OBITUARIES.

Samuel Lewis Penfield (1856–1906).

(With a Portrait, Plate VI.)

IN the person of Professor Penfield the Mineralogical Society has lost an eminent Honorary Member, whose death has deprived Yale University of a brilliant and inspiring teacher, and has robbed our science of one of the most ardent of modern investigators. When a man imbued with the genius and the zeal for original research passes away in the fullness of years we can at any rate feel that he has accomplished the work for which he was best fitted and has bequeathed the full results of his abilities to his successors; but when a man, like Penfield, is taken in the prime of life, while his powers are ripe for the achievement of new discoveries, and while past success is being crowned by the promise of even more mature work, the loss is irreparable.

Penfield was born on January 16, 1856, at Catskill in New York, and was the son of a prominent merchant of that town; he was educated at home and at the local school, from which he passed to the academy at Wilbraham, Massachusetts, and thence, at the age of eighteen, to the Sheffield Scientific School at Yale University. He graduated with honours in 1877, having followed the course of chemistry. He had always been attracted towards mathematics and natural science, and shortly after taking his degree found an opening which led him into the paths of mineralogical research.

Professors G. J. Brush and E. S. Dana were just beginning their investigation of the minerals from Branchville, Connecticut, and they enlisted the services of Penfield and his classmate and life-long friend, H. L. Wells, who had become assistants in the laboratory of analytical chemistry, and were ready to undertake the necessary analyses. The two young men had thus at the outset of their career the opportunity of studying many new and interesting minerals. Penfield himself was shortly afterwards transferred as assistant to the mineralogical laboratory. Among the minerals which he analysed during this period were eosphorite, triploidite, dickinsonite, fairfieldite, fillowite, triphylite, childrenite, amblygonite, cymatolite, and spodumene.

In 1880 he proceeded to Germany, and for two semesters worked with Professor Fittig in Strassburg at organic chemistry, publishing a joint

research with him on some organic compounds in 1882. Although Groth was at that time Professor of Mineralogy in Strassburg, and Penfield seems to have attended some of his lectures, his work was entirely on the organic side, and he was evidently contemplating the career of a chemist. His earlier work had, however, given him an interest and an experience in mineralogical chemistry, which were soon to find an application.

At this time the post of Instructor in Mineralogy at the Sheffield Scientific School, under Professor Brush, became vacant, and in 1881 Penfield was offered and accepted the position. During the next two years he published papers on monazite, scovillite, lithiophilite, descloizite, and beryl.

In 1884 he returned to Germany, in order to perfect himself in the methods of physical mineralogy, and studied during the summer semester with Professor Rosenbusch at Heidelberg. In 1888 he became Assistant Professor, and in 1893 full Professor of Mineralogy at the Sheffield Scientific School, and till the end of his life devoted himself with untiring zeal and energy to the twofold duties of his position—teaching and research.

Penfield's scientific publications extend over a period of very nearly thirty years, and amount to more than 110 in number. The earlier papers deal, for the most part, with the chemical composition of various minerals, but he became more and more interested in the study of their crystalline form, and towards the close of his life he devoted himself ardently to crystallographic problems and methods.

Throughout his whole career his researches were conducted with consummate skill and perseverance. Many of them led to results of the highest importance: it is only possible here to call attention to a few of the most prominent as types of his work.

One of the striking discoveries with which his name is associated is that of the isomorphous replacement of fluorine by hydroxyl. His very first published scientific paper was in 1877 on the composition of triphylite, one of the Branchville minerals. In the following year Brush and Dana, in the first of their papers upon these minerals, quoted Penfield's analysis of triploidite and pointed out that it led to the remarkable conclusion that hydroxyl can replace fluorine in a series of minerals so closely related as to be considered isomorphous. Little attention was paid to this statement at the time, except in the way of opposition: many of Penfield's subsequent analyses contributed further evidence of the same replacement, but they excited further opposition on

the part of many chemists: Rammelsberg, for example, always refused to accept Penfield's conclusions, and as late as 1895 in the second supplement of his 'Mineralchemie' criticized the view as quite untenable. But by this time the evidence accumulated by Penfield was too strong to be ignored, and to-day hydroxyl plays a well-recognized part in mineral-formulae as equivalent to fluorine.

