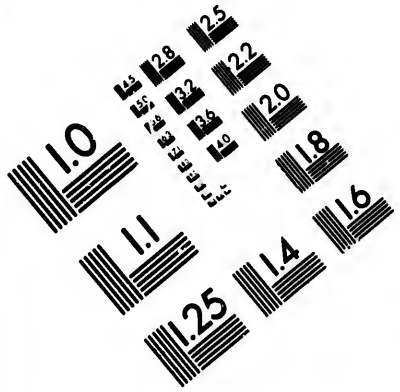

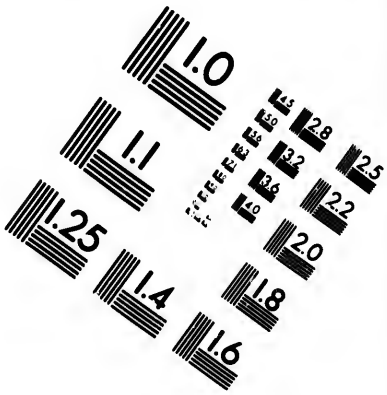

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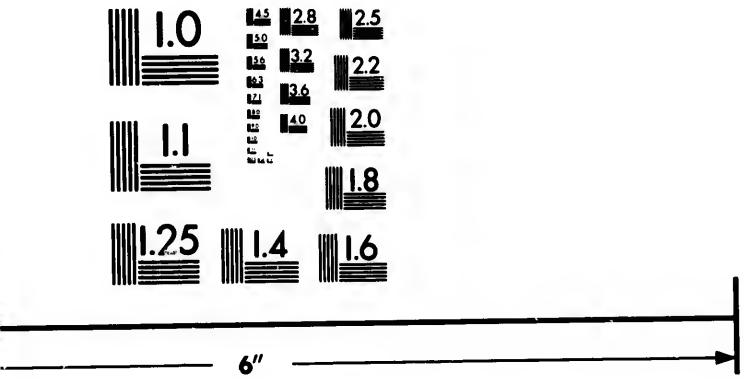

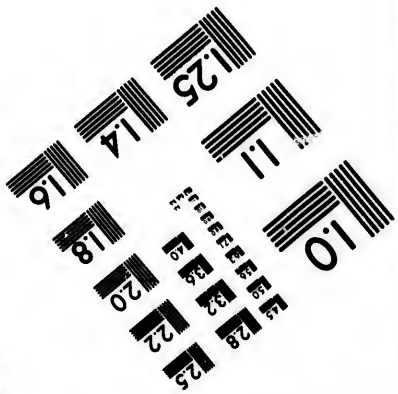

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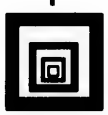

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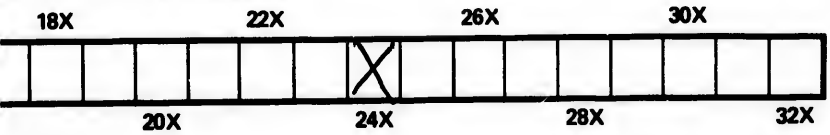

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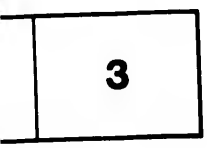

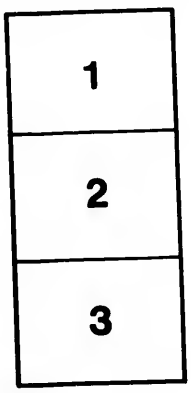

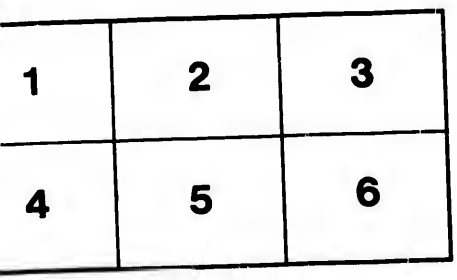

THOMAS STERRY HUNT, M. A., D. Sc., LL. D., F. R. S.

