



## Hans Wondratschek (1925–2014)

Theo Hahn\*

Institut für Kristallographie, RWTH Aachen, Jaegerstrasse 17–19, 52056 Aachen, Germany. \*Correspondence e-mail: hahn@xtal.rwth-aachen.de

Hans Wondratschek, a German mineralogist and crystallographer, died on 26 October 2014 in his home town of Karlsruhe, after several months of illness, shortly before his 90th birthday. Hans began his career as an experimental mineralogist. Later, his main activity and interest turned towards theoretical crystallography and group theory, with particular achievements in four-dimensional symmetries and subgroups of (three-dimensional) space groups.

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Photograph courtesy of Klaus Wondratschek

Hans was born in Bonn on 7 March 1925. Here he also went to school and studied science, particularly mathematics and chemistry. For his PhD topic he turned to mineralogy and crystallography. He received the Dr. rer. nat. degree in 1953, under the mineralogist and crystallographer Will Kleber, with a dissertation *Über die tensoriellen Eigenschaften symmetrischer Körper (On the Tensorial Properties of Symmetrical Bodies)*. This early work was the beginning of his great interest and ability in the mathematical treatment of crystallographic problems, but for the next few years his emphasis was on experimental mineralogical problems. Thus, he began in Bonn with investigations of his beloved sanidine megacrystals of Volkesfeld (the southern volcanic Eifel mountains) which became his lifelong ‘hobby’.

After his PhD he worked for five years (1953–1958) with Heinz Jagodzinski at the Max-Planck-Institut für Silikatforschung in Würzburg. Here, he collaborated with Ludwig

Merker on work on new compounds with the apatite structure (e.g. Pb–I and Pb–Br apatites). There followed three years (1958–1961) in Zürich at the Institut für Kristallographie und Petrographie of the ETH Zürich, in the laboratory of Fritz Laves. Here, he participated in experimental research on feldspars and quartz, especially on infrared absorption of these minerals. His partner in the Laves group was Georg O. Brunner. With Alfred Niggli he developed the ‘cryptosymmetries’ (generalizations of point groups). In 1961 he returned to his old university in Bonn. Here he received under Alfred Neuhaus his *Habilitation (venia legendi)* for mineralogy and crystallography with a thesis on pyromorphites (lead apatites). Thereafter he spent three years as *Privatdozent* in Freiburg/Breisgau.

In 1964 Hans was appointed Professor of Mineralogy and Crystallography at the Universität Karlsruhe (TH), as successor to Heinz Jagodzinski. Here he remained until his retirement in 1991, but he continued to work and perform research until a few months before his death. In Karlsruhe his abilities and his success as a theoretical crystallographer were fully manifest and widely accepted. In the subsequent years, he and his collaborators produced many publications and contributions to books. He cooperated closely with a group of mathematicians in Aachen under Joachim Neubüser. The numerous papers originating from this cooperation dealt with the structure of space groups, with subgroups and, most importantly, with the derivation of the 4894 four-dimensional space groups. This work culminated in the monograph *Crystallographic groups of four-dimensional space* by Brown, Bülow, Neubüser, Wondratschek & Zassenhaus (1978).

Hans was active in the preparation of Volume A of *International Tables for Crystallography* (with the author of this obituary); its first edition appeared in 1983, the fifth edition in 2002. He wrote the fundamental Chapter 8 on *Introduction to space-group symmetry*, in addition to numerous contributions

to the space-group tables. To Volume B of these *Tables*, he and Mois Aroyo (Sofia) contributed in 2001 (third edition 2008) a chapter *Crystallographic viewpoints in the classification of space-group representations*.

In addition, research concerning the subgroups of space groups and the crystallographic orbits continued and led to (with Ulrich Müller, Marburg) Volume A1 of the series, *Symmetry relations between space groups* (2004, second edition 2010). After this followed a close cooperation with Mois Aroyo (now Bilbao) on the sixth edition of Volume A (to appear soon), until a few months before his death.

Hans received many honours for his work: in 1981 he was awarded the V. M. Goldschmidt-Preis der Deutschen Mineralogischen Gesellschaft, in 1987 the F. Becke-Medaille der Österreichischen Mineralogischen Gesellschaft and in 2001 the Carl-Hermann-Medaille der Deutschen Gesellschaft für Kristallographie. From 1989, Hans was also a member of the Academy of Science Leopoldina in Halle/Saale.

Hans was a very active, enthusiastic and highly respected academic teacher, both nationally and on the international scene. In particular, he organized and participated in more than 15 international summer schools about crystal symmetries and space groups, one in China, and many after 1989 in eastern European countries. A school in Sofia led to the publication of a book *Symmetry of Crystals* by Th. Hahn and H. Wondratschek (1994).

Hans was a creative scientist of high international reputation. We all – his family, his friends, his colleagues and his students – will greatly miss him. For me, he was for more than fifty years a (sometimes controversial) discussion and lecturing partner and an always helpful and very personal friend. Hans is survived by his sister Riele Thees, two sons, Klaus Wondratschek and Axel Warnicke, and three grandchildren, Paula Wondratschek and Frank & Daniel Warnicke, to whom our sincere condolences go.