An important application of the principle is given in the memoir upon the chemical composition and related physical properties of topaz, which he made in conjunction with J. C. Minor, and which is a model of the best type of scientific research; work which introduces method and order where previously irregularities had prevailed in what was known of a common mineral. The authors showed that the percentage of water, which is only small, and had previously been regarded as the result of incipient decomposition, increases as that of fluorine diminishes, and that different specimens of topaz, if arranged in order of their fluorine-percentage, exhibit a regular progressive change in specific gravity, in refractive indices, in birefringence, and in optic axial angle. This enabled them to refer all topaz to the exceedingly simple formula $(AlF)_2SiO_4$, in which F is replaceable by OH.

Another most remarkable investigation, in which the same replacement is again invoked, was that of the chondrodite group, whose complex crystallographic characters had been deciphered by Scacchi, vom Rath, and others. Penfield and W. T. H. Howe succeeded in proving that the group consists of three species distinct in chemical composition as well as in crystalline form, and differing progressively by a molecule of Mg_2SiO_4; also that the length of the vertical axis is proportional to the number of the magnesium atoms in the formula. This striking morphotropic relationship rendered it possible to predict, for the first time in the history of mineralogy, the composition and form of a hitherto undiscovered mineral, and constituted a very notable scientific advance.

Among the more refined and difficult of his chemical researches may be mentioned those on tourmaline, canfieldite, spangolite, connellite, hamlinite, bixbyite, parisite, and his last published (1906) memoir on stibiotantalite.

In addition to the new minerals analysed for Brush and Dana, as mentioned above, he established, in conjunction with other authors, the following new species: bixbyite, canfieldite, clinohedrite, gerhardtite, glaucochroite, graftonite, hamlinite, hancockite, leucophoenicite, nasonite, nesquehonite, pearceite, roeblingite, and spangolite.

Possessed not only of extraordinary insight and quick apprehension,

but also high inventive skill and dexterity of manipulation, Penfield could not fail to be one of the most gifted and successful of mineral chemists. He possessed the same qualities as a crystallographer, but his chief interest in crystallography was as a practical means of mineralogical research; and he devoted much time to the determination of the geometrical and physical characters, not only of minerals, but also of laboratory compounds. Among the most noteworthy of his crystallographic studies were the determination of clinohedrite, argyrodite, pearceite, sperrylite, and the double halides prepared by Wells.

In much of his work he enlisted the co-operation of his assistants and pupils.

Towards the end of his career, when his mind was much occupied with teaching, he devoted much thought to practical and graphic methods for the representation of crystals, and his protractors and the methods of drawing and projection which he described are now well known. To this period belong his papers upon the stereographic projection and its application to geographical maps and sailing charts, a subject for which he anticipated important developments in the future.

Penfield's clearness of exposition is nowhere better exhibited than in the revised and enlarged edition of G. J. Brush's 'Manual of Determinative Mineralogy, with an Introduction on Blowpipe Analysis,' which was published in 1896, and was followed by several other editions. The introductory chapters which he wrote for this book are models of clear and lucid treatment, and among the very best that can be placed in the hands of elementary students.

For a few years before his death his health was such that he was obliged to husband his strength with great care, and to set very definite limits to the work that he could undertake; nothing was more characteristic of the man than the courage and determination with which he set himself to do the work of which he was still capable. The planning and equipment of his new laboratories in Kirtland Hall was at that time a great pleasure to him.

