyses in the U. S. Patent office reports are omitted. Most of the articles have been examined and the references verified, particularly those relating to geology. A few papers cited in the Royal Society's catalogue or published in the North American Review and the Am. Jour. Agriculture, and others of a controversial nature have not been seen. A few titles have been taken from Darton's Catalogue and Index of Contributions to North American Geology, 1896, and from Russell's Index to the Literature of the Newark System, Washington, 1892.

In most cases the year is taken from the title page of the work. In the case of the Proceedings of the Boston Society of Natural History, beginning with October, 1843, the date of the signature at the bottom of the page is considered to be the real date of publication, and has been so taken in this list. In the case of several societies, the date of the title page is from one to two years later than the date of the actual publication of parts and the distribution of reprints.

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Third Annual Report on the Geology of the state of Maine. Augusta, pp. 276. Abstract Amer. Jour. Sci., XXXVII, 1839, 376-380.

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On tin ore and chlorophyllite from New Hampshire, pp. 45-46.

On inversion of strata at Mansfield, Mass, p. 62.

On ore of antimony, copper, silver, etc., in New Hampshire, p. 90.

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Remarks on the saline and other ingredients of Zea mays and other grains, pp. 123-124.

On a buff-colored salt of lead from maple sugar, pp. 126-127.

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On the construction of an improved mountain barometer, pp. 33-38.

Separation of silica from plants, p. 44. From stems of reeds, rushes, straw and grass.

Remarks on cancrinite, nepheline, elæolite, and zircon, from Litchfield, Me., pp. 44-48. Gives chemical analyses.

Chemical analysis of the Rosendale and Connecticut hydraulic limestones and cement, pp. 48-49.

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Remarks on Forbe's travels in the Alps, p. 33.

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1846.

Proc. Boston Soc. Nat. Hist., ii, 1848.

On the importance of the science and art of mining, pp. 110-114. Gives

observations upon lake Superior copper district. Abstract in Amer. Jour. Sci., II, 1846, 118-119.

On copper and zinc ores from Warren, N. H., p.147.

Remarks on a paper on the geology of a portion of the White Mountains, by professor W. B. and H. D. Rogers, (in the Amer. Jour. Sci., May, 1846,) p. 147-148. Argues against melting of sandstones and slates in the formation of the White mountains; notes included fragments of slate in the granite.

Chemical analyses of sand from the desert of Sahara, p. 170.

On copper ores from Coate's mine, Frederick Co., Md., p. 185.

Amer. Quart. Jour., Agric., iv, 1846.

Analyses of soils, pp. 220-238.

Analyses. Sale of mineral lands, reports of committees, 1845-46. (By J. H. Rolfe). 29th Cong., 1st session, III, No. 591, 1846. Cited by N. H. Darton.

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Boston Jour. Nat. Hist., v, 1848.

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Proc. Boston Soc. Nat. Hist., ii, 1848.

Exhibition of cartilage from mastodon bones, p. 198.

On the Tertiary of Maine, p. 213. Deposits from Lubec to Portland, now known to be Pleistocene.

On analysis of snow at Boston, p. 217.

On crystals of a bi-sulphate of copper and zinc from cinders at Point Shirley, p. 218.

An experiment in the fusion of feldspar, p. 218.

On cetacean vertebræ from a clay stratum in Machias Me., p. 255.

On palæontology of the Diluvium of Maine, p. 256.

On copper from lake Superior, pp. 259-260.

Boston Medical and Surgical Journal, xxxvi, 1847.

Remarks on the discovery of etherization, p. 180.

1848.

Amer. Jour. Sci., v, 1848.

Translation of a tribute paid to American geologists by M. L. Elie de Beaumont, in Leçons de Geologie Pratique, pp. 137-138.

Translation of a circular addressed to C. T. J., as president of Assoc. Amer. Geol. and Nat., in regard to a statue of Geoffrey St. Hilaire, pp. 138-139.

Ibid., vi, 1848.

Discovery of Tellurium in Virginia, p. 88. From auriferous vein in Whitehall, near Fredericksburg.

A new method of extracting pure gold from alloys and from ores, p. 187. Oxalic acid and carbonate of potash method. Also in Edinb. New Phil. Jour., XLVI, 1849, 164-166.

Proc. Boston Soc. Nat. Hist., iii, 1851.

Remarks on Prof. Hare's experiments on fire-flies, p. 8.

Remarks on metamorphosed rocks, pp. 19-20. Did not regard water in minerals as proof that they were not of igneous origin.

Observations upon the drift scratches on the Roxbury conglomerate, p. 28. Fracture of the pebbles runs N. 30 degrees E.

Notes on the solubility of gun cotton, p. 30.

Remarks on a zeolite mineral from lake Superior, pp. 76-77.

1849.

Amer. Jour. Sci., vii, 1849.

Copper of the lake Superior region. (A letter to the editor). pp. 286-287. Notes a 50-ton lump of copper. "Those who were surprised that I recommended working mines for native copper should come and see and they would believe."

Proc. Boston Soc. Nat. Hist., iii, 1851.

Observations on an oyster bank near Newcastle, Me., p. 88.

Remarks on the relative age of the American continent, p. 88. Considered oldest on account of the granite showing marks of greater age.

Remarks on gold ore from Virginia, p. 122. First report of Tellurium and Silenium in America.

Remarks on the structure of ice and glaciers, pp. 124, 126.

Remarks on fissures in puddingstone of Roxbury, p. 127. If due to contraction, pebbles should drop out. Suggested that an earthquake shock might have been the cause of the phenomenon. Considered the puddingstone anterior to the coal.

Observations on the comparative effects of the inhalation of nitrous oxide and the vapor of chloroform and sulphuric ether, pp. 132-133.

Report on the geological and mineralogical survey of the mineral lands of the United States in the state of Michigan. Ex. Doc. No. 5, House Reps., 31st Congress, 1st Sess., pt. 3, 1849, pp. 398, 399, 452.

1850.

Amer. Jour. Sci., ix, 1850.

Description of the Vermiculite of Millbury, Mass., pp. 422-428. Communicates an analysis by Richard Crosseley.

Boston Jour. Nat. Hist., v, 1850.

Anhydrous prehnite. Analysed Jacksonite, Whitney, and found the same percentage of water as in prehnite. Abstract in Amer. Jour. Sci., x, 1850, p. 121.

