

Josef Zemann (25. Mai 1923 – 16. Oktober 2022)

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The MinWien2023 meeting is dedicated to Josef Zemann. He was teacher, mentor, colleague, and friend to many colleagues in Vienna but also all over the world. Josef Zemann was born in Vienna on 25 May, 1923, a time of economic uncertainties and social instabilities. His scientific career started with the doctoral thesis entitled “*Über die Struktur des Pharmakosiderits*”, for which he received the academic degree *doctor philosophiae* on 17 July, 1946.

Inspired by crystallography, Josef Zemann stayed for one year at the Massachusetts Institute of Technology in Boston with Martin J. Bürger, one of the pioneers of X-ray crystallography. Quite shortly after his return to Vienna, he became associate professor and some years later full professor at the “Mineralogisch-Kristallographisches Institut” at the Georg-August-Universität in Göttingen. During this time Josef Zemann focussed primarily on topics in crystal chemistry, such as the stereochemistry of Li, Cu and Te atoms, electrostatic lattice energies, as well as crystal absorption spectra in the infrared range. His years in Göttingen constituted a fulfilled time, thanks to the great working conditions and an academically inspiring atmosphere. In 1967 he responded to the call to move to the University of Vienna and succeeded his former teacher Prof. Dr. Karl Ludwig Felix Machatschki. As the head the Institut für Mineralogie und Kristallographie at the Alma Mater Rudolphina - Universität Wien for 22 years until his retirement in 1989 he was scientifically active and an internationally recognised expert in the field of mineralogical crystallography.

Josef Zemann’s early work in Vienna, Boston, and Göttingen was dedicated to the determination of crystal structures by X-ray diffraction. His interest was the recognition of the stereochemistry of cations, especially of Cu^{2+} and Te^{4+} ions that were basically unexplored at that time. In recognition of his research on the stereochemistry of Te^{4+} ions, a novel tellurite mineral was named after him, i.e. zemannite, $[\text{Zn}^{2+}\text{Fe}^{3+}(\text{TeO}_3)_3]_2[\text{Mg}(\text{H}_2\text{O})_6 \cdot n\text{H}_2\text{O}]$, $n \leq 3$. (Fig. 1).

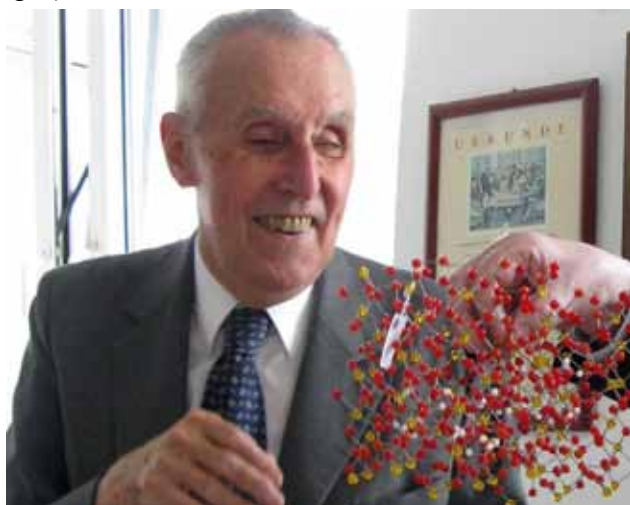


Figure 1. On the occasion of his 85th birthday in 2008 Josef Zemann receives a ball-and-stick model of the crystal structure of his mineral zemannite.

Foto: Kurt Mereiter

Among the milestones of his scientific work were infrared spectroscopic studies, where he tread new conceptual and methodological ground. At one hand he used polarized IR radiation and crystallographically oriented crystal platelets to localize hydrogen bonds associated with OH⁻ groups or H₂O molecules. At that time, it was practically impossible to localize H atom positions by means of X-ray diffraction techniques. Achievements in applying IR spectroscopy were groundbreaking as he recognized for the first time small amounts of hydroxyl groups to be detectable even in nominally anhydrous rock-forming silicates such as in olivine, andalusite, the three TiO₂ modifications, or in enstatite. Even here he was able to localise the orientation of the OH⁻ dipoles in relation to the crystallographic orientation of the mineral samples and consequently to the atomic arrangement. In addition, it was also possible to discriminate between liquid inclusions and structurally oriented hydroxyl groups incorporated in the crystal lattice. The strong interaction between the IR radiation and the OH⁻-dipoles allow to detect concentrations in the tenth weight-percent range. In the 1960s it was doubtless assumed that the Earth's mantle does not contain any OH⁻ or H₂O contents. Today, it is estimated that due to the solubility in the above-mentioned minerals large quantities of OH⁻ and H₂O are stored in the upper 660 km of the Earth's mantle corresponding to the volume to the Earth's oceans.

Josef Zemann's broad scientific oeuvre is supplemented by a series of papers dealing with the crystal chemistry of carbonates, focussing on both the structure types, their topological relations, as well as on the aplanarity of carbonate groups. The calculation of electrostatic lattice energies was a first step towards a modern atomistic modelling and the stability of structure types.

The significance of Josef Zemann's academic work and his reputation within the scientific community was honoured by a large number of honours and awards. He became honorary member of six National Mineralogical Societies (America, Austria, Soviet Union, Poland, Germany, and Romania). The ÖMG appointed him to their Honorary President. He received also numerous awards and medals: the Gustav-von-Tschermak-Seysenegg and the Erwin-Schrödinger medals (both from the Austrian Academy of Science), silver medals (the Abraham-Gottlob-Werner-Medal from the DMG and from the Masaryk University Bruno), a gold medal (Comenius University Bratislava), the Emanuel Bořický Medal (Karlsuniversität Praha), and he became correspondent of the Geologische Bundesanstalt Wien.

Furthermore, his remarkable contribution to crystal chemistry and his input to the knowledge in mineralogical and crystallographic sciences was honoured by various scientific academic memberships. On leave from Göttingen and as a welcome to Vienna he became Corresponding Member of the Akademie der Wissenschaften zu Göttingen in 1967 and the Österreichische Akademie der Wissenschaften (the latter elected him 1972 as a Full Member). A further membership was awarded by the Academia Mediterranea delle Scienze (Catania, Italy) and a Honorary Membership by the Hungarian Academy of Sciences. He was elected as a Corresponding Member by the Kroatische Akademie der Wissenschaften und Künste and the Polish as well as the Croatian Academies of Sciences. He was particularly pleased, in fact he was proud to become a Member and Senator of the Deutsche Akademie der Naturforscher Leopoldina, which had already founded in 1652.

On the evening of 16 October 2022 Josef Zemann passed away gently and peacefully only a few months ahead of his 100th birthday. His person, his tireless commitment and enthusiasm, his keen sense of observation, but also his kindness and humour remain unforgettable. We will remember Josef Zemann as our teacher, mentor, and an outstanding scientist.