

MEMORIAL OF ALEXANDER EVGENIEVICH FERSMAN

L. J. SPENCER, *Formerly Keeper of Minerals in the British Museum.*

The Russian Academician A. E. Fersman, whose name was added in 1937 to the short select list of Correspondents of the Mineralogical Society of America, died at Sochi on the Black Sea on May 20, 1945, at the comparatively early age of 61. With the death of Academician V. I. Vernadsky (1863–1945) earlier in the same year, Russia has been suddenly deprived of her two most prominent and energetic mineralogists and geochemists.

Fersman was born at St. Petersburg on November 8 (October 27, old style) 1883, but his early years were spent in the south of Russia. While at the high school at Odessa he had developed a keen interest in minerals, and he therefore went in 1901 to the mining academy at Novorossiysk (Ekaterinoslav). In 1904 he entered Moscow University, where he was a pupil of V. I. Vernadsky, whose influence is clearly shown in all his later work. His first paper in 1904 was on the crystallography of some organic compounds, followed in 1905 by a list of Crimean minerals in the Simferopol museum.

In 1907 he went abroad, working in Paris under A. Lacroix, and in Heidelberg under H. Rosenbusch and Victor Goldschmidt, and travelling in Italy and Switzerland. At Heidelberg, in collaboration with Goldschmidt, elaborate work was done on the crystallography of diamond, the results being published in "Der Diamant" (Heidelberg, 1911), a handsome volume of 291 pages with 206 text-figures and 43 plates. The coloured plates give excellent illustrations of the light-figures reflected from the curved surfaces of the crystals. Incidentally, the title-page of this volume gives the name of the first author as A. von Fersmann: but there is no reference to such a title in any of his many Russian publications. The early part of his extensive work on Russian zeolites and on the minerals of the palygorskite group appears to have been done in Paris. During this period he also produced a 46-page paper on the mineralogy of the island of Elba. This was the beginning of his extensive researches on pegmatites during many subsequent years.

Returning to Russia in 1910, he took a large part in organizing the Peoples' (Shanyavsky) University in Moscow, where he was the first professor of mineralogy, giving here his first lectures on geochemistry. In 1912 he was professor in the girls' high school (Bestuzhevsky) in St. Petersburg, and also an assistant under Vernadsky in the mineralogical museum of the Academy of Sciences. Later he was for a time professor of mineralogy and crystallography in the University of St. Petersburg. On



Академик Александр Евгеньевич ФЕРСМАН

1883-1945

his election as Academician in 1919, he became director of the museum, which was reorganized in 1930 as part of the Lomonosov Institute, including mineralogy, geochemistry, and crystallography, and was transferred to Moscow in 1934.

The Academy of Sciences of the U.S.S.R. has a bewildering number of sections and branches, committees, commissions and councils, institutes laboratories, museums, libraries, scientific societies and journals, all engaged in intensive scientific research. In many of these Fersman was a driving force: his activities were not confined to the Lomonosov Institute. He was also director of the Geographical Institute and of the Khibina Research Station in the Kola peninsula, and was closely connected with the institutes of archaeological technology, history of cultural relations, aerophotography, optics, radium, hydrology, ceramics, soils, etc., etc. Furthermore, he was responsible for controlling and editing much of the voluminous literature published by the Academy.

Even all this was not enough to satisfy the man's dynamic energy. After the war of 1914-18 and the revolution of 1917, he realized and persistently insisted upon the importance of developing the country's natural resources, specializing more particularly in the mineral resources. Numerous expeditions were organized, many of them led by himself, to the Urals, Crimea, Caucasus, Kazakhstan, Turkestan, Altai Mountains, Transbaikalia, northern Mongolia, Karelia, and the Kola peninsula, etc. Large deposits of native sulphur were discovered in the Kara-Kum desert east of the Caspian Sea, and deposits of uranium and vanadium ore at Tyuya-Muyun in Fergana.

The intensive exploration and investigation of the alkalic rocks of the Khibina and Lovozero tundras in the Kola peninsula was commenced in 1920. There in the uninhabited and desolate region within the Arctic Circle this work led to a prosperous industry. Already in 1934 the new town of Kirovsk had a population of 40,000. The vast deposits of apatite-nepheline-rock have been worked for apatite, while the separated nepheline has been used in the manufacture of aluminum, soda and potash, and in the ceramic industry. Deposits of pyrrhotine (for sulphuric acid) and molybdenite have also been worked. Rich concentrations of minerals containing rare-earths, titanium, zirconium, and uranium have been found; and many new minerals have been discovered, including one to which the name "fersmannite" has been given (*Am. Mineral.*, 16, 92). "Minerals of the Kola Peninsula" is the title of a paper contributed by Fersman to this journal in 1926 (vol. 11).

