

L. J. Spencer's work at the British Museum

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LEONARD JAMES SPENCER, Keeper of Minerals in the British Museum (Natural History) from December 1927 to July 1935, joined the Department of Mineralogy officially on January 1, 1894, filling a vacancy caused by the death in 1892 of Thomas Davies. Davies had served in the Department since 1857. Trained by Nevil Story-Maskelyne, Keeper from 1857 to 1880, he had taken a great share in the arrangement and labelling of the mineral collection and in his later years had also had charge of the collection of rocks. Spencer was almost equally well qualified as a petrologist and as a mineralogist. He had studied chemistry at the Dublin Royal College of Science before going to Cambridge, where he studied geology as well as mineralogy and chemistry and gained the Harkness Scholarship for Geology in 1893. The examination for the vacancy at the Museum was held in August 1893 and Spencer was the successful candidate. Fortunately for mineralogy it was decided to assign him to work on the mineral collection, and at the request of the Keeper of Minerals, [Sir] Lazarus Fletcher, he went to Munich for three months (at his own expense) to study crystallography in Professor Paul Groth's laboratories. It was owing to this entirely voluntary period of study abroad that Spencer's appointment to the Museum staff was delayed until January 1, 1894, a delay which in later years operated to his disadvantage.

The staff of the Department when Spencer joined it consisted of [Sir] Lazarus Fletcher, Keeper since 1880, [Sir] Henry A. Miers, appointed 1882, and George Thurland Prior, appointed 1887. All three were Oxford men of high attainments.

The Department was well equipped with apparatus, and accommodation was adequate for the small staff of four scientific officers and five attendants. It consisted of four studies, chemical laboratory, balance room, librarian's room, clerk's room, and a lapidary's shop.

The work on the mineral collection when Spencer joined the Department was being done almost entirely by Miers. As described by Fletcher in successive annual returns, the scientific and executive work relating

to the collection included 'the preliminary examination of specimens submitted for purchase or exchange, the registration and incorporation of those recently acquired, the determination of the physical and geometrical characters, and the preparation of species-, variety-, and locality-labels'. All this work was in theory assigned to one assistant, but in fact the register of recently acquired specimens was kept by Prior in addition to his work in the chemical laboratory and on the rock collection.

Though the move of the collection from the British Museum building in Bloomsbury to the new museum at South Kensington had been completed in 1881, there was much work still to do on the arrangement of specimens in exhibition cases and in the cabinets. There was also in preparation a descriptive catalogue of all the specimens. This catalogue, usually referred to in the Department as the crystallographic catalogue, was a somewhat ambitious project started by the Keeper, Nevil Story-Maskelyne, in 1875 and described by him in his annual return for that year as a 'Scientific Catalogue of the whole collection, with crystallographic descriptions and chemical analyses of those specimens the composition of which it is desirable more accurately to determine'. This catalogue has not yet been completed nor has any part of it been published, but in the preparation of the materials for it successive assistants have found abundant subjects for original research, and the most important results of this work have been published in the *Mineralogical Magazine* from time to time.

Beyond the preparation of this catalogue there was no definite plan of research nor was the work of the assistants limited to any one branch of mineralogy, though Fletcher repeatedly stated in his annual returns that 'a mineralogist can no longer satisfactorily attempt both to keep abreast of scientific knowledge and to undertake original research in more than one of the three main branches (physical, petrological, and chemical)'.

For the brief period of two years Spencer was working with Miers on the mineral collection, and from him he had much information on its history and on the work that had already been done. With Miers's departure to take up the Professorship of Mineralogy at Oxford the whole of the work on the mineral collection was in Spencer's hands until G. F. Herbert Smith joined the Department in 1897. Herbert Smith on his arrival took over the work of selecting specimens offered for purchase or exchange, and the crystallographic catalogue for the halides and (later) oxides, and specialized in the study of physical (optical) characters

of minerals and gemstones, geometrical crystallography, and the improvement of optical instruments for this work.

