

James Dwight Dana. By Prof. James Geikie.

(Read July 6, 1896.)

The subject of this notice came of good New England stock, his father, James Dana, having removed from Massachusetts to Utica, in New York, where his son was born on February 12, 1813. Young Dana appears to have early indicated a decided taste for the pursuit of science. While a boy he studied chemistry with his schoolmates, and made frequent excursions in search of minerals—a training which, no doubt, was largely instrumental in determining the line of investigation in which he subsequently distinguished himself. At the age of seventeen Dana entered Yale College, where he came under the influence of the elder Silliman, and finally determined to devote himself permanently to science. In 1833 he accepted an appointment as instructor in mathematics to the midshipmen of the U.S. Navy, and while thus engaged enjoyed a delightful cruise in the Mediterranean. Among the fruits of this excursion was Dana's first paper—"On the Conditions of Vesuvius in 1834." His leisure hours on shipboard he seems to have employed in working out, by special methods, certain problems of mathematical crystallography, some account of which he published in the following year. In 1836 we find Dana again at Yale, acting as assistant in chemistry to Prof. Silliman, and busy with the preparation of his first important work, the *System of Mineralogy*,—a volume of 580 pages, which was issued in 1857—surely a remarkable achievement for a youth of twenty-four! Next year he was so fortunate as to be appointed mineralogist and geologist to the Exploring Expedition to the Pacific and Southern Oceans under the command of Commodore Wilkes. The Expedition, consisting of five ships, sailed in August 1838, and proceeded first to Madeira. Thereafter Rio Janeiro was visited, and the ships passed down the coast and through the Straits of Magellan, where one of the smaller vessels was lost in a storm, and the ship to which

young Dana was attached made a narrow escape. He then visited in succession Chili and Peru, and subsequently crossed the Pacific, touching at the Paumotus, Tahiti, and the Navigator Islands, on his way to New South Wales and New Zealand. From New Zealand the voyage was resumed to the Fiji Islands, the Sandwich Islands, the Kingsmill Group, the Caroline Islands, and thence north to the coast of Oregon, where Dana's ship was finally wrecked. He then accompanied the party that crossed the mountains and passed down the Sacramento Valley to San Francisco. Here the wanderers again set sail, and made their way home by the Sandwich Islands, Singapore, the Cape of Good Hope, and St Helena, arriving at New York on 10th June 1842. It is needless to say that the experiences of these four eventful years made a profound impression upon Dana, and influenced all his subsequent life. For the next thirteen years he was fully occupied in studying the materials brought home by the Expedition, and in preparing his reports. His geological observations are contained in a large quarto of 746 pages, accompanied by a folio atlas of 21 plates (1849). Besides this great work, he prepared a *Report on Zoophytes* of similar extent, with an illustrative atlas of 61 plates (1846), and a *Report on Crustacea*, which occupies 1620 pages, and is accompanied by an atlas of 96 plates (1854). Nor were his energies during this period confined to the elaboration of these reports, for we find him at the same time issuing three successive editions of the *System of Mineralogy* (1844, 1850, 1854), and two editions of the *Manual of Mineralogy* (1848, 1857), besides many papers communicated to various scientific journals. Not a few of these appeared in the *American Journal of Science*, of which, in 1846, Dana had been made an editor, associated with Prof. Silliman, whose assistant he had been in 1836-37, and whose daughter he had married in 1842. In 1850 he was appointed to the chair of Natural History in Yale College—the title of the chair being subsequently changed to that of Geology and Mineralogy.

The enormous amount of work accomplished in the few years after Dana's return from abroad testifies to his abounding zeal and enthusiasm. Unfortunately, as his son Prof. E. D. Dana remarks, "he was but little restrained by the thought that injury to health

was possible." But a few years after the last of the Expedition Reports was published his health broke down, and he never quite recovered his former strength. Henceforward, he was subject to the severest limitations as regards work and mental labour; but by avoiding excitement and husbanding his strength, he was enabled to accomplish a wonderful amount of scientific work. Thus, in 1862, he issued his *Manual of Geology*, in 1864 his *Text-Book of Geology*, and in 1868 the fifth edition of the *System of Mineralogy*—his last and most important contribution to that department of science. Notwithstanding all his care, the preparation of this great work proved too much for his strength—his health again gave way, and was only slowly restored. With advancing recovery, he gradually resumed his course of quiet labour—doing much work in the field as a geologist, attending to the duties of his chair, and writing a number of important papers and books. New editions of his *Manual of Geology* appeared in 1874 and 1880, and of the *Text-Book of Geology* in 1874 and 1883. He also found time to write a new work entitled *Corals and Coral Islands* (1872), and yet another geological volume—*The Geological Story briefly Told* (1875).

Dana had so far regained strength in 1887 that he was tempted to take a long journey. The accounts of an eruption of Kilauea in the Sandwich Islands had greatly interested him, and he determined to revisit that region, the acquaintance of which he had first made in 1840. Accordingly, he set out with his wife and youngest daughter, and the result was all that he or his friends could desire. He greatly enjoyed himself, every incident of the visit, his son tells us, being entered into with the enthusiasm of a mind which years could not make old. On his return he wrote a number of papers descriptive of what he had seen, and in the winter of 1889–90 prepared his work on Volcanoes, which, along with a new edition of *Corals and Coral Islands*, appeared early in 1890—the prefaces of both books being dated on his 78th birthday. In the autumn of the same year, however, his health once more gave way, and for several months his busy pen was laid aside. But he could not long endure complete rest; and, by-and-by, was able to dictate a small work dealing with the geology of the New Haven district, which was issued in 1891. His duties as professor

