(1954) Der Grundstoffhaushalt der Erde. *Univ., Z. Wiss., Kunst. Lit.* **9**, 171–178.
(1957) (WITH I. EIGENFELD) Über den angeblichen Alkaligehalt des Disthens. *Anz. Österr. Akad. Wiss., Math.-naturwiss.Kl.*, **1957**, 151–152.
(1958) Über die Formel des Sapphirins. *Anz. Österr. Akad. Wiss., Math.-naturwiss.Kl., 1968*, 17–19.
(1960) Acceptance of the Roebling Medal of the Mineralogical Society of America. *Amer. Mineral.* **45**, 411–412.
(1964) Nachruf: Hermann Tertsch. *Almanach Österr. Akad. Wiss.*, **144**, 355–360.
(1964) Die Kristallchemie des Aluminiums. *In Actes du symposium sur les baurites, etc.* Vol. 1, 171. Zagreb 1964.

THE AMERICAN MINERALOGIST, VOL. 56, MARCH–APRIL, 1971

# MEMORIAL OF CHARLES MAUGUIN

**September 19, 1878–April 25, 1958**

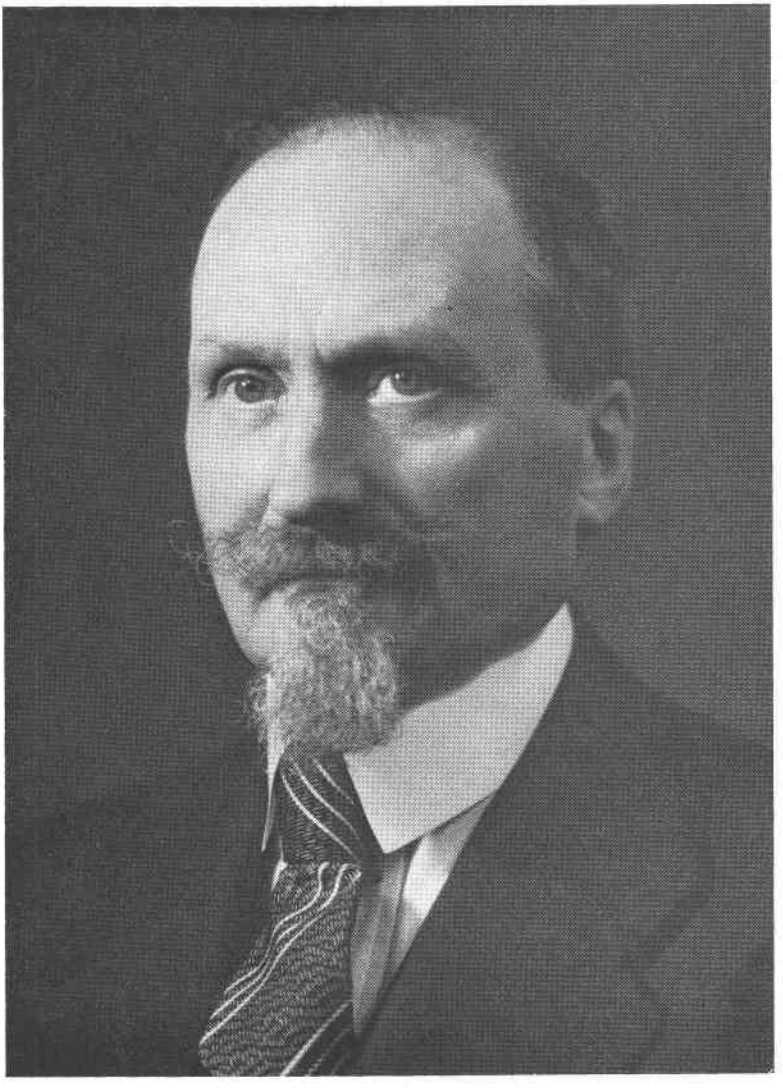
JEAN WYART, *Laboratoire de Mineralogie-Cristallographie, Faculté des Sciences de L'Université de Paris, Paris, France.*