There is no need to detail Spencer's work on the arrangement of the collections. It involved not only rearrangement in desk cases in the main gallery but, in addition, special exhibits of pseudomorphs, enclosures in crystals, artificial minerals (with Miers), models of famous diamonds (1901), and the setting up of large specimens in the pavilion (1895-97), and in case-ends. His rearrangement of calcites and aragonites led him to seek for rapid means of distinguishing aragonite from fibrous forms of calcite and he successfully achieved this, using specific gravity and optical characters, and published a paper on his methods in 1897.

He had to prepare for the printer the species-, variety-, and locality-labels, and he utilized a spare set of the locality-labels to make a topographical catalogue in book form of all the localities represented (1900). The Student's Index to the Collection of Minerals was also Spencer's care. He had assisted Miers with the new (20th) edition in 1895 and he himself prepared further editions in 1897, 1899, and 1903. He also assisted in the preparation of the 'History of the Collections', vol. 1, published in 1904.

Spencer's early publications were the direct outcome of his work on the crystallographic catalogue. He began by cataloguing pyrite which he finished in 1896, but he also had to bring up to date the catalogue for other sulphides, and by 1895 he was working on enargite and related minerals. His first paper written from the Museum in collaboration with G. T. Prior was on the aluminium phosphate, augelite, which up to 1894 was known only as a massive mineral. In June 1894 Spencer discovered crystals associated with bournonite and pyrite from Machaca-marca, Bolivia. At first thought to be a new phosphate, the crystals were identified with augelite by comparison with specimens from the original locality, Westana, Sweden, obtained from C. W. Blömstrand. The paper was read before the Mineralogical Society on November 20, 1894. A paper on enargite was presented to the Society in April 1895. This might have served as a model for the publication of the descriptive catalogue planned by Story-Maskelyne twenty years earlier. It gives: literature, complete list of forms starring those present on the Museum specimens, tables of angles establishing new forms, parameters, habits, twinning, parallel growths, identity with 'clarite', and a discussion of other minerals of similar composition, and, finally, a list of localities for enargite.

Other papers arising from Spencer's work on the crystallographic

catalogue followed in quick succession: 'Zinckenite and wolfsbergite (chalcostibite) from Wolfsberg in the Harz; and the zinckenite group'; and 'The crystallography of plagionite: new crystal forms on stephanite, enargite and anglesite'; and, with G. T. Prior, 'The identity of andorite, sundtite, and webnerite' (1897), and 'Stanniferous argyrodite from Bolivia: . . .' (1898), and three short papers on augelite, diaphorite, and miersite (1898). In 1899 he produced his paper on 'Plagionite, heteromorphite and semseyite as members of a natural group of minerals' with analyses by G. T. Prior, in which he discussed possible formulae for these minerals and, extending V. C. Butureau's structural formula for plagionite to the other two minerals, indicated as most probable the formulae for pure crystals of the species which are those now adopted. In 1899 also the well-known paper by Prior and Spencer on 'The identity of binnite with tennantite; and the chemical composition of fahlerz' was published. The material for this investigation was partly derived from specimens collected by R. H. Solly from the famous quarry in the Binnenthal in 1898.

Another part of Spencer's work on the mineral collection involved the selection of specimens from collections presented to the Museum or offered for purchase. In 1894 he had arranged and labelled a small collection made by Lady Cust, and a much larger collection, 550 specimens, chiefly from Cornwall, formed by the Williams of Caerhays and presented by John Charles Williams in 1893. Specimens from Broken Hill, New South Wales, offered for purchase by J. R. Gregory in December 1897, and purchased in 1898, afforded the material for a paper on 'Marshite, miersite and iodyrite . . .' read to the Mineralogical Society in 1898 and published in 1901, and a later paper by Prior and Spencer on 'The cerargyrite group (holohedral-cubic silver haloids)' (1902). Spencer's descriptions in the earlier of these two papers of the behaviour of miersite and iodyrite when heated on a microscope slide are remarkably good as are also his conclusions on the mutual relations of these two minerals.