Proc. Boston Soc. Nat. Hist., iii, 1851.

Remarks on the exemption of the primary formations from cholera, pp. 168-169. C. more likely to occur on recent and tertiary rocks owing to the character of the water drunk.

The mirage of lake Superior of the months of July and August, 1847, p. 169.

Remarks on a calamite from Bridgewater, Mass., p. 223.

Remarks on salt and carbonate of soda from the west, pp. 223-224.

Analysis of water from a hot spring in the region of the Great Salt lake, p. 224. Reprinted in Amer. Jour. Sci., x, 1850, p. 134.

Remarks on the plumbaginous mica slates of Vermont, p. 224.

Remarks on Foster and Hill's opinion as to the age of the lake Superior sandstone, p. 228.

Eulogium upon Dr. Martin Gray; p. 231. By title only.

Analyses of three samples of white cast iron, pp. 232-235.

Remarks on the desirability of examining a sandstone in the quarry, p. 241. Best test for resistance to weather.

Analysis and description of Vermiculite from Millbury, Mass., pp. 243-245. Analysis by Richard Crosseley.

On a mineral named Jacksonite, pp. 247-248. "The purport of the paper was to show that Jacksonite is not a new mineral.... Mr. Whitney being present, stated that he had full confidence in the results of his own examination of the mineral in question, and he must still consider it a new mineral." J. D. Dana accepts Jackson's criticism.

Remarks on Prof. Rogers' theory to account for the origin of the green sand of New Jersey, p. 249. "The process would be similar to that of the drying of French green."

Suggestion that bog iron ore combined with lime would be of agricultural use, p. 257.

Remarks on an Aztec skull from Mexico, p. 260.

Analyses of Algerite by Mr. Crosseley, pp. 278-279.

Description and analysis of asphaltum recently discovered in New Brunswick, pp. 279-280. Asphaltum from Dorchester, N. B.

Remarks on artificial minerals from slags of an iron furnace in Pennsylvania, p. 282. Also in Proc. Amer. Assoc. Adv. Sci.

Remarks on the change of level of lake Superior, p. 292.

Description and analysis of Tellurium ore from Whitehall, Va., pp. 297-299. Also in Proc. Amer. Assoc. Adv. Sci.

Observations upon the solution of lead and tin by Cochituate water. p. 299.

Remarks on iron ore from the Allegheny river in Penn., p. 319.

Remarks on the effect of concentrated sulphuric acid on minute algæ and spores, p. 320.

Remarks on tertiary deposits in Duxbury, Mass., pp. 323-324, p. 329.

A shark's tooth, a cetacean vertebra, lignite and a cast of a Tellina, in Marshfield in a clay marl over a green sand, 30 feet from the surface. Also Proc. Amer. Assoc. Adv. Sci., IV, 1851, p. 251.

Remarks on pot-holes in N. H. and N. J., p. 324. Also Proc. Amer. Assoc. Adv. Sci., IV, 188-190.

Some observations on the age of the sandstones of the United States, pp. 335-336.

On crystals of Allanite, containing protoxide of cereum in Labrador feldspar at Franklin, N. J., p. 326. Also Proc. Amer. Assoc. Adv. Sci., IV, 1851, 324.

Appointed a committee with Dr. N. B. Shurtleff and Dr. Cabot, Jr., to memorialize Congress on the subject of attaching a corps of naturalists to the Mexican Boundary Commission, p. 326, 330.

Observations upon the age of the sandstones of the U. S., pp. 335-336; 337-339. Thinks age of all our red sandstones questionable.

Bull. Geol. Soc. France, (II) vii, 1850.

Remarque sur la géologié du district metallifère du Lac Superior, pp. 667-673.

An address before the Plymouth Co. Agricultural society, Bridgewater, Sept. 25, 1850, 8to, pp. 29.

1851.

Amer. Jour. Sci., xi.

Geological report on the lake Superior copper region, pp. 147-148. Also Karsten Archiv., XXV, 1853, 656-667. A notice.

Proc. Boston Soc. Nat. Hist., iv, 1854.

Description and analyses of pitch stone from Isle Royale, lake Superior, pp. 47-49. He argues that phosphate of lime is not necessarily of organic origin, since it occurs in igneous rocks.

Remarks on "Asphaltic coal" from New Brunswick, pp. 55-56. Also exhibits sticks of phosphorus made from phosphate of lime from New Jersey.

On coal and ganoid fishes from the head of the bay of Fundy, pp. 64-65. Also ibid., pp. 73-74, together with observations on Sigillaria.

Remarks on the insoluble portion of the coal from Hillsboro, N. B., p. 81.

Proc. Amer. Assoc. Adv. Sci, 4th meeting, New Haven, 1850. 1851.

On ancient pot-holes in rocks, pp. 188-190.

On Tertiary fossils at Marshfield, Mass, p. 251. Paper not published. See Proc. Boston Soc., N. H., III, 323.

Description and analysis of Allanite from Franklin, N. J., pp. 323-324.

Description of Bismuthic Tellurium or Tetradymite from the gold mine of Whitehall, Virginia, with an analysis of the mineral, and its relations to the gold associated with it, pp. 324-325.

On the manufacture of zinc and zinc white, pp. 335-337. Description of works at Franklin, N. J., and of process and mills at Newark, N. J.

Analysis of red marl of Springfield, Mass., pp. 337-338. An igneous contact product. Showed wood painted with it.

Remarks on the limits of barrenness and fertility in soils, p. 338.

Artificial minerals from an iron furnace in Easton, Pa., pp. 384-385. Gives analysis.

Zircon, sodalite, cancrinite, etc., from Litchfield, Me., pp. 385-386. By title only.

Report on the Albert coal mine, containing an account of the situation and geological relations of the rocks, including and accompanying the coal. New York, 1851, pp. 58. (With reports by Percival and Aug. H. Hayes.) Maps and plates referred to but not accompanying copy in Library museum, Comp. Zool., Cambridge, Mass. Reviewed in Amer. Jour. Sci., XIII, 1852, pp. 276-277. Darton lists a Boston edition; not seen.

Anniversary address before the American Institute, 16th Oct., 1851. New York, 1851, pp. 23.

1852.

Proc. Boston Soc. Nat. Hist., liv, 1854.

