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Arthur Francis Hallimond (1890–1968)

ARTHUR FRANCIS HALLIMOND, a member of this Society since 1912, was born on 17 January 1890 at Saltburn, Yorkshire. He was at Sir William Turner's School, Coatham, Yorkshire, from 1899 to 1908 and from there won a scholarship at Pembroke College, Cambridge, where his college tutor was Arthur Hutchinson, at that time lecturer in Mineralogy and later Professor.

Hallimond read mathematics in his first year and then proceeded to the Natural Science Tripos in which he gained first class Honours, taking chemistry, physics, geology, and mineralogy. Thus he was well equipped for his first post as assistant-curator of the Museum on Practical Geology, then in its original 1851 building in Jermyn Street.

There he had under his charge the Ludlam Collection of minerals of which the foundation and main part was Charles Hampden Turner's Collection, acquired from Henry Heuland in 1820 and catalogued by Armand Lévy between 1820 and 1828 but not published until 1837.

It was on specimens from this fine collection that Hallimond did his first important mineralogical work. In the course of a study of specimens till then classed as autunite he was able to show that among them were two other, distinct, new minerals, bassetite and uranospathite. This work is a good example of careful optical and goniometric work such as had to be done to establish identifications before X-ray analysis in any form was available for such investigations. The papers describing the results were published during the First World War and consequently did not attract the attention they would have done earlier.

Early in the war Hallimond was seconded for work on steel manufacture and refineries with the South Durham Steel and Iron Company at Stockton. As a result of this work and in collaboration with Dr. J. H. Whiteley, he produced a number of papers on the acid hearth and slag, the metallurgy of carbon steels, and the mineralogy and microstructures of slags, with minor papers on vogtite and monticellite published in the *Mineralogical Magazine*. Some of this work earned for the joint authors Carnegie Scholarship Awards from the Iron and Steel Institute in 1919 and 1923. Another result of this work was Hallimond's collaboration in Geological Survey Special Reports on *Refractory Materials; Ganister and Silica Rock, and Sand for Open Hearth Steel Furnaces* first published in 1918. Later in the same series of Geological Survey Reports he was responsible for the *Special Report on the Bedded Iron Ores of*

England and Wales. For this work he received the Lyell Award of the Geological Society in 1926.

For a few years following on this work Hallimond seems to have been free to return to more purely mineralogical research. Following on a paper published with E. G. Radley in 1922 on the composition of glauconite he was led to a study of the available analyses of the micas from which he derived a chemical classification for the whole group. This was published in the *Mineralogical Magazine* in 1925 and 1926 and it was followed by a paper on the molecular volumes of the micas and this again by three papers on atomic volumes in relation to certain isomorphous series (1927–9).

From 1929 work of quite a different kind diverted Hallimond's attention from pure mineralogy. Since 1924 the Geological Survey Board had been giving consideration to various geophysical methods of surveying and in 1929 a start was made by testing traverses with an Eötvös balance over selected areas in the British Isles. Hallimond, who had been graded Senior Geologist in 1922, was now put in charge of complementary magnetic surveys. The results of this work were published in the *Summary of Progress of the Geological Survey* for 1929 and 1930. Unfortunately this work of the Survey was discontinued in 1931 because a move from the old—and now unsafe—building in Jermyn Street to the new building in South Kensington seemed imminent. Hallimond was one of a group charged with the arrangement in advance of exhibits, complete with specimens, diagrams, and labels, to be ready to be placed in their allotted places in the new museum. Hallimond was responsible for the arrangement and display of the collection of metallic and non-metallic economic minerals. It was expected to make the transfer to the new building in 1933 but the move was postponed for a year in order to allow the International Monetary Congress to be held in the partly empty halls. Frustrating as this delay was to all the museum staff and to the Survey it had the happy result of bringing the opening of the new museum into coincidence with the celebration of the Centenary of the Geological Society in July 1935.

After the completion of the exhibition work in the new museum Hallimond resumed his mineralogical and geophysical work and he took charge in 1938 of an extensive magnetic survey for hematite in Cumberland and Lancashire the results of which were partly published in *Geological Survey Bulletin No. 2* (1939) and in two war-time pamphlets, for already the Second World War was upon us.

In that war his work was directed partly to methods of mineral separation by air flotation, to the identification of the mineral constituents of aluminous cements, and, with E. F. Herroun, to the study of the magnetization of rocks. This last was a return to earlier work published by the Royal Society in 1933.