The work with Prior on andorite and sundtite, referred to above, and their work on augelite and argyrodite had already introduced Spencer to Bolivian sulphide minerals and fresh material was provided by the arrival of a collection made by Sir Martin Conway on an expedition to the Bolivian Andes in 1898. A paper on 'Crystallised stannite from Bolivia', read in November 1899, was the first of several contributions by Spencer on Bolivian minerals, largely encouraged in later years by his friend and school-fellow, T. Malcolm Roberts, who presented many

fine specimens from Bolivian localities. A full account of Sir Martin Conway's collection was published in an appendix by Spencer to Sir Martin's 'Bolivian Andes' in 1901.¹ In the matter of collecting he was not behindhand himself; indeed, as a boy he had formed a collection of minerals and fossils numbering some 3,000 specimens. In 1898 he had attended the meeting of the British Association at Bristol where he read two papers to section C (Geology) on 'Leadhillite in ancient lead slags from the Mendip Hills' and 'Supplementary list of British minerals'. He did some collecting in the Mendips that year, and the collection then made was referred to later in 1923 when he made a fresh visit to the district and discovered the new minerals chloroxiphite and diaboileite, collected some fifty good specimens of hydrocerussite, not previously recorded from the Mendips, and recorded and described also crednerite and wulfenite, new for that district.

In June 1902 as a result of [Sir] Lazarus Fletcher's persuasive powers a large number of fine specimens of gold ores from Australia were presented by the Government of Western Australia and several gold-mining companies. The material had partly been brought together for the Paris Exhibition of 1900, and had been shown at the Coolgardie Exhibition in 1899, Glasgow Exhibition 1901, and a Colonial Exhibition at the Royal Exchange in 1902. A paper entitled 'Mineralogical notes on Western Australian tellurides: the non-existence of "kalgoorlite" and "coolgardite" as mineral species', was published in February 1903. It included descriptions of altaite, calaverite, sylvanite, petzite, and coloradoite. The formula of coloradoite was proved to be HgTe , as for the original mineral from Colorado. Every fragment used in the analyses of the mineral was separately picked out and examined under a microscope before it was accepted.

A short 'Note on the pleochroism of adamite' from Chañarcillo, read in November 1903 (but not published until 1914) completes this account of the first ten years of Spencer's work on material in the Museum collections, but in addition he had accomplished much work at home on mineralogical literature. In December 1903 appeared 'A (third) list of new mineral names', the preceding lists having been published in 1897 and 1900. He had compiled the entries for, and edited, the mineralogy volumes (including petrology and crystallography) for the International Catalogue of Scientific Literature for 1901 and 1902; abstracted some 1,200 mineralogical papers for the Journal of the Chemical Society and,

¹ The paper on stannite (1901) contains a fine example of Spencer's crystal drawings with which he illustrated his papers.

finally, he and Mrs. Spencer had completed by December 1903 the translation of Max Bauer's 'Endelsteinkunde' (xvi+627 pages) which was published in 1904.

Spencer might well have felt satisfied with his first ten years' work at the Museum. Certainly his colleagues fully appreciated it, and the Geological Society showed its recognition of the value of his contributions to mineralogy by awarding him the Wollaston Fund in 1902.

The second decade of Spencer's work at the Museum takes us almost up to the beginning of the First World War. In 1904 important changes were made in the system of registering, labelling, and cataloguing the mineral collection. Some years previously G. T. Prior had started a slip catalogue of rock sections and it had proved its worth. Spencer now set about making a slip catalogue of the parts of the mineral collection for which he was responsible, beginning with copper. A slip was prepared for every specimen and on this was written all available information about it. It involved copying on to slips the register entries and all the details recorded for each specimen in the crystallographic catalogue. At the same time the numbering system was changed. From the beginning of 1905 every mineral specimen received two numbers; the year and a serial number. A fresh series of serial numbers began with every year. The adoption of the new numbering set free the serial numbers B.M. 87172 onwards for registration of specimens acquired before the General Register was opened in 1837 or belonging to large collections like the Allan-Greg collection acquired in 1860, which, having complete catalogues of their own, had never been entered individually in the departmental register. In the course of this cataloguing many specimens belonging to the historic collections of Sloane and Greville were identified. The minerals figured in James Sowerby's 'British Mineralogy' and 'Exotic Mineralogy' and in Miers's 'Mineralogy' were all identified and noted.