Remarks on raindrop imprints and allied phenomena, pp. 131-132. "Has sought carefully for impressions of rain drops (in the lake Superior sandstones) for the purpose of identifying the age with that of the Connecticut river sandstone, but in vain."

Description of five new species of fossil fish and notices of fossil plants from the shales of the coal formation at Hillsboro, N. B., pp. 138-143. Palæoniscus alberti, P. brownii, P. cairnsii, P. sp.

Remarks on a daguerreotype of a fossil fish, pp. 151-152.

Remarks on the characters of coprolites, p. 169.

Observations on a wavy sandstone in the shales at Hillsboro, N. B., p. 170.

Remarks on the "sienite" of Nahant, *loc. cit.*

Remarks on tracing the source of sediments. p. 179. Case on Petitcodiac river in N. B. Fineness increasing in proportion to the distance from probable source indicates the action of water rather than ice in their distribution.

Observations on the relation of Stigmaria to Sigillaria, pp. 179-180. Doubtful as to their identity.

On an extensive deposit of marine shells near Portland, pp. 181-182.

Remarks on relative amount of oxygen in moist and dry air, p. 186.

Observations on the effect of sugar and raisins upon explorers, p. 187. "When suffering greatly from cold....eating a few raisins was sufficient to impart a glow to the whole system."

Observations upon a vein of anthracite at Vinal Haven, Me., and upon frictional electricity in cannel coal, p. 188.

Account of the process of etherization as performed on a puma for the purpose of cutting off its claws, p. 232. By title only.

Analysis of the body and scales of a species of Palæoniscus from the Albert coal mine in Hillsborough, N. B., p. 239.

Observations upon the Bream (Pomotis vulgaris), in a pond near Plymouth, Mass., p. 241.

Proc. Amer. Acad. Arts and Sci., ii, 1852.

On manganese in the water of streams, p. 111. M. in the middle of lake Superior and in the blood.

Report of a committee on coast marks, pp. 221-223. Proposal to have U. S. Coast Survey undertake observations.

Remarks on apatite from Hurdstown, N. J., pp. 241-243.

Temperature at which charcoal takes fire, p. 256.

Analysis of crystal of phosphate of lime from Hurdstown, N. J., p. 261.

Remarks on Prof. Horsford's explanation of an explosion of burning fluid, pp. 316-317.

On the use of alcohol as important to agriculture, pp. 322-323.

Observations on tellurium in gold ore from Frederick, Va., p. 2.

Bull. Geol. Soc. de France, x, 1852.

Sur le terrain houiller d'Hillsboro (Nouveau Brunswick), pp. 33-39. Gives two sections. In a lawsuit, court adopted J.'s decision concerning "asphalt."

Review of (his) reports on the coal of the Albert Coal Mining Co., Hillsboro, N. B. New York, 1852, 8to, pp. 40. Library Boston Society Nat. Hist.

Reports of the New Jersey Zinc company, 1852. New York, 1852, pp. 32. Geological report by Dr. C. T. Jackson, pp. 10-15, pls. 1 and 2, mentioned, but not in Harvard University copy.

Report on the trade and commerce of the British North American colonies, and upon the trade of the Great Lakes and rivers, by I. D. Andrews. 32d Cong., 1st sess., Senate, Ex. Doc. No. 112, xi, 1852. (Not seen.) Cited by N. H. Darton.

Boston Medical and Surgical Journal, xlvii, 1852.

Poisonous chloroform, pp. 117-120.

1853.

Proc. Boston Soc. Nat. Hist., iv, 1854.

Observations upon the Eupychroite from lake Champlain, pp. 259-260. Trap mineral; concludes that phosphorus is an element in the interior of the globe. Further remarks on pp. 264-265, 259-260.

Remarks on compressed crystals of tourmaline, p. 265. Also account of zinc mines, Sussex county, N. J. (Title.)

Account of the process of extracting iron from the ore called Franklinite in Sussex county, N. J., pp. 295-296.

Report on the coal lands of Egypt, Belmont, Evans, Palmer and Wilcox plantations of Deep River, N. C., 8vo pamphlet. New York, 1853. Cited in Proc. Boston Soc. Nat. Hist., iv, 1854, p. 403.

Bull. Geol. Soc. de France, (II) x, 1853.

Sur les mines de cuivre et de houille de la Caroline du Nord., pp. 505-506. Extrait d'une lettre a M. Delesse.

Report on the copper mine of the North Carolina Copper company, 1853, pp. 8.

Ueber den Metall führenden Distrikt, am Obern See in Staate Michigan. Karsten's Archiv., xxv, 1853, pp. 656-667.

Report vindicating the rights of C. T. Jackson to the discovery of the anæsthetic effects of ether vapor. (Appended to Morton, W. F. G. statement, etc., 1853, pp. 493-566.) (Not seen.)

1854.

Proc. Boston Soc. Nat. Hist., iv, 1854.

Remarks on the claim that Lord Sterling opened the "Sterling" mines in New Jersey, p. 308.

Remarks on crystalline limestones, pp. 308-309.

Remarks on the Wilkesbarre coal field, p. 328.

Remarks on the geology of portions of North Carolina, Georgia and Tennessee, pp. 397-401.

Ibid., v, 1856.

On the relations of Green river to the Mammoth cave in Kentucky, p. 57.

On gold, silver, lead and copper, at Bridgewater, Vt., p. 62. Also notes on native iron from Sonora, Mexico.

On fossiliferous erratic blocks at Mt. Katahdin, Me., and on the south shore of lake Superior, p. 85.

Chemical researches on the composition of the scales of the gar-pikes, p. 92. Contain fluorine.

Catalogue of rocks, minerals, and ores collected during the years 1847 and 1848 on the geological Survey of the United States mineral lands in Michigan. Smithsonian report for 1854, pp. 338-367, 1855.

1855.

Proc. Boston Soc. Nat. Hist., v, 1856.

Analysis of Allophane from Tennessee, p. 120.

Remarks on tides in lavas of volcanoes, pp. 139, 142.

Remarks on effects of gradual transportation of earthy matters from elevated lands, p. 142. "When the difference of level had been sufficiently altered to be adequate to overcome the resistance of the earth's crust a paroxysmal elevation might take place with all the phenomena of an earthquake, as happened in Chili in 1834."