In a cheery letter written a few months before his death he wrote—'I have to be careful not to take too much exercise or exert myself physically and my hours of work are very much shortened. I ought not to get tired in any way, and I tire easily, so I have to be very careful and constantly on my guard. I go to my laboratory every day and get in about five hours' work. As I look back upon the last three years I can see that something considerable has been accomplished. My

troubles came just as my new laboratory was being started. It has taken a great amount of time and energy, but energy well spent, and the work is done. . . . It is a great delight now to work in my new building where the surroundings are most attractive and everything can be kept clean and neat.' Then after a description of the work on which he was engaged—'I have other things also on hand or in my mind, but I cannot put out work as fast as I formerly did. During hours allowed for study I prefer to work rather than read. I am not complaining; I am so much better than I ever expected to be three years ago.'

He died on August 12, 1906.

In January 1897 he had married Miss Grace Chapman of Albany, New York, who survives him.

None who knew Penfield could fail to be impressed by the earnestness, simplicity, and sincerity of his character: in scientific and intellectual matters he was inspired by a boyish enthusiasm and the keenest enjoyment of life and of the work and occupation of an active student and teacher. He endeared himself to colleagues and pupils alike, and made many warm and enduring friendships in Europe and America. Those who were privileged to enjoy his society when he visited Europe in 1894 and 1897, or to see him among his colleagues in their bachelor quarters at the Sheffield Scientific School, or later in the enjoyment of a happy married life in his own peaceful home, carried away the recollection of a sweet and affectionate nature, and feel that by his death they have lost one of the most warm-hearted and sincere of friends.

H. A. M.

Robert Philips Greg (1826–1906).

(With a Portrait, Plate VII.)

Born at Manchester on March 23, 1826, Robert Philips Greg passed away at his residence, Coles Park, near Buntingford, Hertfordshire, on August 20, 1906, in the 81st year of his age. His death has removed one who took a prominent part in the formation of the Mineralogical Society and who for the first ten years of its existence held the important office of Treasurer. He was compelled to relinquish this office in November 1885 by the continuance of the severe, and all but fatal illness which befell him in the summer of that year, and, as his health in the following year still remained precarious, he finally severed his connexion with the Society.

Among those who have assisted in the development of the mighty

industry which centres at Manchester, the Greg family hold an honoured place. One of the best known of its members was Robert Hyde Greg (1795–1875). A man of exceptional capacity and gifted with more than ordinary business acumen, he had a prosperous commercial career, and the high position he held among the merchants of Manchester was recognized by his election in 1844 to the presidency of the Chamber of Commerce. Despite the engrossing claims of his widely-ramifying business, he took keen interest in public affairs and still found leisure for antiquarian and scientific pursuits. He played a leading part in the agitation in favour of Parliamentary Reform and the Repeal of the Corn Laws, and his fellow-citizens testified to the esteem in which they held him by electing him in 1839 as their representative in Parliament, without his previous knowledge and even against his will, at a time when he was enjoying a brief holiday in Switzerland. He had sufficient appreciation of minerals to expend in 1835 the sum of £1,300 on the purchase of the fine collection which had been formed by Thomas Allan (1777–1833), F.R.S., a well-known banker in Edinburgh; but his knowledge of mineralogy was slight and he made no additions to the collection. He married in 1824 Mary (1799–1878), the daughter of Robert Philips, a prominent Manchester merchant, and had by her a family of four sons and two daughters. Their eldest child was Robert Philips Greg.

At the time of young Greg's birth the old order of things was on the eve of change, but had not entirely vanished: in Manchester, merchants still lived on the spot where their working hours were spent, and his parents were occupying a house in King Street actually adjoining his father's business premises in Chancery Lane. Two years later they moved to Ardwick, then in the country, but now an ugly suburb dominated by factory chimneys and penetrated by railway viaducts, and eventually at the end of 1831 they settled down at Norcliffe Hall, close to the Quarry Bank Mill, which has belonged to the Greg family since 1783. Norcliffe Hall is pleasantly situated near Wilmslow in Cheshire, and about ten miles from Manchester. Here Greg spent most of his boyhood. He received his early education from the Rev. John Colston, of Styal, thenceforth a lifelong friend; in 1840 he was sent to Mr. Malleson's School, Hove, Brighton, where he remained two years; and after spending a single session at the Manchester New College he proceeded in 1843 to Edinburgh University. At the age of nineteen he commenced his business training, and on his coming of age in 1847 he was taken into partnership by his father. He seems never