When the numbering system was changed the labelling system was also improved. Many of the old, coloured labels gummed on the specimens were perishing. With characteristic thoroughness Spencer attended evening classes in paper-making and paper-testing and used the knowledge so obtained to select the best kind of paper for the new labels. These were of two kinds: a small, gummed ticket for the number, to be affixed to the back of the specimen, and a so-called 'permanent' label, with printed heading, for permanently keeping with each specimen information as to the name of the species, associated minerals, the locality, and how and when it was acquired. All writing on the labels

was done in indian ink as it had always been in the registers and specimen labels previously. Similar care was exercised in the design of labels for microscope slides, and in the selection of card and paper for new specimen trays, and for locality labels for minerals and meteorites. A spare set of mineral locality labels had been used to form a topographical index of localities in 1900. This had been kept up to date, and the localities were also indexed alphabetically. In 1912, 683 new meteorite labels were printed and the opportunity was taken to print two sets on thin paper to form an alphabetical and topographical index of meteorites in the collection. Later (1914) spare sets of mineral locality labels were also printed on thin paper for use in the index.

In the Mineral Gallery most of the basic arrangement of cases was finished, but important collections were acquired and incorporated during this pre-war period; that of Miss Caroline Birley (3,000 specimens) in 1907, the Tendron bequest (1910), and a large selection of specimens from the Walker collection (219) in 1912. Guide labels drafted by Spencer giving case numbers of important species were affixed to pillars in the gallery in 1905, and new editions of the Student's Index were published in 1908 and 1914.

The year 1909 was marked by the appointment of the Keeper of Minerals, [Sir] Lazarus Fletcher, to be Director of the Natural History Museum, and G. T. Prior became Keeper in his stead. As an immediate result of Prior's promotion Spencer took over the general register from November 1909 in addition to his other work. He maintained this register in his own handwriting almost to the day of his retirement in 1935, only leaving to his trusted assistant, Miss J. M. Sweet, the registration of such large collections as that of C. O. Trechmann presented by Dr. C. T. Trechmann in 1926, the Liversidge collection bequeathed in 1927, and the Ashcroft collection of Swiss minerals, parts of which were presented in 1930, 1932, and 1935.

Spencer was responsible between November 1909 and July 1935 for over 20,000 entries in the current registers, all made with meticulous accuracy and consistency. The writing of labels from the register entries and the copying of the entries for the slip catalogue he entrusted to others, but if this work was in arrears he would take a hand at it himself. As a result of this great increase in Spencer's work on the register and the slip catalogue, some falling off in the volume of his original papers might have been expected. Nevertheless in the period 1904 to 1913 he produced thirteen papers under his own name as well as collaborations with other authors. His own papers included descriptions

of: irregularly developed crystals of zircon from Ceylon; phenakite from Tanganyika Territory; a 'Note on "feather-ore": identity of "domin-gite" (= "warrenite") with jamesonite'; further notes on some Bolivian minerals; and his well-known paper 'On hopeite and other zinc phosphates and associated minerals from the Broken Hill mines, North-Western Rhodesia' announcing the discovery of the two new species parahopeite and tarbuttite. With H. J. Johnston-Lavis he described a new mineral, chloromanganokalite, from Vesuvius, and he contributed notes on the crystallography of cassiterite pseudomorphs from Bolivia for Richard Pearce, and on bertrandite from Cornwall for [Sir] Arthur Russell. When examining crystals from Cornish tin furnaces sent in 1910 by his friend Richard Pearce, Spencer became convinced that crystals described as ' β -tin' by C. O. Trechmann in 1879 were identical with stannous sulphide. He completed his work on this material in 1910 but withheld publication until 1921 during the lives of authors principally concerned with the earlier papers. Other work in 1911 of which publication was postponed was on the crystallography and optical properties of the minerals celsian and paracelsian discovered in considerable quantities in old workings at the Benallt mine in Carnarvonshire by [Sir] Arthur Russell in 1911 and recorded in a letter to 'Nature' in that year.

In 1901 a special exhibit of a selection of models of famous diamonds had been arranged and Spencer had drafted descriptive labels for it. The discovery of the Cullinan diamond in 1905 aroused renewed and widespread public interest in the larger diamonds of South Africa. A glass model of the Cullinan was presented to the Museum by the Premier (Transvaal) Diamond Mining Company in 1906, and a temporary exhibit of models of famous diamonds was placed in the central hall from August 1907 to February 1910. As a result of his work on this exhibit Spencer wrote in 1910 'Notes on the weight of the "Cullinan" diamond, and on the value of the carat-weight', and in 1911 'The larger diamonds of South Africa'.