Remarks on the views of Dr. A. A. Hayes and Dr. John Bacon concerning the cause of the taste and odor of Cochituate water, pp. 161-164. Hayes' rejoinder, pp. 169-175; Jackson's reply, pp. 175-176. (About this time, report of the Cochituate Water Board, by Horsford and Jackson. Not seen.)

Remarks on the age of the red sandstones from Connecticut, p. 186.

On the oxides of cerium, didymium, and lanthanium, in a large crystal, p. 189.

On raindrop impressions in foot-prints, p. 189.

Remarks on the qualifications of Mr. Marcou in relation to his geological discoveries in the Rocky mountains, p. 191.

Translation (?) of extracts from a letter of M. Elie de Beaumont, dated Paris, March 23d, 1855, p. 204-205.

On anthracite coal from Japan, p. 207. Coal used by U. S. S. Mississippi on return voyage.

Remarks on local characters of minerals, and on their association, pp. 225-226. Also described a fossil skeleton of a large cetacean from Maine. (Not printed.)

An account of some researches into the composition and manner of formation of different kinds of steel, p. 232-233.

Presentation of fossil shells from tertiary strata of Wilmington, N. C., p. 233.

Geology of parts of New Brunswick and Nova Scotia, pp. 242-250.

1856.

Proc. Boston Soc. Nat. Hist., v, 1856.

Observations upon a pumiceous substance reported to have been found floating around a point of explosion and ebullition in the water of the Ohio river, p. 290.

Exhibition of a vial of blood taken from the heart of a woman who died from the effects of chloroform, inhaled at a dentist's office, and remarks on the same, pp. 307-309.

Remarks on Gigandibus caudatus, Hitchcock, p. 309.

Action upon the death of Dr. T. W. Harris, p. 313.

On the chemical analysis and comparison of serpentine marbles known under the name of Verd antique, pp. 314-319.

Exhibition of a new water filter, with remarks on cyclopean animalcules caught therein, p. 333.

Explanation of the formation of stalactites, p. 335. Cites stalactites in the grotto at Carneal, near Trieste.

Remarks on analyses of serpentine, pp. 341-342.

Remarks on the replacement of human bones by phosphorus, pp. 346-348.

Account of the method employed in the extraction of oil from Menhaden and of converting the residual matter into a substitute for guano, pp. 355-356.

Observations on Hawaiian lavas, p. 356.

Remarks on the Philosophical Society of Victoria, p. 357.

Exhibition of a specimen of aluminum manufactured into a thimble, p. 357.

Ibid., vi, 1859.

Geology of Alger's Beryl hill, in Grafton, N. H., p. 23.

Account of the trap dykes of Cohasset and other places, pp. 23-24.

On the coal formation of Deep River, N. C., pp. 30-32, 33. Visited in May, 1856.

Chemical analysis of a variety of Agalmatolite, pp. 32-33. Rock found on border of Deep river coal field, N. C.

Reported remarks on the trilobites from Braintree, Mass, pp. 42-44.

Geological report of lands belonging to the Ridgway company in Ely county, Penn. Philadelphia, 1856, 8vo, pp. 19. Copy in Harvard College library.

Report of the Ridgway Farm and Land company, together with the geological report of Dr. C. T. Jackson. Philadelphia, 1856, pp. 29. Copy in Mrs. Jackson's possession.

Boston Medical and Surgical Journal, liv, 1856.

Chloroform and formic acid, p. 146.

Formic acid in the blood, pp. 242-244.

1857.

Proc. Boston Soc. Nat. Hist., vi, 1859.

On supposed replacement of human bones by phosphorus, p. 57.

On mineral concretions of hydrated black-oxide of manganese imbedding sand, p. 91. From Tuftonboro, N. H.

On hematite iron ore belonging to the Brandon Iron and Car Wheel Co., p. 131.

On landslides on the Presumpscot river, in Westbrook, Me., pp. 133-134. Also remarks on concretions.

On Cyathophyllum in the drift of lake Superior, p. 139.

Exhibition of articles made of aluminum, p. 139.

On the alloys of aluminum with silver, copper, and zinc, p. 159-160.

On the cements of sandstones and conglomerates, pp. 168-169.

Remarks on crystallized sugar from Chinese sugar cane raised in Massachusetts, p. 170.

An account of the copper mine so-called at Elk Run, Fauquier county, Va., p. 183. In trap dikes coming through triassic sandstone.

On superposition of the sandstones of the Connecticut river at Northfield, Mass., p. 184. Palæozoic wanting.

On crystals of cane sugar, p. 203.

Maryland marbles and iron ores, pp. 243-245.

On carbonate of lime in sea-water from coral regions, pp. 257-258.

Observations on the shells of Alasmodonta arcuata from Maine, pp. 258-259.

An account of the sand sharks caught near Nantucket, p. 259.

Presentation of a brick from Manomet, near Sandwich, p. 260.

Remarks on vibrations noticed at the dam at Nashua, N. H., p. 267.

Observations on the occurrence of a Spongilla at the Brookline reservoir gates, p. 268.

Remarks on the presentation of a pink water lily (Nymphia odorata) from a pond in Yarmouth, p. 268.

Remarks on crystals of sugar from Sorgum saccharatum or Chinese sugar-cane, pp. 286-287.

Proc. Amer. Acad. Arts and Sci., iii, 1857.

Remarks on the copper and gold mines of North Carolina and on the coal region of Deep river, N. C., pp. 68-69.

Analysis of water from Sacramento river, Calif., p. 196.

Remarks on crustacea in Cochituate water, p. 252.

Prospectus of the American Exchange Mining and Smelting company. Letter to Messrs. Henry B. Elliott and associates. Baltimore, Md., June 16th, 1857. Copy in Mrs. Jackson's possession.

1858.

Proc. Boston Soc. Nat. Hist., vi, 1859.

Analysis of the supposed meteoric stone from Marblehead, Mass., pp. 294-295. Resembled slag of a copper smelting furnace.

Remarks upon the Chinese sugar-cane, pp. 296-297; 299-300.

Remarks on the presentation of a Chinese yam (Discorea batatus), p. 337.

Remarks on the presentation of the earth almond (Cyperus esculentus), p. 337.

Remarks on the exhibition of a sample of crystallized sugar from Chinese sugar-cane, p. 337.

Observations on oölite ore from Wisconsin, p. 341.

On the Chinese sugar cane, pp. 341-342.

Repetition of communication on fluorine in fish scales, p. 366.