By Persifor Frazer.

T. Sterry Hunt

THE AMERICAN GEOLOGIST.
VOL. XI, PLATE I.

[*From The American Geologist, Vol. XI, January, 1893.*]

THOMAS STERRY HUNT, M. A., D. Sc., LL. D., F. R. S.

By Persifor Frazer.

The subject of this notice expired of an affection of the heart in the Park Avenue hotel, New York city, February 12th, 1892; a man who made his influence felt in many departments of science, and whose labors in the fields of chemistry, geology, and mineralogy have enriched those sciences; not only directly, but indirectly by drawing the attention of other master minds to many moot points concerning them. On his father's side, his ancestors and their descendants have left enduring remains of their work both in art and letters, one of the earliest of his line who lived in America, William Hunt, having been one of the founders of Concord, Mass. On his mother's side his lineage is enriched by "the gentle, mystic Peter Sterry, and that uncompromising preacher, Thomas Sterry, who wrote the notable tract, 'The Rot Among the Bishops,' in 1667, and that gave to New England Consider and Thomas Sterry, the Mathematicians" (Biographical sketch of T. S. Hunt by James Douglas). Consider Sterry was a civil engineer and the author of text books on arithmetic and algebra in use a hundred years ago. Thomas Sterry Hunt was born in Norwich, Conn., September 5th, 1826. During his early childhood his father moved to Poughkeepsie and died there when the subject of this memoir was but twelve years old; whereupon

his mother and her family of six children returned to their old home in Norwich. For a while Thomas attended the public school, but soon was called to assist in the support of the family.

He found employment first in a printing office; then in an apothecary's shop; and finally in a book store. Although he remained but six months in each of these situations it is more than probable that his extremely receptive mind was strongly influenced by all of these occupations. He frequently attributed his attention to details in the correction of MS., and his quick and unerring detection of faults in typography, to his experience as a practical printer. His after love of chemistry could not but have been developed if it was not instigated by his surroundings in the second of these situations; and his love of general literature and familiarity with authors doubtless commenced with his opportunity to prowl over a collection of miscellaneous books, absorbing their contents in the interval of his active duties, and laying the foundation of that correct expression and pure style which distinguished to the last his spoken and written thoughts. Some of the elements of Dr. Hunt's genius were a life-long habit of attention, an accurate judgment to select out of the assorted impressions received that which was valuable or new, a phenomenal memory in retaining such concepts, and consistency in adopting them to regulate his conduct or modify his ideas. It is therefore not at all incredible that this exceedingly impressionable mind at its most impressionable age may have assimilated both the tastes and the faculties which directed the course of his after life during the short periods of those diverse occupations. This is rendered the more probable from the fact mentioned by Mr. Douglas, that on leaving these three employments to assume the duties of clerk in a not too busy country store, the future Cantab. Doctor kept a skeleton and certain home-made chemical apparatus under the counter for use in the intervals afforded by his commercial duties. He carried on original research in this rural retreat even while mastering the rudiments of chemistry. He visited the sixth annual meeting of the Association of American Geologists and Naturalists held in the geological lecture room of Yale college from Wednesday, April 30th, to Tuesday, May 6, 1845, and was there elected a member of that body. It is interesting to note that in his nineteenth year, at this, the first meeting he attended of the body

which four years afterwards became the American Association for the Advancement of Science, Dr. C. T. Jackson made a communication "On the copper and silver of Keweenaw Point," and Prof. H. D. Rogers "submitted some remarks on the question of the Taconic rocks," &c., which the speaker believed to be "only the well known lower Appalachian strata disguised by some alteration of mineral type induced by igneous metamorphosis." These two subjects were destined to receive great attention at the new member's hands down to the last days of his life.