to have been completely absorbed in commercial affairs, and had certainly considerable leisure and opportunity for following up the many intellectual pursuits in which he was keenly interested. In 1857 he married Louisa Russell (1834–99), daughter of Samuel Stillman Gair, of Liverpool; they had no issue. They made their home first at Outwood Lodge, near Prestwich, and subsequently, in 1871, moved to Coles Park, which has been the property of the Greg family for upwards of 120 years. The house is charmingly placed amid sylvan surroundings, the natural beauties of which Greg did so much to enhance, and its approach recalls on a smaller and softened scale the features of a Derbyshire dale. Here they lived the remainder of their lives, and Greg engaged in the varied duties and occupations of a country gentleman. In 1873 he was appointed Justice of the Peace for the County, and in 1897 he succeeded to the Chairmanship of the Buntingford Bench. He enjoyed good health until his critical illness in 1885; he was affected by some form of blood-poisoning and had to suffer the amputation of his right foot, an operation which owing to the subsequent gangrening of the wound nearly cost him his life. Convalescence was tedious and slow, and two years elapsed before he recovered such measure of activity as an artificial substitute for his lost foot would allow. In 1895 his wife was attacked by the epidemic of influenza prevalent at that time, from which she never wholly recovered and to the after-effects of which she succumbed four years later. After her death Greg led a very quiet life; indeed, his own impaired health and the increasing weight of years would have in any case resulted in comparative seclusion. His death, though sudden, was not entirely unexpected. He was buried on August 23 at Westmill, of which village he was the squire, and the funeral was attended by a large number of relatives and others wishing to pay to him a last token of respect.

Until the time of his critical illness, Greg was an ardent collector; full of enthusiasm, he would spare no effort and grudge no expense to secure a coveted specimen. He began with spiders as a boy. On reaching manhood he turned his attention to the 'Allan' collection of minerals, then in his father's possession at Norcliffe Hall, and expended some £800 in the purchase of desirable specimens. Thanks to his energy, the collection became by far the finest private collection of minerals of the time in this country. The acquisition of specimens by purchase or exchange brought him into relations with collectors and others interested in minerals. In this way he made the acquaintance of W. G. Lettsom (d. 1887), like himself a keen collector, with whom he

collaborated in the production of the 'Manual of the Mineralogy of Great Britain and Ireland', which though published in 1858—nearly half a century ago—still remains the only work dealing with the general distribution of minerals in the British Isles. The book was written in four years, a remarkably short space of time for a work of that kind. With its publication Greg's interest in minerals seems to have waned, and in 1860, two years after its publication, he negotiated on behalf of his father the sale of the collection to the Trustees of the British Museum. He published a few papers on mineralogical subjects, the most important of which are the description of a new oxychloride of lead, matlockite, the discussions of the crystalline forms of leucophane and of rhodonite, and a paper with the late Professor Heddle on British pectolites. During the succeeding eighteen years he devoted much attention to the study of meteorites and meteor-showers, mainly from the astronomical point of view. He was a member of the Committee appointed by the British Association to report on observations of luminous meteors, and he wrote a large number of papers bearing on this subject, which form an enduring contribution to science. He got together a small collection of meteorites which was sold in 1865 to the Trustees of the Calcutta Museum for £500, and commenced in 1875 the formation of a collection of prehistoric implements which he sold in 1889 for £304. In consequence doubtless of the lengthy visit which he and his wife together with a party of relations paid to Egypt and the East in 1880, he commenced, three years later, a book on the comparative philology of the old and new worlds; it, however, did not actually appear till 1893, owing to the intervention of the severe illness already alluded to.