Remarks on the presentation of the geological maps of the United States and New Mexico, by William McClure and M. Marcou, p. 368.

Observations on insectivorous insects, p. 400.

(With H. S. Piggatt.) Gardner Hill Mining company, prospectus, charter and reports. Baltimore, 1858. 8vo, pp. 15.

1859.

Proc. Boston Soc. Nat. Hist., vi, 1859.

On tobacco (Nicotiana tabacum) from Hatfield, Mass., pp. 408-409.

Ibid., vii, 1861.

Observations on the preservation of animal tissues by arsenic, p. 5.

Remarks on exhibition of Tetradymite and Itacolumite associated with native gold from Georgia, pp. 22-23.

Remarks on coloring matter from a red beetle (Reduvius), p. 24.

Remarks on pyrophyllite from Lincoln Co., Ga., pp. 24-25.

Observations on dye from the red bug (Reduvius), p. 29.

Remarks on the corrosive properties of Mexican guano, pp. 29-30.

Remarks on tartaric acid in American wines, p. 30.

A sketch of the theory of metamorphism as now adopted. pp. 30-31. "Anthracite coal fields of Pennsylvania acted upon by hot water under ocean pressure, a satisfactory explanation."

Mode of formation of native copper and silver of lake Superior, p. 31. "From the chlorides of these metals in contact with iron."

Remarks on the action of gases from volcanic eruptions in killing fish, p. 39. Action not due to heat, but to sulphurous, sulphuretted hydrogen and chlorohydric acid.

Remarks on the peculiarities of thermal springs, pp. 45-47. In the Vosges, Roman baths, lake Superior, etc.

On the silky growth from the base of the fronds of tree ferns, p. 48.

On Tuckahoe or Indian bread, a fungus growth in the southern states, p. 48. Contains no starch but cellulose and mucilage.

Remarks on a trilobite from the calcareous slate at St. Mary's bay, Newfoundland, p. 64. Identical with Paradoxides harlani; formation can be traced from Braintree to Newfoundland.

Remarks on the so-called Japanese wax produced from the berries of Rhus succedaneum, pp. 54-55. Is not a wax.

Remarks on the most natural route for a railroad to the Pacific, p. 70. From New Orleans via Texas and N. Spain to Mazatlan.

Remarks on the death of Alexander von Humboldt, pp. 70-71.

Remarks on specimens of Paradoxides from Braintree, Mass., and St. Mary's Bay, Newfoundland. The latter in a boulder; measurements given. P. harlani.

Observations on search for coal in rocks carrying fernlike impressions and markings resembling lepidodendron near Pembroke, Me., p. 75. Opinion of futility of search somewhat shaken.

Report on the frozen well at Brandon, Vt., (with Mr. J. H. Blake), pp. 81-84. Opinion as to cause reserved.

Observation on the relations of rocks at Perry, Me., to the Silurian, p. 86. Rest on Silurian.

In regard to frozen wells at Brandon, Vt., and Oswego, N. Y., p. 135.

Remarks on specimens of a compact specular iron ore from Phillipsburg, N. J., p. 136, Occurrence described.

Remarks on the wax plant of Japan (Rhus succedaneum) and on the tea plant, pp. 149-150.

Remarks on white marl in the bottom of a pond in New Hampshire, p. 151.

Remarks on the discovery of tin ore at Los Angelos, p. 152.

Allusion to sugar in native grapes, p. 152.

Remarks on green feldspar from sea-wall near Southwest Harbor, Me., p. 160. Amazon stone; hitherto known only in Siberia.

Remarks on artificially produced minerals received from M. Daubree, p. 160.

Remarks on a meteorite from Oregon, p. 161; also pp. 174, 175-176, 191, 279.

On the position of the Roxbury conglomerate, p, 183. Dissents from Marcou's view that it belongs to the "new red sandstone," maintains that it underlies the coal.

1860.

Proc. Boston Soc. Nat. Hist., vii, 1861.

Remarks on the elongated pebbles found in the conglomerates at Newport and in Vermont, p. 209. Thought no change has taken place since deposition. Averse to any theory which requires softening after deposition.

Remarks on a pearl covered secretion from a Unio from Michigan, p. 278.

Remarks on a memorial to Congress in relation to the Oregon meteorite, p. 289.

Observations upon the bituminous and coal deposits of the Albert mine, New Brunswick, p. 295.

Analysis of the juice of the leaf-stalks of the garden rhubarb (Rheum rhoponticum), p. 305.

Remarks on the reopening of old mines in New Hampshire, p. 349. Fronconia iron mine; argentiferous galena at Warren; copper at Bath.

On andalusite macle in an altered argillaceous slate on Mt. Washington, pp, 349-350. Boulders of it at Boar's Head, near Rye, N. H.

Remarks on the formation of the distorted and indented pebbles at Newport and Roxbury, p. 354, Thought they might be formed by beach action, but thought the Vermont pebbles might have been formed by segregation from the rock. Notes decay to depth of from 80 to 100 feet at Dahlonega, Ga.

Proc. Amer. Acad. Arts and Sci., iv, 1860.

Observations on Tetradymite from Spottsylvania, Va., Bornit from Dahlonega, Ga., also gold, p. 192.

Analysis of Bornite from Dahlonega, Ga., p. 196.

Vegetable wax from Japan; Trilobite from Newfoundland, p. 199,

Olivine bearing meteorite from Rogue river, Oregon, p. 359.

Amer. Jour. Dental Sci., x, 1860.

Influence of the sun's rays in the production of organic matter, pp. 557-560.

Boston Medical and Surgical Journal, liii, 1860.

Influence of the sun's rays in the production of organic matter, pp. 213-215.

Existence of nitrogen in plants, its origin in animals, pp. 289-292.

Statistics of poisoning in New England, pp. 389-391.

1861.

Proc. Boston Soc. Nat. Hist., vii, 1861.

Remarks on the age of red sandstones at Perry, Me., Nova Scotia, Keweenaw Pt., and of the Albert coal in New Brunswick, pp. 396-398. Considers Keweenaw rock as Trias (Marcou); fossils from Perry indicate Triassic age.

Announcement of the occurrence of andalusite macle between Boar's Head and the White mountains, p. 418. At South Berwick, Me.

Remarks on a specimen of Boghead coal from Torbonnehill, Scotland, p. 422. Considered Stigmaria the underground stem of Sigillaria.