Between 1907 and 1910 Spencer made three visits on short vacations to the north of England to visit mines and mineral localities and to collect. The most important result of these collecting trips was his paper 'On the occurrence of alstonite and ullmannite (a species new to Britain) in a barytes-witherite vein at the New Brancepeth colliery near Durham', based on material obtained at the mine in 1909. The mine was revisited in 1946 on the field excursion of the Mineralogical Society, but no more ullmannite was found.

One cannot refrain from again mentioning the vast amount of bibliographical work Spencer did at home. Besides editing the *Mineralogical Magazine* and continuing his work on the International Catalogue of Scientific Literature, he also collaborated in the 'Tables annuelles de constantes et données numériques, de Chimie, de Physique et de Technologie'. He produced three more lists of new mineral names (1907, 1910, and 1913), 174 articles for the 11th edition of the 'Encyclopaedia Britannica', and 244 articles for Thorpe's 'Dictionary of Applied Chemistry'. In addition he translated the whole of R. Brauns' 'Das Mineralreich', v + 432 pages (1908-12), and wrote a very useful elementary treatise, 'The World's Minerals' (1911).

The War of 1914-18 brought little change in the routine work of the Museum. All the younger men were away on active service, but the work went on. Spencer added to his work outside the Museum the night duties of a special constable in his home district. A list of the more valuable specimens, compiled for the History of the Collections in 1903, was brought up to date. Many of these specimens were removed to a place of safety in 1918, but, except for the collection of gemstones, all were back in their places in the first week of January 1919. An improved topographical index for mineral localities represented in the collection was commenced in 1920.

Occasional accessions and purchases were fewer than usual in this period, but F. N. Ashcroft presented the whole of his collection of foreign zeolites to the Museum during the War (between 1914 and 1920), and Spencer registered them all as they came in and arranged a temporary exhibit of part of the collection in 1914. The collection of the Rev. John More Gordon was bequeathed to the Museum and incorporated in 1922. Spencer's published papers during the War were few: 'Crystals of iron phosphide (rhabdite) from a blast-furnace', and 'A butterfly-twin of gypsum' (1916). 'A (seventh) list of new mineral names', appeared punctually at its three-yearly interval in 1916. After the War he published on the mineralogical characters of turite (= turgite), new crystal forms of pyrites, calcite and epidote, fibrolite (= sillimanite) as a gemstone (1920), and on curvature in crystals (1921). The last was a collection of notes prepared for J. E. Stead, the metallographer, with whom Spencer collaborated in a paper on the ternary alloys of tin—antimony—arsenic in 1919. The paper on ' β -tin' and on the new lead-copper minerals from the Mendip Hills referred to above were published in 1921 and 1923, and his paper on 'Euclase and platinum from diamond-washings in British Guiana' was read in 1923. Up to this

time there had been no published record of the occurrence of platinum in British Guiana.

The eighth and ninth lists of new mineral names appeared in 1919 and 1922 and the first of Spencer's triennial 'Biographical notices of mineralogists recently deceased . . .' was published in 1921. He was still collaborating in the production of the 'Tables annuelles de constantes . . .' and editing the *Mineralogical Magazine*, but the outstanding achievement of Spencer's work in his 'spare' time in this period was the commencement of *Mineralogical Abstracts*. A scheme for the preparation of abstracts of mineralogical literature had been discussed by the Council of the Mineralogical Society in 1917, but the decision to publish *Mineralogical Abstracts* in their present form was taken at a meeting on January 20, 1920, and the first number of 16 pages was issued as an appendix to No. 88 of the *Mineralogical Magazine* in March of that year. It contained 38 abstracts, all by 'L.J.S.' It was intended that the Abstracts should cover the period 1915 onwards, so continuing the record of mineralogical literature compiled by Spencer for the Catalogue of Scientific Literature which had been brought to an end by the War in 1914.

