

Memorial of Glauco Gottardi 1928–1988

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Glauco Gottardi died in Modena on September 1, 1988, killed by an illness that appeared suddenly in the early part of summer. He was 60, but kept the energy, the passion for his work, and the intellectual curiosity of a young man. He kept on working up to the last day of his life, leading his coworkers with advice and suggestions for the preparation of the national meeting of the Italian Association of Crystallography, which did take place later on, in October, 1988, in Modena. I learned of his death in Vienna, where I was participating in the European Congress of Crystallography. We listened in shock to the announcement and to the moving words of the president of the International Union of Crystallography in the wide auditorium of the Technische Universität. The deep feeling caused by the announcement showed immediately Gottardi's international stature.

He had planned to be in Vienna himself, but with regret he had to give up the trip because of the illness. He always loved to travel to Vienna, attracted by the beauty of the city and by the solid friendships he had established there since studying at Felix Machatschki's Institute as a young assistant. I think he admired the Austrians, and the Viennese in particular, for their sense of order, mental order principally, and their feeling for a job well done, together with their great love of life. "What can I do? I am Austro-Hungarian," he sometimes joked, and he would smile, tightening his lips and bending his head slightly, in a way of doing peculiar to him.

Probably an Austro-Hungarian atmosphere was still present during his childhood and adolescence in Fiume (Rijeka), where he was born February 3, 1928, the son of a merchant marine captain. His father encouraged his academic successes by paying for private tutoring for him. The young Glauco at first chose tutoring in gymnastics, then, perhaps because he had acquired sufficient body strength, he shifted to tutoring in German. This is probably the main reason why later on he spoke a splendid German. An Austro-Hungarian atmosphere was also present in a different sense; that is, a familiarity with different customs, languages, and people, a familiarity alive within his own family. In fact, his maternal grandfather had married, in a second marriage, a woman from Croatia; Glauco on various occasions recalled this acquired grandmother, who threw advice and orders in a dialect mixed with Venetian, German, and Croatian. The roots of his ability to be constantly open to the reasoning of others, both in scientific and cultural debate and in civil life, lie perhaps in this familiarity.



At the end of the war Fiume and the whole of Istria became part of the Yugoslavian Federal Republic, and Gottardi's family moved to a town in the Ligurian hinterland. However Glauco was there only in the summer months because in 1945 he entered the Scuola Normale Superiore in Pisa as a student of chemistry. He took his degree in chemistry in 1951, but his interest had long been directed toward mineralogy, and already in his first years at the university he was working at the Institute of Mineralogy; an able agent of this recruitment was Giorgio Marinelli. That institute, completely destroyed by the war, had been reconstructed "with energy and determination" by Stefano Bonatti. Gottardi found there an environment favorable to his research and to the different stages of his scientific career: assistant professor, associate professor with courses in geochemistry and then in mineralogy, and finally, the appointment in 1963 to the chair of Mineralogy at the University of Modena.

In reviewing the broad scientific production of Glauco Gottardi, with over 90 titles, it is not difficult to detect the rational framework that links his achievements. In the period of his formation and maturation, concluded in 1957 with his appointment as associate professor of mineralogy, he carried out a series of studies on very different subjects: morphologic crystallography, mineralogenesis, geochemical methodology and crystal chemistry. I will mention from this period his work on perrierite, a new mineral found in the sands of Nettuno beach. This work was published while he was still a student. It was followed by a series of papers, written in part with Stefano Bonatti, that defined the relationships between perrierite and chevkinite and at the same time clarified the crystal-chemical position of these phases in the wide family of silicates with octahedral chains. At the end of this period the direction of his research was clear: he headed firmly toward the study of the structure and crystal chemistry of minerals. In the subsequent period, corresponding to his last years in Pisa and his first years in Modena, the structural studies of perrierite and pumpellyite and of the zeolites dachiardite and stilbite were carried out. It seems proper to remark that a structural study still could be at that time a work of higher handicraft and not something mass-produced, as it is frequently today: the reading of those papers still gives, in fact, an intellectual delight, clearly indicative of the quality of the work.

In the second half of the 60s Glauco Gottardi directed his research to the study of natural zeolites, undertaking a broad, complete program, from field research and identification, through the determination of chemical composition, crystallographic properties, and behavior upon heating, to the study of the structural framework and crystal chemistry. It is likely, I believe, that he chose this subject not only because of the geometrical elegance of the zeolites' frameworks, which he had helped to reveal, but also because of the fascination of combination games linked to the possibility of complex substitutions in the structural cavities and in the tetrahedral sites of the framework. In any case his focusing on zeolites preceded by a few years the explosion of interest in these minerals.

Such a broad research program obviously required financial support, equipment, and, last but not least, bright researchers. Thanks to his perseverance and intelligence Gottardi succeeded in a reasonable time in acquiring for his Institute the necessary equipment and a team of young scientists, a veritable school. This group, in a few years of intense and extraordinarily productive work, became one of the world's most prestigious in the study of zeolites. The unusual atmosphere of "serenity, joyfulness . . . harmony" of those years in Modena has been expressed with his customary charm by Fiorenzo Mazzi in his "Recollections on G. Gottardi." Gottardi's research was in this period closely linked to that of his group and concerned primarily the structural framework of natural zeolites in different groups, the Si/Al arrangement in the tetrahedral framework, the derivation of possible structures through systematic enumeration, and the relationships

between topological and real symmetry. The volume *Natural Zeolites*, which he published with E. Galli in 1985, summarized twenty years of the group's activity and will be for many years the primary reference on all aspects of natural zeolites.

It would take too long to enumerate the various academic positions that he held (chairman of the Faculty of Sciences, acting president of the University of Modena), the numberless commissions and national and international committees where he served with distinction, the scientific societies of which he was a member. I will only mention that he was vice president of the Italian Society of Mineralogy and Petrology and of the sister French society, a national member of Accademia Nazionale dei Lincei, and an Honorary Fellow of the Mineralogical Society of America.

I attempted with this brief note to outline, though only very schematically, the scientific life of G. Gottardi and to point out the importance of his work and its impact on all of us. Those of us who had with him close ties and a strong friendship will always miss his unexpected telephone call, short and made at the most unusual times; his advice, always important because sincere; his comfort in sad moments. We shall each keep, with his memory, the privilege of having been his friend.

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