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PRESENTATION OF THE ROEBLING MEDAL OF THE MINERALOGICAL SOCIETY OF AMERICA FOR 1969 TO FRITZ LAVES

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The 28th recipient of the Roebling Medal is distinguished in many ways. The highest award of the Mineralogical Society of America is given specifically for outstanding original research. The Society's Golden Jubilee recipient has produced an extraordinary amount and variety of premium quality fundamental research, and he continues to do so at an amazing pace. Fritz Henning Emil Paul Berndt Laves is also distinguished for having more names than anyone else I know. Young Fritz's father was a judge in Hannover, where the medalist was born on February 27, 1906, and if the father was anything like the son turned out to be, it is not surprising that prospective godfathers were standing in line.

Laves' professional career can be split into three phases—German, American, and Swiss. He attended the Universities of Innsbruck and Göttingen, but his doctorate was earned under Paul Niggli in Zurich in 1929. Laves then went back to Göttingen as an Assistant under V. M. Goldschmidt in 1930, and was obviously a favorite of Goldschmidt's, for permission to smoke in the laboratory was a unique privilege awarded to him. I don't know from whom he "borrowed" his cigarettes in those days. His early work in crystallography and crystal chemistry led him into the field of intermetallic compounds, and his papers in 1934 with Löhberg and in 1935 with Witte on the AB_2 compounds and the structure of $MgNi_2$ and its relation to the $MgCu_2$ and $MgZn_2$ structure-types opened the door to a major advance in understanding alloys. The principles underlying the formation of a set of intermetallic compounds that have come to be known as the Laves phases were laid down, and an enormous amount of research on these alloys was stimulated by his pioneer work. The detailed crystal chemistry of many has been studied by Laves and others, and there are now known to be more than 220 binary AB_2 type alloys in this class.

Laves remained an Assistant and "Privat Dozent" at Göttingen until 1944. He could not get a professorship any earlier during Hitler's time because of his stubborn adherence to principles. I have seen a letter from a German official who stated that Laves was not to be trusted, and was known to be a protector of Jews. In August of 1939, Laves was inducted into the German army as a "GI". Paul Rosbaud, bless his soul, was influential enough in German scientific circles to get Laves pulled out of the army in January 1940, and may well have saved his life. He was assigned to a group under Hermann Goering, and charged to develop an alloy stronger than steel and lighter than air. Much of his fine work on alloys was bootlegged during this time, and the fact that many contained Mg was easily rationalized. However, Laves' science was as suspect as his politics, for an alchemist was assigned to look over his shoulder, and contributed to the success of his experiments by oscillating a small crystal sphere on a chain over the crucible. He also insisted on adding powdered crocodile bones to the batch, but because of Rommel's difficulties in the land of the Nile, settled for the tail-bones of a lesser lizard. To get even a brief respite from his colleague, Laves asked to go to Switzerland to confer with Professor Niggli, for Niggli was working with ice and snow, Laves was working with Mg, and after all, both are hexagonal. It worked, and Laves got his vacation. The war ended, and Laves was called to Marburg in 1945 as Professor. With his student, Jagodzinski, he began working on disorder, particularly one-dimensional disorder, related to earlier work on two-dimensional structures and superstructures in crystals.

The second phase in Laves' life begins with a custody transfer document dated November 1, 1948. The first part of the document states: "Receipt is hereby acknowledged of the delivery into the custody of Dr. Julian R. Goldsmith, University of Chicago, of the following named Paperclip Specialist: Dr. Fritz Laves". Paperclip Specialist was a code designation for scientists who were whisked out of Germany by the U. S. Navy—essentially "kidnapped" with their consent. Tom Barth, then at Chicago, had alerted the University to the possible availability of Laves, and as at that time I had an Office of Naval Research Contract to investigate order-disorder in silicates, especially feldspars, everything was done in a shipshape fashion. We had fun with immigration and custom officials on a post factum basis, but fortunately, my tenure as custodian was short lived.

Laves sailed into the feldspars with a vengeance, and more than any other single person, was responsible for the renaissance in that most important and complex mineral group. His discoveries coupled with his deep insight broke down many roadblocks, and contributed enormously to our understanding of the feldspars. Again, as in his work on alloys, many have built upon his inspiring work. The breadth and depth of the work on feldspars is such that a short summary here would do it an injustice. Let it suffice that if you are not up on this subject that touches upon almost all of the possible properties of crystalline substances, you must read the earlier papers of twenty years ago in order to understand the subject.

Laves enjoyed working with his own hands at Chicago. X-ray generators and cameras ran continuously, and students and other faculty members resorted to any subterfuge to get time on the numerous machines. Laves worked with an intensity and drive that few could match. On many mornings I found him in the lab with a stubble of beard and the film hangers full—the signs that he had worked through the night. The feldspar crystals, stuck to glass capillaries with grease, which in turn, were affixed to the goniometer head with clay, all to save precious minutes in mounting, were not the only crystals he worked with. At times, the laboratory stunk with thio-urea adducts and squalene, and he showed that the rhombohedral modification of graphite appeared in cold-worked crystals, not as randomly smeared interlayers of rhombohedral and hexagonal layers, but as clearly defined mixtures of the two phases. Jagodzinski later found the same for SiC worked at 2000°C, and it has also been found to apply in the cold working of argon, etc. It remains a mystery why random stacking is not observed, even though the energy difference in the 2 configurations is very low.

Laves and his family had become quite Americanized. But when, in 1954, he was offered Paul Niggli's post in Zurich, he said to me that this was really one position for which he would even consider leaving Chicago. After much soul-searching, he finally accepted it. The third phase of his life began, and although he may have failed to Americanize Switzerland, he did introduce the cocktail party to Zurich. He also built up the Institute für Kristallographie und Petrographie, both academically and physically. When the old building was gutted and rebuilt from the inside, Laves refused to be interrupted by having his office disturbed. A false "roof" was built over him, and he was encapsulated while he worked on amidst the chaos around him, and his only concession to the mess of progress he brought about was the "hard hat" the workmen forced him to wear. The variety of his work has increased with time, and feldspars, as well as quartz, spinels, and oxides were examined with insight and inspiration, as well as by X-rays, infra-red absorption and resonance techniques. Laves has authored or co-authored 149 significant papers, and an additional 41 by colleagues have come out of the ETH under his directorship. If I have spent more time on the man than on his work, it is because the science is accessible to all.

Professor Laves, we are gathered here in recognition of your leadership in science. Mr. President, it is an honor and a great personal pleasure to present to you Fritz H. Laves.

Fritz Laves