In 1924 Spencer was invited to attend as a guest the Toronto meeting of the British Association, and a small grant made by the Museum enabled him to plan visits to the museums and mineral localities in Canada and in the U.S.A. Spencer set himself an extensive programme. He visited five localities in the province of Quebec, and eleven in Ontario including the silver-mines at Cobalt, and the gold-mines at Kirkland Lake, Porcupine, and Timmins in Northern Ontario, and three localities in Pennsylvania. He saw all the principal museums, four in Canada, eight in the U.S.A., the principal libraries in New York, Washington, and Boston, three research institutions including the Geophysical Laboratory at Washington, and some twelve private collections of minerals. At Rochester, N.Y., he went through Ward's stock of minerals with G. L. English, selecting 189 specimens for the Museum, and he selected for exchange specimens at the Royal Ontario Museum and at the Philadelphia Academy of Natural Sciences. In all he shipped back to the Museum about 12 cwt. of mineral specimens. The total cost to the Museum (exclusive of the purchase from Ward's) was £41. 5s. 9d. Among the minerals secured were twelve of species new to the collection.

The Jubilee meeting of the Mineralogical Society was held in London in 1926 and Spencer joined the field excursion to the north of England

led by Professor Arthur Hutchinson, visiting numerous mineral localities and mines in Cumberland, Westmorland, the Alston district, and Weardale.

His published papers about this time included the description of two new minerals; schultenite from South-West Africa, and aramayoite from Bolivia, both described in 1926. The schultenite was discovered on a specimen labelled lanarkite from Tsumeb; the aramayoite on a specimen from the Animas mine at Chocaya, Potosi, found and recognized as probably a new mineral by T. Malcolm Roberts.

Another new mineral, described in 1928, was potarite, PdHg, discovered in British Guiana by Sir John Harrison in 1924 and 1925. Spencer had previously identified as allopalladium three tiny grains of the same material. He had correctly and skilfully detected palladium, but the mercury had eluded him. The largest of the three grains he had to examine weighed 76 milligrams.

Other papers of this period were 'An inclusion of magnetite in diamond' (1924), and on arrow-head corundum twins from the Zoutpansberg district, Northern Transvaal (1927), and on the wonderful sperrylite crystals from Tweefontein farm, Potgietersrust, Transvaal, (1926). The two sperrylite crystals described measured $5.5 \times 5.3 \times 5.0$ mm. and $18.5 \times 16.5 \times 15$ mm. along their cubic axes, the larger one weighing 33.75 grams. The sperrylite crystals from Vermilion mine, Sudbury, Ontario, described in 1889 measure about 0.5 mm. across.

Before he retired from the Museum Spencer had a hand in the description of yet one more new mineral, bismutotantalite from Uganda, described by E. J. Wayland and Spencer in 1929. He also contributed a note on the crystallography of zunyite from Postmasburg in a paper by L. T. Nel in 1930. The paper on 'Fictitious occurrences of iron silicide (ferrosilicon)', published in 1935, was the result of work done in 1924 and 1929. The last purely mineralogical paper published before he retired was his description of the splendid, colourless crystal of euclase, obtained from H. R. Ruggles-Brice, by whom it was found on the Lukangasi mica mine, Morogoro district, Tanganyika Territory, and of phenakite crystals from Klein Spitzkopje, in South-West Africa.

The last ten years of Spencer's service at the Museum brought him honours and promotion which were richly deserved. He was elected a Fellow of the Royal Society in 1925, appointed to a Deputy Keepership in the Museum in June 1927, and he succeeded G. T. Prior as Keeper of Minerals in December of the same year. He was appointed a Commander of the Order of the British Empire in 1934. He was awarded the

Murchison Medal of the Geological Society of London in 1937, two years after his retirement from the Museum.

There were several changes in the staff of the Mineral Department during this period. E. D. Mountain, who had filled the vacancy caused by Herbert Smith's appointment as Assistant Secretary (later Secretary) of the Museum in January 1921, resigned in December 1926 to take up a lecturership in Geology at Rhodes University College, Grahamstown, South Africa. F. A. Bannister was appointed to the Department in September 1927, and Miss J. M. Sweet had joined the staff in June of the same year. Max H. Hey was appointed in November 1928, and took over Prior's work as chemist, the cataloguing of the zeolites, and, later, of the meteorite collection.