Remarks on coal from the gulf of Chiriqui, p. 423. Probably of Eocene age; analysis given. Also Proc. A. Ac. Arts and Sci., v, 1862, p. 112.

Remarks on a microscope, p. 423. Inverted microscope of J. Lawrence Smith.

Additional notes on the fossil shells and coal from Chiriqui, p. 428. Analysis; microscopic examination showing cellular plants.

Proc. Amer. Acad. Arts and Sci., iv, 1860.

Remarks on marble used in the buildings in Washington, p. 5.

Remarks respecting the Morse magnetic telegraph, p. 100. "Alleged that he himself first made known to Mr. Morse the general idea of the invention, and of the principles upon which it depended."

Proc. Boston Soc. Nat. Hist., viii, 1862.

Remarks on Paradoxides from Braintree and Newfoundland, p. 58.

Remarks on the red color in zincite, p. 145.

Remarks on the occurrence of gold in the United States, p. 172. Hematite of N. C. and Ga. contains gold, iron pyrites does not, but may be mechanically mixed.

Remarks on the decease of Dr. John Evans, U. S. Geologist, p. 177.

Observations on Boue's geological map of the world, etc., pp. 177-178. Also notes Marcou's map of U. S. A.

Fragments of rolled corals from the soil of Cumberland county, N. J., p. 226. Tertiary according to Rogers and Agassiz.

Chemical analysis of a meteoric stone from Dhurmsalla, India, pp. 233-235. See also Proc. Amer. Acad. Arts and Sci., v, 1862, p. 359.

A manual of etherization: containing directions for the employment of ether, chloroform, and other anæsthetic agents, by inhalation, in surgical operations,....comprising also a brief history of the discovery of anæsthesia. Boston, 1861, pp. 134. List of papers on anæsthetic use of ether and chloroform, pp. 125-127. Review of, Boston Medical and Surgical Journal, LXV, 1861, pp. 292-294.

Manual of etherization. With instructions for the preparation of ether and chloroform, and for testing them. Also a brief history of the discovery of anæsthesia. Boston, 1861, pp. 12. Harvard Univ. Catalogue. (Not seen.)

Boston Medical and Surgical Journal, lxv, 1861.

Hints to army surgeons, 109-111.

Ibid., lxiv, 1861.

First practical use of ether in surgical operations, pp. 229-231. Evidence concerning Dr. C. W. Long.

Tabular statement of deaths attributed to the effects of inhaling chloroform, 259-261.

Detection of strychnia in the substance of the blood, pp. 337-339.

1862.

Proc. Boston Soc. Nat. Hist., viii, 1862.

Remarks on a specimen of Domeykite from the vicinity of Portage lake, lake Superior, p. 258. Sp. G. 7.431 and not 4.5.

Ibid., ix, 1863.

Remarks on the recent discovery of gold in Nova Scotia, p. 47.

Remarks on the manufacture of writing inks, p. 55.

Observations upon metamorphic action in eastern Massachusetts and Rhode Island, p. 57. Superheated water must accompany dikes.

Remarks upon crystallized glass, p. 70.

Remarks upon the death of Mr. Henry D. Thoreau, pp. 70-72.

Report of the committee appointed to examine the frozen well at Brandon, Vt., pp. 72-88. (With John H. Blake and William B. Rogers.)

Remarks upon a new method of security against counterfeits in paper currency through the introduction of determinate species of Diatomaceæ into the material of the paper, p. 155.

Proc. Amer. Acad. Arts and Sci., v, 1862.

Comments on a letter from M. Moissent in regard to a new gas engine, pp. 51-52. (Unpublished.)

Report upon the property of the Black River mines, situated in Lotbeniere county, C. E., Oct. 22, 1862. Boston, 1862, 8vo, pp. 7 plus.

The Halifax Copper Mine. Boston, Aug. 18th, 1862. To Carlos Pierce, Esq., pp. 7. Rock "appears to belong to the Taconic system of Emmons, or to the lowest Silurian of Murchison."

Report on the property of the Chaudiere mine. Boston, 1862, 8vo.

Report on the Wickham copper mine. Boston, 1862, 8vo, pp. 8.

Boston Medical and Surgical Journal, lxv, 1862.

Influence of the position of animals under the effects of ether, p. 508.

1863.

Proc. Boston Soc. Nat. Hist., ix, 1865.

Sketch of the copper-bearing belt in Canada, pp. 202-203.

Remarks on the mode of occurrence of Galena at Dubuque, pp. 222-224. Notes on copper and iron ores formed by sublimation.

Report on the Shepherd copper mine in Sutton, C. E. (Petherick, Thomas.) Reports, etc., 1863, 8vo, pp. 10-13.

Report, etc., (Mineral Point Mining Co.) 1863, 8vo, pp. 6-8.

Report upon the Plumbago Mining Co., situated in Puzzle mountain, Neury, Oxford county, Me. (With N. T. True.) Issued by Edward G. Tileston & Co., Boston, 1863, 8vo, pp. 11. Pamphlet in Harvard College library.

Report on the property of the Megantic mine, Halifax, Boston, 1863, 8vo, pp. 8.

Report on the property of the Abercrombie Gold Mining Co. Boston, 1863, 8vo, pp. 6.

(With R. Bennett.) Reports on the property of St. Margaret's Copper mine. Boston, 1863, 8vo, pp. 7.

Boston Medical and Surgical Journal, lxvi, 1863.

Remarks upon the late Dr. L. V. Bell, pp. 73-74.

1864.

Report (Boston and Corinth Copper Mining Co.), 1864, 8vo, pp. 5-6. (Harvard College catalogue.)

Proc. Boston Soc. Nat. Hist., ix, 1865.

Exhibition of specimens of Jersey tea (Ceanothus Americanus) growing on the old red sandstone of Pennsylvania, pp. 333.

Ibid., x, 1866.

Notice of the death of Francis Alger of Boston, pp. 2-6. B. March 8, 1807, Bridgewater, Mass. List of scientific writings.

Presentation of specimens of rock salt from the Petit Anse salt mines of Louisiana, p. 17. (Unpublished.)

Remarks on the habits of the beaver, p. 41. (Unpublished.)

Account of a scientific journey through California and Nevada via Panama, pp. 224-229. Observed a meteorite; determined its altitude.

Exhibition of diaspore from Chester, Mass., p. 240. (Unpublished.)