At the first meeting of the A. A. A. S., held in Philadelphia, September, 1848, Prof. Hunt read a paper "On Acid Springs and Gypsum Deposits of the Onondaga Salt Group," and at this meeting Profs. W. B. & R. E. Rogers read a paper on "The Comparative Solubility of the Carbonate of Lime and Magnesia," establishing the fact that in water impregnated with CO_2, carbonate of magnesia is more soluble than carbonate of lime." The study related to the formation of dolomites, and contained the germ of an idea splendidly developed by Dr. Hunt in after years in connection with the cause of the difference in per cent. of magnesia of the limestones deposited in the oldest and those in the newer geological seas. One might easily and perhaps profitably trace the origin of many investigations which Dr. Hunt has pursued to brilliant discoveries in the sometimes vague, but to him, suggestive questions and observations at these scientific meetings. He remained in Yale for about a year and a half, until some time in 1846, as the assistant of Prof. B. S. Silliman, Jr., through whose aid and that of Prof. Benj. Silliman, Sr., he obtained the appointment of chemist to the geological survey of Vermont, under the charge of Prof. C. B. Adams.

The year following, on the death of Mr. Dennison Olmstead, Jr., whose place on the Vermont survey he had taken when Mr. Olmstead assumed similar duties for the geological survey of Canada, Mr. Hunt again stepped into the vacated position and moved to Montreal, where began that intimate association with the chief geologist, Sir William Logan, which was to last for twenty-five years, or from 1847 until 1872. During a part of this time he lectured on chemistry (in French) at the University of Laval (1856-'62), and for four years on chemistry and mineralogy at McGill University. Besides these duties and the absorbing work of the geological survey which required not only his research in the labo-

ratory and in the field, but a very considerable amount of the literary supervision of the volumes issued, he wrote an immense number of papers, many of which were contributed to "Silliman's Journal."

His first voyage to Europe was undertaken as a delegate of the Geological Survey of Canada to the International Exposition at Paris, in 1855, where he was selected as one of the jury of award, and during his stay was invested with the decoration of Chevalier of the Legion of Honor. Subsequently he was promoted by the French Government to be an officer of this order.

In 1859 he was elected a Fellow of the Royal Society of London. He was again an official delegate from Canada to the London Exposition of 1862, and afterwards served in the some capacity at Paris in 1867. In 1871 he was elected a member of the National Academy of Science of the United States.

From 1872 to 1878 he resided in Boston and lectured on geology at the Massachusetts Institute of Technology. In 1871 he was elected president of the A. A. A. S. Before this Harvard had recognized his merit and conferred upon him the title of M. A., and the University of Laval that of LL. D. In 1877 he was elected president of the American Institute of Mining Engineers. In 1881 Cambridge University, England, bestowed on him, with more than usual ceremony, the degree of LL. D. He was one of the original members of the Royal Society of Canada and its third president. During the year 1876, of the Centennial Exposition in Philadelphia (where he was also on the jury), he first definitely took measures to insure the calling together of a geological congress of the world, and caused a resolution looking to that end to be passed at the Buffalo meeting of the A. A. A. S.

The reunion of this congress, which occurred in Paris, in 1878, was so far due to his skillful efforts that without his aid it could not have been held at that time, though that there would ultimately have been called together such a congress sooner or later, no one doubts. The first suggestion was made by Dr. Hunt, even if we accept the date at which Prof. Capellini, of Bologna, claims that he made a similar proposition not knowing of the earlier one; but even after the proposal had been accepted by the American Association, and a committee appointed, the enterprise would have been relegated to the dust hole of so many of its magnificent uncompleted plans, but for the tact, skill and perse-

verance of Dr. Hunt, who placed himself in relations with some of the more prominent foreign geologists, wisely adding them at first to the American committee, and afterwards gave indispensable aid to the French committee which organized the first meeting in Paris, in 1878.