Ever since his early visit in 1909 to the island of Elba, Fersman was especially interested in pegmatites and the paragenesis of the rarer min-

erals that are concentrated in them. At every opportunity he visited localities where they occur in the Urals, Transbaikalia, Karelia, Kola, etc. Numerous papers resulted, giving his views on their genesis and classification. The successive stages in their formation he recognized as: magmatic (900–800° C.), epimagmatic (800–600°), pneumatolytic (600–400°), hydrothermal (400–50°), and hypogemic (50–0°). His book "Pegmatites, vol. 1, Granite-pegmatites," published in 1931, reached a third edition in 1940. A second volume on the syenite-pegmatites of alkalic rocks of the Kola type was in preparation. In addition to this work on pegmatites in general, another series of volumes was started in 1936 under his editorship on "Pegmatites of U.S.S.R.," giving detailed accounts for each district.

It was evidently this work on pegmatites that led Fersman to his intensive work on geochemistry by which he is best known. He enquired why certain chemical elements and minerals were accumulated in certain places in the earth's crust, and by formulating hypotheses he was able to predict in some cases where minerals of economic value would be found. Some of his views are highly speculative and difficult to follow: he talked of "clarkes" (named after F. W. Clarke, the author of "The Data of Geochemistry"), energetics, "eks" and "veks" and "paragenes," and branched off into topogeochemistry, biogeochemistry, and cosmochemistry. His first book on this new subject was "Geochemistry of Russia" of which volume 1 was issued in 1922 and two further volumes were promised. But this gave place later to a more general work, "Geochemistry," which appeared in four volumes (1933–39), with a second edition of volume 1 in 1934. Other books are "Chemical Elements of the Earth and the Cosmos" (1923); and "The Search for Mineral Deposits on the Basis of Geochemistry and Mineralogy" (1939); and a further one "Mendeleev's Periodic Law and Geochemistry" was promised.

Another side-line arising out of his study of pegmatites was that of precious stones, here again starting from the tourmalines of Elba. In addition to those occurring in the pegmatites of the Urals and Transbaikalia, he made detailed examinations of the emerald mines in biotite-schist of the Urals, and of lapis-lazuli in metamorphic limestone near Lake Baikal. A book "Coloured Stones of Russia" (vol. 1, 1921) was superseded by "Precious and Coloured Stones of U.S.S.R." (vols. 1 and 2, 1923 and 1925). Detailed accounts were given of the "Orlov" and "Shah" historical diamonds, and he was joint author of a large volume on the Russian crown jewels. (This I have never been able to see: a German catalogue mentions 100 plates and the price 350 Marks.) He also wrote on the working of precious and ornamental stones in the Ekaterin-

berg (now Sverdlosk) factories; and still another offshoot was a booklet dealing with the causes of colour in minerals.

Another very ambitious series of volumes was to be on the topographical mineralogy of the U.S.S.R., of which "Mineralogy of the Urals" (vol. 1, elements and sulphides) appeared in 1941 under his editorship. "Geochemists' and Mineralogists' Companion" (1937) is a useful book of reference containing a compilation of miscellaneous data.

To crown all this solid scientific work, he prepared many popular booklets expounding the practical results and inspiring the general public (and no doubt also those in authority who held the purse strings). His well-illustrated "Entertaining Mineralogy" first appeared in 1928 (5th edition, 1937) and was translated into German (Leningrad, 1931). "Three Years Beyond the Arctic Circle" (1924) gave an account of the early work in the Kola peninsula. "Reminiscences about Minerals" (1945) was written in Praha, Bohemia, during a spell of illness brought on by overwork. Others were fortunately translated into English: "The Scientific Study of Soviet Mineral Resources" (International Publishers, New York, 1935, but printed in Russia); "Twenty-five Years of Soviet Natural Science" (Moscow, 1944); "The March of Soviet Science" (London, 1945).

It is really surprising the amount of work that the man got through. His energy and enthusiasm were unbounded, and he evidently possessed the faculty of inspiring the same qualities in a devoted band of followers and research workers, including several women who were also prolific authors of mineralogical papers. With the constantly overflowing and overcrowding of new ideas, much of his work remained unfinished.

Lengthy appreciations of Fersman's work had been given only shortly before his death: "The Life and Scientific Work of Academician A. E. Fersman (for his 60th birthday)," by B. M. Kupletsky, *Bull. Acad. Sci. URSS, Sér. Géol.*, 1944, No. 1, pp. 35-42, with portrait (here reproduced); "Alexander Evgenievich Fersman as a Mineralogist," by N. A. Smolyaninov, *ibid.*, pp. 42-48; "The Geochemical Works of A. E. Fersman," by A. A. Sankov, *ibid.*, pp. 49-57. In 1940 a booklet was issued by the Academy of Sciences giving a bibliography (679 entries!) of his writings for the period 1904-40, together with a short biographical sketch and a portrait.

Unfortunately I never had the opportunity of meeting Fersman personally, but since 1922 he had generously sent me many of his books and papers. I therefore conclude with the following account of his personality, which was written in English in the "Moscow News" of May 25, 1945, by his colleague the veteran geologist Academician V. A. Obruchev: "It is difficult to believe that Academician Alexander Fersman is dead.

We always knew him as such a vigorous, buoyant, optimistic person. To say that an outstanding scientist has departed from us would be insufficient. We have lost a big man, a man tireless in work and in quest, a man with a limitless range of interests and boundless potentialities and talent, a trail-blazer in science, fine orator and popularizer, and with the priceless gift of infecting those around him with his dynamic energy and enthusiasm."