Remarks on drift scratches and glacial deposits, pp. 245-246. Cannot be due to glacial ice. Notes granite boulders in clay beds, 60 feet thick, on Block island, traced to Kingston, 15 miles in a northeasterly direction.

On Cretaceous fossils collected at Santa Barbara and on the quicksilver deposits there; the borax of Lake county, Calif., and the oxide of tin near Los Angelos, etc,. pp. 262-263.

Remarks on specimens of polished rocks from Smoky Valley, Nevada, pp. 303-304. Due to joint effect of snow and sand sliding, finished up by the more delicate touch of blowing sand, in prehistoric times—no sand there now.

Account of the mines of California and Nevada, p. 308. Unpublished.

Chemical analysis of minerals associated with the emery of Chester, Mass., pp. 320-322. Andesine, diaspore, margarite, clinochlore or chlorotoid.

Ibid., xi, 1868.

Remarks on Kackum oil, an indelible ink nut, Ghantee root, and Cashew nuts, p. 31.

Observations on ice forming in summer and disappearing in winter, p. 32. Cases in Russia and at Brandon, Vt.

Observation on the occurrence of veins of dolomite in the Emery mine at Chester, Mass., p. 32. Contained a crystallized sapphire.

Proc. Amer. Acad. Arts and Sci., vi, 1866.

Remarks on examination of pyrites for nickel, p. 81.

Description and analysis of a meteorite from Decotah, pp. 166-167. Iron-nickel-tin-phosphorus contents, 100 lb. specimen.

Paris Acad. Sci., Compt. Rendu., lviii. 1864.

Observations sur des gêtes métalliféres de quelques parties de l'Amerique septentrionale et sur un nouvel aerolithe, pp. 240-242.

(With D. McCaine.) Groton soapstone quarry. Boston, 1864, 8vo, pp. 16.

1865.

Proc. Boston Soc. Nat. Hist., x, 1866.

Analysis of iron ore from the northern end of Staten island, p. 72.

Remarks on prepared peat, pp. 72-73.

Presentation of specimens of carboniferous plants from the Wyoming coal basin of Pennsylvania, and pamphlets by Elie de Beaumont on his pentagonal system of mountain chains, pp. 80-81. Urges American geologists to study de Beaumont's hypothesis.

Discovery of emery in Chester, Mass., pp. 84-90. Gives section, p. 86. A single banking house in London had a monopoly on the deposits in the Grecian archipelago. One of his important interests but the mine was discovered by Dr. H. S. Lucas. Also Paris Acad. Sci., Compte Rendu, LX, 1865, pp. 421-423.

Paris Acad. Sci., Compt. Rendu, lxi, 1865.

Nouveaux details sur les mines d'argent du Nevada, pp. 998-999. Also Cosmos III, 1866., pp. 66-67.

Sur les mines d'or et d'argent de la Californie, pp. 947-950.

1866.

Amer. Jour. Sci., (II) xlii, 1860.

Analysis of some minerals from the emery mine of Chester, Mass., pp. 107-108. Andesite, margarite, and diaspore, by John C. Jackson, fils; chlorotoid.

On the discovery of Corundum at the emery mine, Chester, Mass., p. 421. Finds perfect crystals of sapphire three inches long.

Proc. Boston Soc. Nat. Hist., x, 1866.

Remarks on calcite veins from Martensburg, N. Y., p. 97.

On coating eggs with soluble glass to prevent entrance of spores, p. 98.

Remarks on petroleum, p. 103, (Unpublished.)

Remarks on green feldspar or Amazonian stone from the granite quarries of Rockport, Mass., pp. 167-168. Mentions other minerals found there.

1867.

Amer. Jour. Sci., II xliii, 1867.

Analysis of a meteoric iron from Colorado, pp. 280-281.

Proc. Boston Soc. Nat. Hist., xi, 1868.

Remarks on the death of Dr. A. G. Gould, p. 27.

Analysis of meteoric iron from Bear river, Colorado, pp. 71-72. See Amer. Jour. Sci., next above.

Remarks on the non-occurrence of meteorites in sedimentary strata, pp. 82-83.

Remarks on the touchstone used by watchcase makers, pp. 114-115. Use a polished block of bazanite with 12 gold "keys" of known composition.

Observations upon the alewife in Massachusetts, p. 131.

Observations upon fossils from the green sand of New Jersey, p. 158. Considered same as greensand of England and France.

Remarks on the gold region of Vermont, pp. 243-244. $4 to $12 a ton.

1868.

Proc. Boston Soc. Nat. Hist., xi, 1868.

Chemical analysis of fossil guano from the vicinity of Charleston, S. C., pp. 392-393.

Remarks on the modern methods for the preservation and coloration of wood, pp. 462-464.

Proc. Amer. Acad. Arts and Sci., vii, 1868.

Description of a series of lead-encased block-tin tubes for the conduction of water, pp. 433-435.

Proc. Boston Soc. Nat. Hist., xii, 1869.

Analysis of green Petrosilex from Melrose, Mass., p. 84.

Description of the beds of apatite in North Burgess, Canada West, pp. 88-89. Phosphate of lime not necessarily of organic origin.

California Acad. Sci., Proc. III, 1868.

Measurements of the hight and circumference of twenty-five of the "big trees" (Sequoia gigantea) in Calaveras county, pp. 204-205. Taken in 1865.

1869.

Proc. Boston Soc. Nat. Hist., xii, 1869.

Cited on Portland landslide, p. 236.

Description of a new locality of tin ore in Winslow, Me., p. 267.

Ibid., xiii, 1871.

Remarks on native carbonate of magnesia from Greece, California, Maryland and Kansas, p. 172.

Paris Acad. Sci., Compt. Rendu., lxix, 1869.

Sur les mines de cuivre du Lac Superior, et sur un nouveau gisement d'etain dans l'état du Maine, pp. 1082-1083.

1870.

Proc. Boston Soc. Nat. Hist.,xiii. 1871.

Remarks upon Mr. Shaler's views of the relations of the rocks in the vicinity of Boston, pp. 177-178. "When it is alleged that crystallized rocks like syenite or granite, are altered sedimentary rocks of aqueous origin, we require that the passage state should be demonstrated and this has never been done by any who has advocated such a metamorphosis."

1871.

Remarks upon meteorites, p. 412. Inferred that the fall of meteorites is of modern occurrence—since the tertiary strata were deposited.