At the celebration of the one hundreth anniversary of the discovery of oxygen gas (which was fitly selected as the date of the birth of modern chemistry), held near the grave of Priestley, in Northumberland, Pennsylvania, Dr. Hunt was among the most distinguished guests and vice-presidents, and made, as was usual with him on such occasions, one of the most thoughtful and impressive addresses, entitled "A Century's Progress in Chemical Theory."

It had originally been intended that young Hunt should fit himself for the profession of medicine, but his strong inclination for research in chemistry and geology resulted, as has been shown, in his adopting a career of pure science, interrupted only occasionally by economical reports which only differed from his other work by having the consideration of values added to them.

Among his earlier chemical essays such as "The theory of chemical changes and equivalent volumes," in 1853, it was evident that he was strongly impressed by the brilliant results of Laurent and Gerhardt in the forties and early fifties, and as in so many other cases, this influence is apparent even in his latest chemical works, and is notably in the Northumberland address just alluded to.

It was characteristic of the man that, while fully alive to every new discovery of science, he never forgot the researches of the older savants, and invariably preferred to proceed from their unfinished lines to the newest generalizations, rather than to take a discovery which was a natural consequence of one of these incomplete lines as a new departure. It is through the labors of such men as he that the history of scientific discovery is a continuous narrative and not a mere desultory collocation of dazzling paragraphs. He gleaned the memoirs of the past thinkers, carefully pondering their words and endowing much that was vague and ambiguous with a meaning which bridged over the gap between theirs and the most modern work.

In the "Introduction à l' étude de la Chimie par le systeme unitaire" (Ch. Gerhardt, Paris, 1848, p. 79), the author writes,

"To each metallic or metallous equivalent correspond peculiar properties as we shall see further on. It is as if hydrogen were replaced in these two kinds of combinations by the same metal differently condensed."

Further on he states the law of condensation in the form of $\frac{p}{d} = v$ in which p = atomic weight; d = specific gravity, and v = the atomic volume. Precisely the same equation is used by Dr. Hunt in his essay on "The coëfficient of mineral condensation in Chemistry," &c., where p represents an *aliquot part* of the chemical species, d = the specific gravity, and v = the reciprocal of the coëfficient of condensation. It will be noticed in Dr. Hunt's works that he avoids where possible the employment of the word atom, and uses instead "equivalent weight." He did not believe that the existence of atoms had been demonstrated, nor did he accept the doctrine of interatomic space. He believed matter to be continuous and without interstices. Thus, in the address at Northumberland, he says: "Dalton, as you are aware, linked his discoveries with the old hypothesis of the atomic constitution of matter which is however by no means necessarily connected with the great laws of combination by weight and by number." And again, in his peroration, he says: "The phenomena of chemistry lie on a plane above those of physics and to my apprehension the processes with which the latter science makes us acquainted can afford at best only imperfect analogies when applied to the explanation of chemical phenomena to the elucidation of which they are wholly inadequate. In chemical change the uniting bodies *come to occupy the same space at the same time*, and the impenetrability of matter is seen to be no longer a fact, the volume of the combining masses is confounded, and all the physical and physiological characters which are our guides in the region of physics fail us, gravity alone excepted; the diamond *dissolves* in oxygen gas and the identity of chlorine and of sodium are lost in that of sea salt.

"To say that chemical union is in its essence identification, as Hegel has defined it, seems to me the simplest statement conceivable."

"The type of the chemical process is found in solution, from which it is possible, under changed physical conditions to regenerate the original species. Can our science affirm more than this, and are we not going beyond the limits of a sound philosophy

when we endeavor by hypotheses of hard particles with void spaces, of atoms and molecules, with bonds and links to explain chemical affinities, and when we give a concrete form to our mechanical conceptions of the great laws of definite and multiple proportions to which the chemical process is subordinated? Let us not confound the image with the thing itself, until, in the language of Brodie, in the discussion of this very question, 'we mistake the suggestions of fancy for the reality of nature, and we cease to distinguish between conjecture and fact.' The atomic hypothesis by the aid of which Dalton sought to explain his great generalizations, has done good service in chemistry, as the Newtonian theory of light did in optics, but is already losing its hold on many advanced thinkers in our science."

