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This Week's Citation Classic®

Geller S. Crystal chemistry of the garnets. *Z. Kristallogr.* 125:1-47, 1967.
[North American Aviation Science Center, Thousand Oaks, CA]

The garnet-structure refinements of the previous decade were reviewed. A survey was made of all the cations that enter the garnet structure, and their site preferences were given. With respect to the site preference, the relative ionic size is of primary importance, but the electronic configurations of certain ions also play an important role. [The *SCI*® indicates that this paper has been cited in over 215 publications.]

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Fritz Laves was mainly responsible for my writing this paper; Laves was a great scientist and a warm, generous, courageous person.[1-3]

G. Menzer was the first to determine the crystal structure of the silicate garnets,[4-6] and, because my colleagues and I had done substantial pioneering research on the static magnetic properties and crystal chemistry of the ferrimagnetic garnets,[7] Laves invited me to write an article (on the crystal chemistry of the garnets) for the festschrift to be dedicated to Menzer on the occasion of his 70th birthday. At that time, Menzer was the editor-in-chief of the *Zeitschrift für Kristallographie*, in which the article was to appear, and Laves was one of the four other editors.

During the writing some problems arose that required further experiments, with which I was assisted by G.P. Espinosa. I was also committed to other projects, not the least important of which was an attempt to prepare the superconductor Nb_3Si, which I predicted would have a transition temperature of 32 K. Thus, the final paper was not sent to Laves until four months after I had received the invitation. Laves's response included a copy of his letter, recommending publication to Menzer, who had been unaware of this contribution to his festschrift. The superlatives used by Laves in his estimate of the paper were overwhelming and greatly appreciated by me. I subsequently wrote to Laves, "Your very kind words are most rewarding.... I consider them to be a priceless gift."

The paper is a critical review of the work undertaken in garnet crystal chemistry by my colleagues and me, as well as others. Much of our work was done while I was at Bell Laboratories. Part of my research at what was then the North American Aviation Science Center involved the garnets; from the beginning (1956) my primary interest[7] was in the static magnetic behavior of the materials. In fact, much of the information on ionic site preferences was deduced from the static magnetic behavior. My interest in this field has continued periodically, and since 1973 I have worked in collaboration with a group at the Istituto di Elettronica dello Stato Solido del Consiglio Nazionale delle Ricerche in Rome; our latest publication recently appeared in the *Physical Review*.[8]

The paper has most likely received many citations because it contains a survey and discussion of the site preferences of the ions that enter the garnet crystal structure. Both the particular ions and their site preferences have an important bearing on the physical properties of the garnet crystals. Needless to say, they are important in studies of the crystal chemistry of the naturally occurring silicate garnets. Ferrimagnetic garnet crystals are used in various electronic devices, and the physical properties required for these devices are generally attained by synthesizing materials with appropriate compositions based on ionic site preferences. One important laser system uses an yttrium aluminum garnet crystal doped with Nd^{3+} ions (that replace Y^{3+} ions). Indeed, the garnets are of interest to chemists, electrical engineers, mineralogists, and physicists. Although I don't expect gemologists to cite the article, there are some beautiful natural-garnet gemstones.

1. **Goldsmith J R.** Presentation of the Roebling medal of the Mineralogical Society of America for 1969 to Fritz Laves. *Amer. Mineral.* 55:541-3, 1970.
2. **Laves F.** Acceptance of the Roebling medal of the Mineralogical Society of America for 1969. *Amer. Mineral.* 55:545-6, 1970.
3. **Hellner E.** Fritz Laves 27.2.1906-12.8.1978. *Z. Kristallogr.* 151:1-20, 1980.
4. **Menzer G.** Die Kristallstruktur von Granat (Garnet crystal structure). *Centralblatt Mineral. Geol. Paläontol. A* 1925:344-5. (Cited 5 times since 1955.)
5. ----------. Die Kristallstruktur von Granat (Garnet crystal structure). *Z. Kristallogr.* 63:157-8, 1926. (Cited 15 times since 1955.)
6. ----------. Die Kristallstruktur der Granate (Garnet crystal structure). *Z. Kristallogr.* 69:300-96, 1928. (Cited 55 times since 1955.)
7. **Geller S.** Crystal and static magnetic properties of garnets. (Paoletti A, ed.) *Physics of magnetic garnets.* Amsterdam: North-Holland, 1978. p. 1-55. (Cited 35 times.)
8. **Balestrino G, Paroli P & Geller S.** Growth anisotropy in the Nd-Y and Pr-Y iron garnets. *Phys. Rev. B—Condensed Matter* 34:8104-6, 1986.

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