Charles Mauguin was born September 19, 1878, in Provins, a small town 80 kms. east of Paris. He died April 25, 1958, in his eightieth year, after one month of illness in the hospital Gustave Roussy. He received his elementary education in Provins, and passed, in 1894, the competition examination of the Normal Teacher's Training College of Melun. Then he started his university career by teaching young boys reading and mathematics. At the same time, he himself studied for the entrance examination of the Ecole Normale of Saint-Cloud to become a teacher of a Normal Teacher's Training College. He was admitted in 1902. There he studied mathematics, physics, chemistry, and natural science. He had a studious mind and he was noticed by his professor of chemistry, Simon, who was at the head of the laboratory of organic chemistry of the "Ecole Normale Supérieure" of Paris. So Mauguin began scientific research in organic chemistry and he became Doctor of Sciences in 1910 with a thesis "Bromine sodium amides and their part in the transposition of Hofmann". As he was preparing his thesis, he attended at the Sorbonne the mathematics classes of Emile Picard, Poincaré, Painlevé, Goursat, and the courses of lectures given, in 1905, just before his accidental death, by Pierre Curie on symmetry in physical phenomena. That was his first contact with crystallography and it led him to attend the classes of Frédéric Wallerant, professor of mineralogy and crystallography, who was interested by the liquid crystals discovered, a few years before, by

the German physicist Otto Lehmann. These are organic substances, which give, in a well-defined range of temperatures between those where the isotropic liquid and the solid phases exist, a turbid phase characterized by the fluidity of real liquids and by the birefringence of crystals. Mauguin became the assistant of Wallerant working on liquid crystals whose constitution was thought to be due to an insoluble impurity. Mauguin showed that the turbid phase is constituted by refringent elements, the orientation of which varies from one point to another, so that it is almost opaque in a layer of some tenths of millimeter. He imposed a uniform orientation on the different birefringent elements to obtain a homogeneous and perfectly transparent phase. He succeeded in this by a magnetic field or by simple fusion of the crystals between two absolutely clean, plates of glass, or between cleaved muscovite mica plates. In this last case, the liquid crystal takes such an orientation that the optic axis is parallel to the cleavage, along a crystallographic direction at about 30° to the symmetry plane; at the time (1912) it was rather unexpected; X-rays have since shown that (010) is a glide symmetry plane. If a product like azoxyanisol is melted in a wedge-shaped crevasse obtained by cleavage, the two optical axes in contact with the two surfaces of the wedge, form an angle of 60° with one another. The result is a helicoidal structure for which Mauguin gave the theoretical explanation. This outstanding research was interrupted by the First World War.

In 1919, he was nominated Associate Professor in the Faculty of Sciences of Paris; and was Professor of Mineralogy from 1933 to his retirement in 1948. When he resumed research work after four years of interruption during the war, Mauguin understood the importance of the discoveries of Laue and the Braggs for crystallography and mineralogy; creating in France, the "new" crystallography. He published the atomic structure of cinnabar, calomel, and graphite. In 1925, he undertook a fundamental investigation of micas and chlorites, whose extremely diversified chemical composition is coupled with remarkable invariable crystallographic properties. He chemically analyzed a great number of micas and chlorites, measuring their density and lattice constants with X rays. He found that the cell content of micas includes 12 oxygen and fluorine atoms, that of chlorites 18 oxygen atoms. As for the other chemical constituents, the number of atoms varies from one silicate to another and is mostly fractional, which proves that the unit cell is not repeated identically and that X rays give only an average cell. Thus, it can be seen that Mauguin has contributed greatly to an understanding of the chemistry of silicates.

Mauguin had a strong mathematical background and spent much of his time on studies of group theory and Fourier transforms. He published



*Charles Mauguin*

in 1931 in the *Zeitschrift für Kristallographie*, a paper "Sur le symbolisme des groupes de répétition ou de symétrie des assemblages cristallins". The symbols which appear in this paper were slightly modified after collaboration with C. Hermann. They are still in universal use and they have made the name of Mauguin familiar to every crystallographer.

Having reached the age of retirement in 1948, Mauguin continued up to this last days his life-long habit of studying. He was then chiefly interested in atomic physics and chemistry in relation with biology. His only luxury was books. Childless, he lived a very retired life with Mme. Mauguin, who had become blind in 1930, and who died five months after her husband.

Charles Mauguin was an easy man to get along with and was held in high esteem both by his students and colleagues. Though being a hard worker, he published little, but what he did publish are models of clearness and accuracy.