Besides being a member of the Mineralogical Society (1876–86), Greg belonged to the Royal Astronomical Society (1868–81), the Society of Antiquaries (1878–94), and the Geological Society (1853 till his death), and he frequently attended the meetings of the British Association. According to the Royal Society's Catalogue of Scientific Papers, Greg published twenty-six papers, and was joint author of two others, in addition to the two books mentioned above.

G. F. H. S.

John George Goodchild (1844–1906).

Mr. J. G. Goodchild, who died at Edinburgh on February 21, 1906, was an officer of the Geological Survey, to which he became attached in 1867. He was born near London on May 26, 1844. For many years

he was engaged in mapping part of the Lake District, and, although glacial geology occupied much of his attention while there, he became greatly interested in the local minerals and published 'Contributions towards a List of the Minerals occurring in Cumberland and Westmorland.' This paper appeared in the 'Transactions of the Cumberland and Westmorland Association' (1882–5), of which he was editor. Compelled by ill-health to abandon field-work, he was stationed for some years in the London office of the Survey, whence he was transferred to Edinburgh in 1887. There he took charge, first of the collections of the Scottish Survey, and afterwards of the mineral collection of the Royal Scottish Museum, formerly the 'Edinburgh Museum of Science and Art'. Under the influence of Dr. M. F. Heddle, whose collection passed officially into his charge, he became an enthusiastic student of the minerals of Scotland, and many papers, dealing especially with their probable genesis, proceeded from his active pen. He prepared, too, an excellent guide to the collections under his care, and on Heddle's death he undertook the editing of 'The Mineralogy of Scotland'. The manuscript required much labour in its preparation for press, and important additions, including many plates, were made by the editor. Mr. Goodchild was a man of extremely varied interests, giving at times serious attention to ornithology, botany, ethnology, and archaeology. He was a ready writer (being the author of some two hundred papers) and remarkably fluent as a speaker, so that he was induced to devote much time to lecturing, and in spite of long continued ill-health achieved in this direction pronounced success.

Vivant Léon Moissenet (1831–1906).

By the death of Professor Moissenet at Chaumont on February 2, 1906, the Society loses one of its earliest Honorary Members, he having been elected in 1877. He was born on August 2, 1831, at Chalon-sur-Saône. After passing through the courses of the Polytechnic School and the School of Mines in Paris, he became attached to the French Department of Mines, from which he retired in 1893 with the title of Honorary Inspector General of Mines. In 1869 he became Professor of Assaying and Analytical Chemistry in the School of Mines at Paris. In earlier years he paid several visits to the mining districts of England, and his first paper, in 1857, was on the deposits of lead-ore in the Carboniferous Limestone of Flintshire. In 1874 he published a pamphlet entitled 'Études sur les filons du Cornwall', which was translated into English by Mr. J. H. Collins in 1877.