he had no longer strength to continue, but with partial recovery he resumed work on the fourth edition of his *Manual of Geology*. We are told that from this time till the end he seldom worked longer than three hours a day. "To himself, and still more to those about him," his son remarks, "it seemed many times as if the completion of this great work would have to be left to others ; but with the self-control born of a strong will and long experience, and with the never-failing watchful care of his life-long companion—without which his labours could never have been so productive, nor have been continued so long—he worked on slowly, doing each day only what he had strength for, and finally the labour was accomplished." He finished it in February 1895. When we know that the volume—a large, closely-printed octavo of 1036 pages—was re-written and re-arranged throughout, and necessarily involved the critical consideration of many new facts, theories, and hypotheses, we shall be ready to agree with his son, that the work is a remarkable performance for a man of eighty-two. He did not even now rest. Work of some kind was for him a necessity of existence. A month after his manual was finished, he had completed the manuscript of a new edition of his *Geological Story briefly Told*, and then commenced work on a new edition of his *Text-Book*. But the end was now at hand. On April 13th he was able to go about as usual, and was as bright and vigorous of mind as ever. In the evening, however, he did not feel quite well, and next morning he did not rise. The uneasy feeling seemed to be passing away, but towards evening it returned, and after a very brief period of unconsciousness he quietly breathed his last.

It is impossible, in a few words, to sum up the results achieved by this laborious and indefatigable student of science. He was an acknowledged master in at least three departments—Mineralogy, Geology, and Zoology ; and the broad generalisations which are encountered in his works prove him to have had "a profoundly comprehensive view of nature as a whole." His earliest investigations, as we have seen, were mineralogical—the first edition of his *System of Mineralogy* having appeared so early as 1837. In this work he displayed that anxious desire to do full justice to his predecessors and contemporaries which distinguished his subsequent

labours in this and other fields. In all the later issues of this great work he shows the same astonishing knowledge of the literature of mineralogy. Side by side with this critical compilation of facts, however, we find abundant evidence of independent research and thought. He was at all times less interested in the study of individual mineral species than in the broader questions suggested by a review of the whole science—such as the classification of minerals, theories of crystallogeny, and the morphological relations of species. Mineralogy was his first love, but eventually it became displaced in his affections by its sister Geology. He found in this science greater scope for his activity. The interesting phenomena with which it dealt, and the many problems which it suggested, naturally fascinated a mind like his, and he turned from mineralogy, which he often spoke of as “a department of limited ideas and principles,” to devote his best energies to geological investigation. His *Manual of Geology*, which has passed through four editions, has long been recognised by geologists in all countries as a masterly work. It not only sets forth, with admirable clearness, the facts of the science, but everywhere displays the critical acumen, the breadth of view, and originality of a truly philosophical mind. Dana was not only an active and persistent observer in the field, adding much to our knowledge of crystalline rocks and glacial phenomena, but a generaliser of the first order. Hence it is that we find him turning from first to last to such grand questions as the origin of continental areas and oceanic depressions, the problems of mountain-making, and the phenomena of volcanic action. We must remember also that the work he accomplished in Zoology was of great interest and importance. His extensive reports on the Zoophytes and the Crustacea, obtained during the Wilkes' Expedition, contain descriptions of upwards of 700 forms new to science, while his discussion of the relations of species, and his development of the classification, are held in the highest estimation by biologists. Dana began his zoological studies with a belief, then general, in the special creation of species. It was not until many years' reflection that he came eventually to accept the principle of evolution by natural variation. In the last edition of his *Manual of Geology* (1895), he writes: “It is perceived that the law of nature here exemplified is *not* ‘like produces like,’ but like *with an incre-*

ment or some addition to the variation. Consequently, the law of nature, as regards kingdoms of life, is not permanence but change, evolution. . . . The survival of the fittest is a fact; and the fact accounts, in part, for the *geographical distribution* of the races of men now existing and still in progress; but not for the *existence* of the fittest, or for the power that has determined survival." Again, referring as an example to the giraffe, he remarks that the elongation of the anterior pair of legs has the same purpose as that of the neck—high-reaching in quest of food. "How should the giraffe have had to run to make its fore legs grow faster than the hind legs, and what kind of antics would have started the change in the neck? It has to be supposed that the requisite argumentative variations were somehow begun, and that, under interbreeding, accelerated growth went forward. But the origin of variation is without explanation. And so it is, for the most part, throughout the kingdoms of life. Enough is known to encourage study." Finally, the closing paragraph of his book runs as follows: "Whatever the results of further search, we may feel assured, in accord with Wallace, . . . that the intervention of a Power above Nature was at the basis of man's development. Believing that nature exists through the will and ever-acting power of the Divine Being, and that all its great truths, its beauties, its harmonies, are manifestations of His wisdom and power, or, in the words nearly of Wallace, that the whole Universe is not only dependent on, but actually is the Will of one Supreme Intelligence, Nature, with man as its culminant species, is no longer a mystery."

Although Dana has so recently passed away, it is not too soon to judge of his position in the roll of scientific worthies. The mere mass of facts and data which he has added to the several departments of science in which he laboured would suffice to procure for him a prominent place amongst his fellows. But it is the general suggestiveness of his writings, the originality of his views, and his far-reaching philosophical generalisations, which have most impressed his contemporaries, and which, we believe, will continue to influence his successors. No one who is at all conversant with Dana's work need hesitate to accord him a high place among the

leaders of scientific thought in the century which is hastening to a close.

Personally Prof. Dana was one of the most amiable and genial of men, beloved by his friends, admired and venerated by his pupils. He leaves behind him a reputation of which his fellow-countrymen may well be proud—a reputation which continued to increase up to the very close of his long and fruitful life.