Proc. Boston Soc. Nat. Hist., xiv, 1872.

Letter to nominating committee, Boston Soc. Nat. Hist., p. 2. Cannot consent to become a candidate for the presidency.

Glacier theory of drift, pp. 65-68; 73. Has not been able to adopt the glacial theory of drift phenomena.

Observations upon expansion of rocks due to change of temperature, p. 87.

Remarks on the eruptions of Etna and Stromboli, p. 128.

Remarks on quartzites and slate, p. 129.

Remarks on the action of the poison of the rattlesnake, pp. 133-134.

1872.

Proc. Boston Soc. Nat. Hist., xiv, 1872.

Remarks on Lingula, p. 218. (By title only.)

On the elevation and depression of the Atlantic coast, p. 218. (Unpublished.)

Observations on the occurrence of crystal globes in the Druid mounds of England, p. 305. Thought they were derived from Japan.

Report on the Brandon frozen well, pp. 306-308. Chemical analysis of the water; gravel bed frozen by cold of former vigorous winters.

Remarks on the transportation of boulders in New England. p. 386. Repeated.

Remarks on Labrador feldspar in New Hampshire, p. 392. Not found *in situ.*

Ibid., xv, 1873.

Remarks on pebbles at Newport and Chestnut Hill, p. 3. Could not

admit that these pebbles were ever plastic and attributed their form to the action of water.

Observation upon the failure of earthquake shocks to affect deep mines in California, p. 187.

Letter to Samuel F. B. Morse, dated Boston Nov. 7th, 1837. In "A memorial of Samuel F. B. Morse, from the city of Boston. Public Document, 1872, p. 75-77. Relates to invention of magnetic telegraph.

Relations of syenite at Richmond, elevation of coast of Hatteras region and Maine. Amer. Nat., v, 1872, p. 181.

1873.

Proc. Boston Soc. Nat. Hist., xv, 1873.

Analysis of meteoric iron from Los Angelos, Cal., pp. 254-255.

Remarks on the geological survey of New Hampshire, p. 309. Map could not be colored for want of time, thought no inference could be drawn from fossils found by Hitchcock at Littleton.

Remarks on the death of Dr. Henry Coit Perkins, pp. 310-311.

(Posthumous). 1887.

Catalogue of rocks, minerals. and soils, collected during the geological survey of Rhode Island, summer of 1839. Providence Franklin society, report on the geology of Rhode Island. Providence, 1887, pp. 58-68. This list is based upon two MSS., copies in the possession of the society; probably not before printed.

Reviews and Works growing out of Jackson's Publications.

Review. First report of the geology of the state of Maine. Amer. Jour. Sci., xxxii, 1837, pp. 193-194.

C. U. Shepard. Report, Chester emery mine, 18—, p. 6. Objects to Jackson's considering emery a distinct species from corundum. Cited by B. K. Emerson, Mineralogical Lexicon, p. 62.

Dall, W. H., and G. D. Harris. Correlation papers, Neocene. Bull. 84, U. S. Geol. Survey, Washington, 1892, pp. 32-33. Dr. Jackson's tertiary deposits of Maine, probably quaternary, p. 34. Views on Tertiary deposits in Rhode Island unsupported.

Foster, J. W. and J. D. Whitney. Report on the geology of the lake Superior land district, pt. ii, Washington, 1851, p. 137. Jackson's argument for superior position for lake Superior sandstone controverted.

Van Hise. C. R. Correlation papers, Archæan and Algonkian. Bull. 86, U. S. Geol. Survey, Washington, 1892., p. 384. "Jackson, among the older geologists, has steadily maintained the essentially igneous origin of the granites and syenites." Reviews Jackson's work on these rocks.

Hamel, D. Historical account of the introduction of the galvanic and electro-magnetic telegraph. London, August. 1859, pp. 71. Mentions C. T. Jackson's claim. Copy in Mrs. Jackson's possession.

A large number of pamphlets and irregular publications sprang up in connection with the "ether" controversy, involving the claims of Jackson, Morton, and Wells. See Littell's Living Age, No. 201, March 18, 1848. It has not been thought necessary to collect a full list of these.

Editorial. Inhalation of ether in surgery. Amer. Jour. Sci., III, 1847, pp. 444-447, p. 445.

Sims, J. Morion, M. D. History of the discovery of anæsthesia. Virginia Medical Monthly, May, 1877, pp. 14. Reprint, Richmond. 1877: New York, 1879. Anæsthesia by use of sulphuric ether, demonstrated by Crawford W. Long, M. D., at Jefferson, Jackson Co., Ga., March 30th, 1842.

H. J. Bigelow. Insensibility during surgical operations produced by inhalation. Boston Medical and Surgical Journal, XXXV, pp. 309-317. See this and subsequent volume for numerous references to the subject.

Biographies of Dr. Jackson.

Warren, G. Washington: Resolution concerning Dr. Charles T. Jackson. Proc. Boston Soc. Nat. Hist., XVII, 1875, p. 14.

Editorial. The late Dr Jackson. The Springfield Daily Republican, Sept. 9th, 1880.

Barber, William: Dr. Jackson's discovery of ether. The National Magazine, Oct., 1896, v, 46-58. Gives views of his birthplace, residence in Somerset St., Boston, and of medals received.

Emerson, Edward Waldo: A history of the gift of painless surgery. The Atlantic Monthly, LXXVIII, Nov., 1896, pp. 679-686. Cites Dr. Morrell Wyman. "Jackson was the head and W. T. G. Morton the hand."

Anon: Sketch of Dr. Charles T. Jackson. Pop. Sci. Monthly, XIX, 1881, pp. 404-407.

Anon: Charles Thomas Jackson. Proc. Amer. Acad. Arts and Sci., XVI, 1881, pp. 430-432. Ether controversy led to his insanity. He suggested ether anæsthetics.

Bouvé: T. T.: Historical sketch of the Boston Society of Natural History. Ann. Memoirs, Boston Soc. Nat. Hist., 1880, pp. 167-168. Brief sketch of Dr. C. T. Jackson.

Bouvé, T. T.: Biographical notice of C. T. Jackson. Proc. Boston Soc. Nat. Hist., XXI, 1881, pp. 40-47.

Bartol, C. A.: Charles Thomas Jackson. Boston Daily Advertiser, 1880.

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