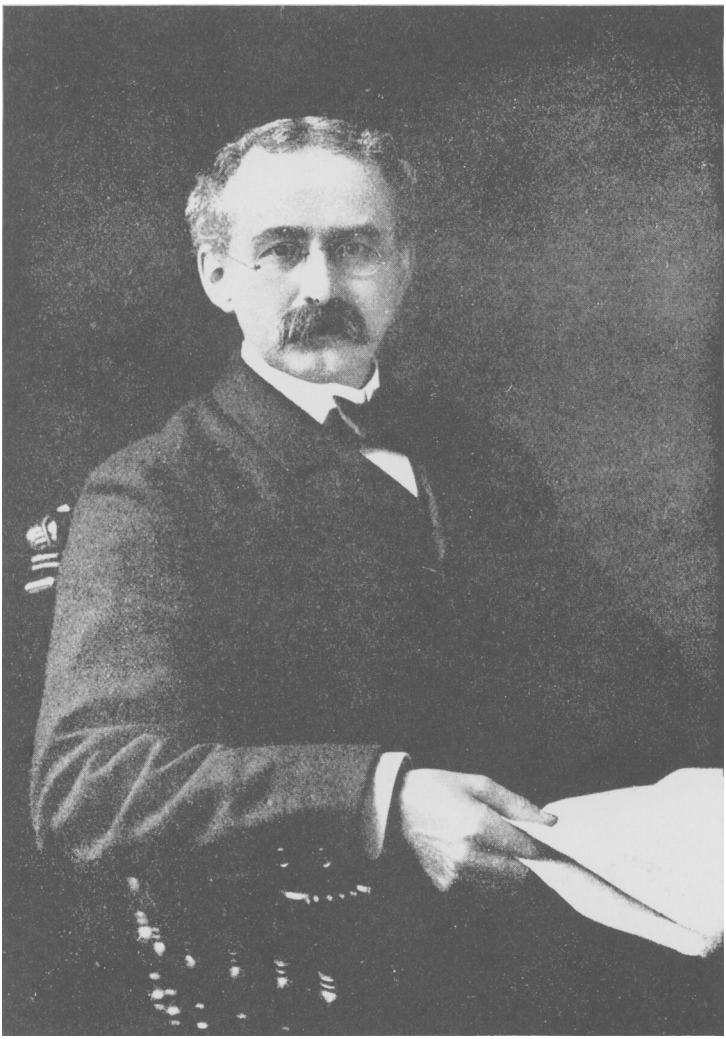
Pierre Curie (1859–1906).

Professor Curie, the co-discoverer with his wife, Madame Sklodowska Curie, of the element radium, and also well known as a physicist, met his death as the result of a street accident in Paris on April 19. He was born in Paris on March 15, 1859, and received his early training at the Sorbonne, graduating as Doctor of Science in 1895. In the same year he became Professor of Physics in the Municipal School of Physics and Chemistry, and in 1900 Professor at the Sorbonne. Some of his earlier work, done in conjunction with his elder brother Jacques Curie, related to the piezoelectricity of crystals (1880); he also published papers on the symmetery of crystals (1884–5) and the capillarity constants of their faces (1885). Electrical researches occupied his attention until his work on radio-activity led to the discovery, in 1898, of radium in the mineral pitchblende. He was a life-member of the French Mineralogical Society.

Henry Augustus Ward (1834–1906).

Dr. Henry A. Ward, who, at the age of seventy-two, was knocked down and killed by a motor-car at Buffalo on July 4 last, was born at Rochester, New York, on March 9, 1834. After studying for four years at the School of Mines in Paris, he became, in 1859, Professor of Natural Science in the University of Rochester, a post which he held till 1865. For a time he acted as superintendent of gold mines in Montana and South Carolina, but soon afterwards returned to Rochester and founded the now well-known 'Ward's Natural Science Establishment', with which he was actively connected for over thirty years. Always an enthusiastic and energetic collector and distributor of specimens belonging to various branches of natural history, he in later years turned his attention largely to meteorites. He could tell many interesting tales of adventure which had befallen him during his travels in out-of-the-way places all the world over, undertaken with the object of securing examples of meteoric falls not represented in his collection. After disposing of large collections of meteorites to the Field Columbian Museum in Chicago and to Mr. C. S. Bement of Philadelphia, he commenced in 1894, at the age of sixty, the Ward-Coonley collection, which in the comparatively short space of ten years became one of the finest in existence. A detailed catalogue of this collection, together with a list of all known meteorites, was published by Professor Ward in 1904 ('Catalogue of the Ward-Coonley collection of Meteorites', Chicago, 1904, 4to, pp. xii +

113, with 10 pls.). At that time the collection, which is now exhibited in the American Museum of Natural History at New York, contained representatives of 603 meteoric falls, with a total weight of material of 2,495 kilograms. Professor Ward was the author of several papers on meteorites, and had collected a large amount of information relating to these bodies, on which he intended to publish a treatise.



SAMUEL LEWIS PENFIELD.

(At the age of 46.)

ROBERT PHILIPS GREG.
(At the age of 79.)