He says in a previous part of the same address: "The doctrine of types, first enunciated by Dumas, advanced by Laurent and perfected by the labors of others, may be said to be the basis of our present chemical theory. It was the conception of the dual water type which first rendered clear the theory of ethers and anhydrous monobasic acids, and thence the generation of bibasic and tribasic acids, whose derivation from the water type I taught as early as 1848, some years before these views were accepted by Williamson and Gerhardt, whose names are usually associated with this extension of the original doctrine of Dumas."

Relating to his peculiar views in regard to interstellar space and the connection of the matter which he supposed to fill it with an atmosphere, he says (id.):

"If now we admit, as I am disposed to do with Mattieu Williams, that our atmosphere and ocean are not simply terrestrial but cosmical, and are a portion of the medium which in an attenuated form fills the interstellary spaces, these same nebulæ and their resulting worlds may be evolved by a process of chemical condensation from this universal atmosphere to which they would sustain a relation somewhat analogous to that of clouds and rain to the aqueous vapor around us."

Dr. Hunt elaborated this theme in his presidential address before the Amer. Inst. of Mining Engineers on another occasion, his query being, 'whence is all the carbon derived which is found in organic structure and combined in the rocks as carbonates?' and his conclusion that it was drawn from "interstellary space," perhaps indirectly from other planets.

This attitude of Dr. Hunt towards the atomic theory and the concrete notions of atoms and molecules has been assumed in past years by some distinguished chemists and is not yet wholly obsolete. It was due, with little doubt, to the reaction which had set in from the mistaken fear that chemists had been led afield by the brilliant generalizations of Berzelius. The writer has elsewhere considered this panic,* but it is pertinent to mention briefly the facts here.

The great Berzelius had successfully determined the least combining weights of a great number of substances, and had been led to apply to these weights the theory of Dalton, and a theory based upon the electrical results of Sir Humphrey Davy.

He had thus built up his system of atoms, binary, and ternary compounds; each molecule of the latter two being composed of an electro-positive and an electro-negative element or compound. He made the single mistake of supposing that in a supposed electro-positive group no electro-negative element could be found. When he carried this idea into the synthesis of organic compounds, he was met by discoveries (such as Melsens' in 1842, of chloracetic acid) which rendered it impossible for him to maintain this hypothesis. It was not duly considered at the time that the portion of the Berzelian hypothesis which was proven to be inconsistent with the facts was a minor and unessential part of the whole, and that the great and important generalization of this master among masters remained untouched. His ineffectual efforts to bolster up the fallacious part of his system threw doubt on it all, and one by one his strongest supporters abandoned his entire beautiful theory for a species of chemical agnosticism.

Finally, in 1848, Gmelin, in the colossal dictionary of chemistry, (humorously called "a handbook,") abandoned all attempts at graphic description of compounds and went back to the apparent weight of combination of Lavoisier's time. This timorousness of the chemists of that day affected the progress of theory for nearly thirty years, and it was during these years that Dr. Hunt was active in research. [See the History of Chemistry by von Meyer, Leipzig, 1889]. The motive of this abandonment of the ground so gallantly won by Berzelius was doubtless a good one, viz: the desire to avoid the faults of the alchemists, and to confine the

*"The Helps and Hindrances to the Progress of Chemical Theory," Introduction to chemical lecture course at the Franklin Institute, November 10th, 1890.

activity of workers to concrete facts and indisputable conclusions, but it was like a panic in an army, and lost many a great mind like that of Dr. Hunt to the abstract branch of chemical research.

In the period covered by Dr. Hunt's work it was not good form among the masters to consider theoretical chemistry at all, but rather to work sedulously to collect facts. Yet these facts once gained it has resulted that the old fabric of Berzelius has been re-erected. Additional superstructure indeed has been added, but his foundations have been left untouched.