SELECTED BIBLIOGRAPHY

(1910) *Les amides bromées-sodées et leur rôle dans la transposition d'Hofmann.* Thèse de Doctorat. Paris, 1910 [*Ann. Chim. Phys.* (*8*), 1911).
(1910) Cristaux liquides en lumière convergente. *C. R. Acad. Sci. Paris,* **151,** 886–888.
(1910) Liquides birèfringents à structure hélicoïdale. *C. R., Acad. Sci. Paris,* **151,** 1141.
(1911) Sur la représentation géométrique de Poincaré relative aux propriétés optiques des piles de lames. *Bull. Soc. Fr. Mineral.* **34,** 6–15.
(1911) Sur les cristaux liquides de Lehmann. *Bull. Soc. Fr. Mineral.* **34,** 71–117.
(1911) Orientation des cristaux liquides par de champ magnétique. *C. R. Acad. Sci. Paris,* **152,** 1680–1684.
(1912) Sur l'agitation interne descri staux liquides. *C. R. Acad. Sci. Paris* **154,** 1359–1361.
(1913) Orientation des cristaux liquides par les lames de mica. *C. R. Acad. Sci. Paris,* **156,** 1246–1247.
(1924) La structure des cristaux déterminée au moyen des rayons X. *Conf. Rapp. Phys. Paris.*
(1923) L'arrangement des atomes dans les cristaux de cinabre. *C. R. Acad. Sci. Paris,* **176,** 1483–1486.
(1924) Arrangement des atomes dans les cristaux de calomel. *C. R. Acad. Sci. Paris,* **178,** 1913–1916.
(1926) Réseaux polaires et diagrammes de diffraction des rayons X. *Bull. Soc. Fr. Mineral.* **49,** 5–32.
(1926) Structure du graphite. *Bull. Soc. Fr. Mineral.* **49,** 32.
(1927) Etude du mica muscovite au moyen des rayons X. *C. R. Acad. Sci. Paris,* **185,** 288–291.
(1928) Etude des micas (non fluorés) au moyen des rayons X. *C. R. Acad. Sci. Paris,* **186,** 879.
(1928) Etude des micas fluorés au moyen des rayons X. *C. R. Acad. Sci. Paris,* **186,** 1131–1133.
(1928) Etude des chlorites au moyen des rayons X. *C. R. Acad. Sci. Paris,* **186,** 1852–1855; *Bull. Soc. Franc. Mineral.* **51,** 185–187.

(1928) Les rayons X ne donnent pas toujours la véritable maille des cristaux. *C. R. Acad. Sci. Paris*, **187**, 303–304.
(1928) Etude des micas au moyen des rayons X. *Bull. Soc. Fr. Mineral.* **51**, 285–332.
(1930) La maille cristalline des chlorites. Livre jubilaire de la Société française de Minéralogie, 279.
(1931) Sur le symbolisme des groupes de répétition ou de symétrie des assemblages cristallins) *Z. Kristallogr.*, **76**, 542–558.
(1936) Sur la théorie de la réflexion des rayons X par les cristaux. *J. Phys.*, *VII*, **7**, 233–242.
(1943) Diffraction des rayons X par un cristal de dimensions limitées. Influence de la forme: cas de l'octaèdre régulier. *Bull. Soc. Fr. Minéral. Cristallogr.*, **66**, 409, 434.
(1944) La structure des cristaux d'après Haüy. *Bull. Soc. Fr. Minéral. Cristallogr.* **67**, 227–265.
(1954) L'origine des atomes. *Bull. Soc. Fr. Minéral. Cristallogr.* **77**, vol. 1,. p. 73–96

THE AMERICAN MINERALOGIST, VOL. 56, MARCH–APRIL, 1971

# MEMORIAL OF WILLIAM JOHN MILLER

**April 26, 1880–July 27, 1965**

JOSEPH MURDOCH, *University of California, Los Angeles, California 90024*

William John Miller divided his lifetime rather evenly between the eastern and western parts of the country. He was born in Red Bluff, California in 1880, and died in San Diego on July 27, 1965.

His early life was spent in Red Bluff, a frontier town close to the foothills of Mount Lassen, in the upper Sacramento Valley. Here he became expert as a fisherman, wilderness explorer, and amateur natural historian. Although his father died when Miller was young, he was determined to study some phase of natural history, and the nearby and varied geologic phenomena of Mount Lassen directed his energies toward the earth sciences. He helped finance his education by working in the lumber mills of the northern Sierra Nevada. At the age of 16, he entered the College of the Pacific at San Jose (the predecessor of the present University of the Pacific at Stockton), majoring in chemistry and geology, and was elected to Phi Beta Kappa on his graduation in 1900. The College appointed him instructor in geology and chemistry, and his teaching here continued until 1903. During his summers, he was a field assistant to the late Ralph Arnold, who was doing field work in the Santa Cruz Mountains for the United States Geological Survey. During this time he completed work on a geological study in the Oak Hill region of the Santa Clara Valley of California. In addition, he began graduate study at Stan-