The end of the war afforded Hallimond an opportunity for work for which he was particularly well qualified. Very early in his career he had displayed great interest in, and aptitude for, instrument design. With H. H. Thomas he had designed a refractometer for liquid mixtures (1921) and in 1930 he devised a magnetic separator for dealing with mineral powders. By 1944 he was interesting himself in microscope design and he published a note in *Nature* on the possibilities of using polaroid to replace the expensive Nicol prisms of Iceland spar still in use in polarizing microscopes.

He was secretary of a committee set up in January 1944 in conjunction with the Geological Society and the Royal Microscopical Society 'to investigate the manufacture of petrological microscopes' and to make recommendations. This committee issued two reports during 1945.

In November 1945 he visited Germany as the leader of a British Intelligence Objectives sub-committee, in company with Dr. G. F. Claringbull and Mr. B. O. Payne of the firm of Cooke, Troughton, and Simms, to study the petrological microscope industry. The works of E. Leitz (Wetzlar), R. Winkel (Göttingen), and Steeg and Reuter (Bad Homburg), and several university departments were visited and a report was issued in 1946.

Notes on Hallimond's later work on the microscope and on reflected-light microscopy have been contributed by Mr. S. H. U. Bowie and Dr. N. F. M. Henry:

'Following the reports on the petrological microscope mentioned above he worked closely with Mr. E. W. Taylor of Cooke, Troughton, and Simms, of York, in the design of a range of polarizing microscopes to meet the requirements set out in the reports. A series of microscopes resulted that were to revolutionize microscope design. The microscopes produced were for both transmitted and reflected light and were the first to employ polaroid instead of the traditional Nicol prism.

When the Second World War ended there was no modern book in English on the subject of reflected light microscopy and the optics of absorbing crystals and Dr. Hallimond did much to meet this need with his *Manual of the Polarizing Microscope* published in 1948. The book, reissued as a greatly enlarged edition in 1953 and reprinted with amendments in 1956, did much to lay the foundations of modern ore-microscopy.

When Dr. Hallimond retired from the Geological Survey in 1950, he was able to devote more time to his interest in microscope design and became a consultant to Cooke's. By then he was thinking of even more advanced microscopes and his association with the firm (later Vickers Ltd.), which lasted until 1965, resulted in the development of some of the best polarizing microscopes available anywhere. At the same time as he was working at Cooke's he was for a time consultant to the Chance-Pilkington Research Laboratories and to the Atomic Energy Research Establishment at Harwell.'

Of his work for Pilkington's Dr. R. C. Jewell writes: 'He introduced the Company to the great importance of reflected-light microscopy. This was particularly successful for the examination of inclusions in glass and refractories and particularly for inclusions of chromite. He gave much helpful advice on a variety of topics in the field of mineralogy.'

All this later work he did at his house in Golders Green, Hampstead, where he had fitted up an efficient workshop and laboratory.

Mr. Bowie's note continues: 'Dr. Hallimond's work in the field of reflected-light microscopy brought him into contact with many others in the same field and he was particularly well known in the U.S.A., France, Germany, and Switzerland. He was a member of the Committee of this Society set up in 1962 to examine the development of new fields of interest with special reference to reflected-light microscopy and was a founder member of the Group known as the Committee on Ore Mineralogy (now

Applied Mineralogy) established a year later. From the beginning this committee fostered close contacts abroad in addition to doing work in this country to encourage a branch of mineralogy that had long lagged behind. One of the first activities of this committee was to organize an International Summer School of Ore Mineralogy in Cambridge in 1963. Because of Dr. Hallimond's contributions to ore mineralogy and his continued assistance to all members of the Committee he was appointed Honorary President of the British Summer School on Ore Mineralogy in 1967 and he shared this honorary position with Professors Ramdohr and Orcel at the Second International Summer School held at Bensheim in Germany the same year.'

In recent years he devoted much of his time to producing a new edition of his *Manual of the Polarizing Microscope*, and just prior to his death he was engrossed in putting the finishing touches to the manuscript and he was able to pass for the press the proofs of the first half of the book.

Dr. Hallimond was a member of several learned Societies including the Geological Society, the Institution of Mining and Metallurgy, the Royal Microscopical Society, and the Geologists' Association. He was a Fellow of the Mineralogical Society of America. He had served on the Council of our Society for many years and he was Chairman of the Clay Minerals Group from 1957 to 1959. He had been awarded the degree of Doctor of Sciences of Cambridge in 1932. He visited his old college in Cambridge on many occasions and is remembered with affection there, as elsewhere, by his surviving friends.

He died in hospital in London on 2 September 1968.

W. C. S.