As an illustration of the unconscious repetition by Dr. Hunt of the mental processes of Gerhardt, compare his statement regarding the definition of organic chemistry in "A new basis of chemistry (§ 15) with the following language of Gerhardt: "Comme toutes les matières organiques sans exception aucune, renferment du carbone, on peut dire qu'elle—(la chimie organique)—"est la chimie du carbone." [Ch. Gerhardt Précis de Chimie Organique, Notices préliminaires, Paris, 1844.] The minds of these men worked in similar grooves, and had Dr. Hunt replaced Laurent in collaboration with Gerhardt it is very probable that similar results would have been obtained.

His research in mineralogy and geology was of similar character to that in chemistry. Here again besides the keen observing power of a "Forscher" Dr. Hunt was an attentive student of the literature of his subject, and he seldom, if ever, made the mistake of beginning an old investigation as if he were the first to think of it. On the contrary, it seemed his mission to exhume and revitalize the views of the oldest savants in the subjects that he treated; imparting to their words a meaning which either had not been understood, or the import of which had been overlooked. It is thus that we find him going back to Werner's views in his "crenitic" hypothesis; to Amos Eaton, in his reconstruction of the base of the American column; to Breithaupt, in his classification of mineral species. And whether or not in every case the original views of his subject justified his interpretation of them, the attention which he called to these views threshed out the remaining seed which had not been previously extracted and made more secure the fame of the old masters. The tendency of this treatment also was beneficial in restricting the number of new "schools."

On the other hand it must be acknowledged that Dr. Hunt in

the later period of his life often spent too much of his valuable time in reclamations of precedence in the announcement of generalizations which had been ascribed to others, basing his claim sometimes on printed words of his own which did not unmistakably define the same ideas. There is no question that in these cases he was sincere, and that from his point of view his claims were just, for he commenced his useful career as a scientific writer with more than the usual amount of that caution which is the indispensable quality of a true savant. Still, he was the unquestioned author of so much that was valuable that he might well have spared himself the controversy and annoyance of these struggles, some of which were very unpleasant to him.

He will be remembered chiefly by his valuable additions to our knowledge of the constitution of the crystalline rocks and his theories concerning their genesis and classification. His leading thought for thirty years was that minerals took the place in crystalline rocks of fossils in the clastic rocks as a means of determination of their history, relative age, &c., but he nowhere pretended (as sometimes has been unjustly said of him) that we were yet able to interpret aright all of the phenomena they presented.

He was an enthusiastic admirer of flowers and a skillful botanist and arborist, contributing much to bring to the attention of the public the necessity of caring for our wantonly wasted forests, and interesting himself greatly in the establishment in Canada and the United States of Arbor day.

He was also a keen critic and an omniverous reader of the current French and English literature, being especially fond of poetry. His memory of the thoughts of those poets whom he most admired was extraordinary, and as a rest from the graver labors of a geological investigation he would sometimes repeat pages of graceful lines. While extremely cautious in expressing any opinions on religious subjects he did not conceal from those who enjoyed much of his society that he was an agnostic of his own peculiar kind, neither affirming nor denying any of the dogmas of any church, but finding much to respect in all of them.

Like most men of ability, Dr. Hunt admired women and recognized the need of their refining influence. He was too great a man to be above enjoying "small talk" when he found himself among those who produced no other kind, and if it was surprising

to hear this learned scientist repeating pages of sentimental verse, it was still more so to note that not only could he on occasion excel in the art of colorless polite conversation, but invariably excited the admiration of his hearers by his accurate memory for the thousand trifles which form its staple, and, in fact, actually enjoyed it. Nevertheless, a word was enough to divert him from this light pastime, and he would lose the smiling presence which accompanied his badinage and drop by instinct into a thoughtful and well expressed monologue.