With this staff of assistants to help him, Spencer was able to devote time and energy to developing his plans for improved exhibits in the gallery and to contacts outside the Museum. Cases at the entrance to the gallery previously used as book-cases for periodicals were provided with internal lighting and filled with attractive exhibits. The upper panes were used for large transparencies (added in 1930), and one case was arranged (in 1928) very skilfully to show the beautiful effects of fluorescence of minerals in ultra-violet light. Already in 1927, in his paper on 'South African occurrences of willemite', Spencer had added a note on the 'Fluorescence of willemite and some other zinc minerals in ultra-violet rays', using for his experiments a mercury-vapour lamp. He had seen high-tension sparks used at Franklin Furnace for the detection of willemite in ore and on the washing-tables, and as he recalled in a later paper, he had attended in 1892 a short course of lectures on fluorescence by Sir George Stokes, and the experiments performed in a beam of sunlight admitted through a slit in a window shutter had remained a vivid recollection. The new fluorescence exhibit was described in a paper in 'The Natural History Magazine' in 1928. It was probably the first public exhibit of its kind. It attracted great interest, and similar exhibits have since been set up in many natural history museums and private collections, particularly in the U.S.A.

In 1929 Spencer left on the second of his long journeys abroad. He attended the British Association meeting in Cape Town and Johannesburg, and the International Geological Congress in Pretoria, at which he was one of the British Government delegates. On this trip he covered 7,500 miles by rail and 1,500 by car, visiting amongst other places the Kimberley diamond mines and the Vaal River diggings, the gold-mines of the Rand, the Premier Diamond mine, the Bushveld and Pilansberg

in South Africa; Livingstone, Lusaka, Bwana M'Kubwa, and N'Kana; and he collected much material at Broken Hill, Rhodesia. In South-West Africa he visited the diamond-fields at Luderitz Bay, copper mines at Tsumeb, the vanadium mine at Grootfontein, Windhoek, and several localities in the Namib desert. At Windhoek he saw in the Public Garden a pile of some thirty masses of meteoritic iron from Gibeon, and near Grootfontein he examined the largest known meteorite, an iron estimated to weigh 60 metric tons, which lies where it fell on Hoba West farm. Altogether 17 cases of minerals were shipped home after this South African trip, and he secured the promise of many other specimens, including a 136 kilogram mass of the Gibeon iron, presented to the Museum by the Administration of South-West Africa.

During Spencer's absence in Africa the redecoration of the Mineral Gallery had been completed, and on his return a start was made on the provision of new wall-cases. These cases fitted with glass shelves and internal lighting enabled the best of the large mineral specimens to be seen to advantage for the first time. [A description of the lighting arrangements in the new cases and in the older cases outside the gallery was given in a paper in the 'Museums Journal' in 1932.] The first of these new cases was completed in time for the fiftieth anniversary of the opening of the Natural History Museum in 1931. The celebration was postponed from April 18 to September 29 so that it should coincide with the meeting of the British Association in London, when many delegates from home and overseas visited the Museum.¹

Spencer always kept in mind the needs of visitors, and in 1930 he produced a 4-page guide leaflet to the Mineral Gallery for free distribution. 10,000 copies were printed for each edition, and by 1934 it had run through five editions. Later work in the Mineral Gallery to which Spencer devoted his attention was the exhibit of the gemstones of the Sir Arthur Church collection and of the Clarke-Thornhill collection, the latter bequeathed to the Museum in 1934. He published an account of these collections in 'The Gemmologist' in 1934 and later in the same year papers on 'Pollucite, a new gemstone', and 'Sir Hans Sloane's precious stone collection'. Earlier he had described in 'The Natural History Magazine' a magnificent crystal of aquamarine from Minas Geraes, weighing 2,505 grams and measuring 13 cm. in height, and a crystal of topaz from Madagascar, weighing 2,290 grams (1927 and 1928).

¹ At this meeting of the British Association, Spencer gave 'A Second supplementary list of British minerals', bringing up to date the list given at the British Association meeting in Bristol thirty-three years earlier.

A paper on 'Gemstones in the Museum collection . . .' was published in the first volume of 'The Gemmologist' in 1931, and a short paper on Pebbles, in very popular style, was contributed to the same journal in 1934. The latter paper resulted from the acquisition in 1934 of a large collection of pebbles presented by E. J. Dunn of Melbourne, Australia.