He had a keen sense of the humorous and a loud and contagious laugh which inspired in others as much hilarity as the sally which called it forth. His nature was emotional, but controlled by strong and well balanced reasoning power, so that no serious view of his on any scientific subject was influenced by it. It follows that where this reasoning power was not exercised, as in the ordinary small worries and mishaps of life he exhibited an extreme passion, tenderness, or sensitiveness. This characteristic while it enabled him to enjoy much that was unfelt by a coarser nature, was nevertheless, the cause to him of extreme suffering from causes which would have made no impression on most men.

His weaknesses were not those which could detract from his greatness, nor did they contain anything sordid or hateful, while the salient points which distinguished him above others placed him in that indefinable class of great men whose thoughts have moulded our century. It was an instructive lesson in psychology to stand beside him and observe how smoothly and forcefully his mind worked on subjects of the greatest difficulty, and how beautifully it recorded its work in well chosen sentences cadenced to express the smallest variations of meaning, and so beautifully clear as to render further interpretation unnecessary even for the least intelligent of his hearers.

The conversion of Dr. Hunt from the views of Mather, who in 1843 rejected the theory which assumed the Adirondacks or Macomb mountains to be primary gneiss, as described by Maclure in 1817 and afterwards more fully by Amos Eaton in 1832, and substituted another in which a great part of the crystalline rocks of New York, such as the Highlands, and also those of Canada, were considered altered Silurian deposits, gives a good illustration of his fairness and astuteness. While Murray and his official superior,

Logan, were of the opinion that the Green Mountain range in Canada was altered paleozoic, Hunt was privately convinced of the truth of the conclusions drawn by Macfarlane & Bigsby in 1862-63, and though for several years he could not state his change of view in the official publications of the Canada Geological Survey, he announced it in 1870, and added additional reasons in its support. Dr. Hunt has given a sketch of this episode in the AMERICAN GEOLOGIST. [Geological history of the Quebec group, vol. v, p. 212, 1890.]

This conversion made him an active partisan of the pre-Cambrian party in similar controversies in other countries, and brought him in contact with Dr. Hicks, who in 1867, in collaboration with Harkness, published his reasons for differing from the opinion of De La Beche, Murchison and Ramsay, that the crystalline schists of north and south Wales were altered Cambrian. Hicks finally announced in 1877 that they belonged to two unconformable series of different geological ages, but both older than the oldest Cambrian. In 1878 Dr. Hunt, Prof. Hughes, of Cambridge, Prof. Torell and others, visited the localities in Anglesey and Carnarvonshire, and confirmed Dr. Hick's conclusions. The history of this controversy between the official geologists of the British Geological Survey and Dr. Hicks, and ultimately the complete triumph of the latter, are matters of recent occurrence. Dr. Hunt lent valuable assistance to his Welsh friend besides finding a confirmation of his own conclusions as to the pre-Cambrian character of like American series in this analogous discovery across the sea.

One of the secrets of Dr. Hunt's success was his indefatigable industry. He rarely made notes in the field, but on returning from a long and arduous day's tramp through the mountains retired to his room after the evening meal and wrote down the results of the day's work; thus sparing himself many an erasure of opinions expressed in the morning which further observation in the afternoon served to refute. This labor would often occupy him far into the night, but he never omitted it, and his thus thoughtfully compiled notes often became without change, parts of his permanent works.

He was one of the few great observers who was also a great

generalizer. Many persons who could not fully grasp his ideas spoke disparagingly of the manner in which he would often allude to some geological horizon as occurring from Alabama to Canada, but he had well weighed his words before making such statements, and further investigation but serves to confirm their accuracy.

He could see farther into the plan of construction of the earth's shell than his observations would justify him in asserting, and he chafed at the restrictions which the slow accumulation of facts condemned him to; still he did not abuse that highest of research's weapons, the scientific imagination, but subordinated it in stating conclusions, and only gave it full play in the reconnaissance which precedes research.

By Dr. Hunt's death, science is poorer by one earnest votary, and America is deprived of one brilliant and useful son.