Spencer's visits to Windhoek and Grootfontein had renewed his interest in meteorites, and on his return he had published a paper on 'Meteoric irons from South-West Africa' describing the Gibeon iron, and Hoba, and he gave a more detailed account of the Hoba meteorite (with chemical analysis by M. H. Hey) in 1932. Six other individual meteorites were described between 1930 and 1935, and in addition many papers were published on meteorite craters and tektites referred to below. A very useful paper on 'Pseudometeorites' was published in 'The Natural History Magazine' in 1931. Meteorites were soon to claim much of Spencer's attention. The discovery of the new meteorite craters at Henbury (1931) and Wabar (1932) fired his enthusiasm more than anything else had done. He described the meteoritic iron and silica-glass from the Henbury craters and from Wabar in a paper published in 1933. The great collection of the meteoritic irons from Henbury acquired in 1932 by presentation, purchase and exchange; the silica-glass from the meteorite craters at Wabar discovered by H. St. J. B. Philby, and the still unexplained masses of silica-glass found in the Libyan Desert by P. A. Clayton in 1932, were all subjects of special exhibits arranged by Spencer, as also an exhibit of the collection of stones from the shower of meteorites from Tenham (Queensland) acquired in 1935. His discovery of the presence in the black parts of the Wabar glass of minute spheres of nickel-iron representing a 'rain' or rather 'drizzle' of molten metal, condensed from iron and nickel vapours, was astounding but convincing evidence of the very high temperatures and the local exhaustion of atmospheric oxygen during the explosion caused by the impact of large crater-forming meteorites. He published papers on meteorite craters in 'Nature' and in 'The Geographical Journal' in 1932 and 1933, as well as some notes on the origin of tektites in 'Nature' and in the 'Comptes Rendus' (Paris). Then came the discovery by P. A. Clayton of the remarkable silica-glass in the Libyan Desert. Its origin was a complete mystery. There was every hope that meteorite craters would be found in the vicinity of the glass, and although now in his sixty-fifth year Spencer eagerly accepted an invitation to join an expedition in December 1934, organized by the Survey of Egypt, with O. H. Little and

P. A. Clayton, inspector of the Egyptian Desert Surveys. The expedition found no trace of meteorite craters among the high sand-dunes surrounding the locality and the origin of the Libyan Desert glass remains unsolved, but great quantities of the glass were obtained and a full survey of the locality was completed.

After his return from the Libyan Desert Spencer made yet one more short collecting trip before he retired. This was an attempt to secure the entire contents of a small stalactite cave in the Carboniferous Limestone with a view to setting it up again in the Museum, a project Spencer had had in mind ever since his very early days in the Department. A small cave was broken into in a quarry near Shepton Mallet, Somerset, in April 1935. Spencer went down at once to make arrangements. Unfortunately the cave had to be cleared quickly to make way for further quarrying and time did not allow of elaborate plans. With two quarrymen to assist him Spencer brought away 10 cwt. of fine stalactites and stalagmites, and a small group of these was eventually (1939) set up in a case outside the Mineral Gallery.

In May and June 1935 a little time was spent in clearing up odds and ends before the day came for Spencer to retire on July 8, but the secret of Spencer's great output of work was that a task undertaken was carried through, and he left very little work unfinished. His note-books, bound in twenty-eight neatly indexed volumes, are available in the Mineral Department library for future reference.

Of those who were at the Museum when Spencer arrived in 1894 all had long since retired, but two of the Experimental Officers have served with him since 1906. They, and the younger men, remain to carry on the methods Spencer taught for the care of the mineral collections and the library. To them and to those who preceded them the Department owes much, and Spencer would be the first to acknowledge the value of their work.

Happily Spencer's retirement from his official position in the Museum has not severed his connexion with the Department of Mineralogy. Devoting his time almost entirely to the preparation of *Mineralogical Abstracts* and to editing the *Mineralogical Magazine*, he is a constant visitor to the departmental library. Always interested in the work of the Department, he is ever ready to assist with advice and with information from his vast store of knowledge those who are trying to carry on the high standard set them during his forty years' service in the British Museum.
