

## 10 / Epilogue

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AFTER GOLDSCHMIDT'S DEATH, Dr. Ivar Oftedal, who was then senior Curator, was appointed Acting Director of the Museum, and Aslak Kvalheim was appointed Director of the Raw Materials Laboratory. Tom. Barth returned from Chicago to his professorship in March 1949, and was then appointed Director of the Museum; Oftedal was appointed Professor of Mineralogy after Goldschmidt and moved to the Blindern campus of the university. The Raw Materials Laboratory moved to larger quarters in Trondheim in 1952, and was incorporated into the Norwegian Geological Survey as the Geochemistry Division in 1962.

Kristoffer Stenvik, who had worked closely with Goldschmidt in the development of olivine as a refractory material, continued this work in the Raw Materials Laboratory. In 1947 the commercial exploitation of Norwegian olivine was handed over to a government company, A/S Olivin, and Stenvik worked for that company until 1957, when he returned to the Raw Materials Laboratory. Olivine is now a major mineral product in Norway, estimated production in 1991 being approximately 3 million tons, valued at 35–150 kroner/ton, depending upon quality and degree of processing.

I was able to revisit Norway in the summer of 1948. At the museum I found my room exactly as I had left it more than eight years earlier, even to the spectrographic plates I had developed the day before I left. Dr. Ivar Oftedal was working through Goldschmidt's papers, which included hundreds of pages of manuscript intended for his comprehensive treatise on geochemistry. The outline of the book was there, but some of the chapters were barely started or incomplete, and much of the material was in his handwriting, which was not easy to decipher. We were both very dubious as to the possibility of completing a publishable manuscript. It is to the great credit of Dr. Alex Muir of the Rothamsted Experimental Station that he undertook this task, resulting in the publication in 1954 of Goldschmidt's *Geochemistry*, a 730-page volume. The book reflects the

amazing versatility of this great scientist, and his ability to synthesize and correlate a vast amount of scientific data. Goldschmidt's will directed that the royalties should accrue to the Raw Materials Laboratory, which shared them with Dr. Muir.

Following World War II the science of geochemistry enjoyed a vast expansion. Much of this resulted from the enormous demand during the war for raw materials, and from the atomic bomb program, with its emphasis on the geochemistry not only of uranium and thorium but also of the many rare elements produced by their fission. New techniques and instruments for chemical analysis revolutionized the determination of small amounts of minor and trace elements. New fields of investigation, such as the origin of the elements, were opened up. An international journal, *Geochimica et Cosmochimica Acta*, began publication in 1950, largely through Paul Rosbaud's efforts;<sup>1</sup> volume 1 contained 338 pages, volume 54 (1990) contained 3608 pages. The Geochemical Society, founded in 1955, now has some 1800 members in 44 countries; its highest award is the Goldschmidt Medal, presented annually together with an honorarium endowed by the late Dr. Lester Strock.

In 1947 I left New Zealand and joined the staff of Indiana University as Professor of Mineralogy. In addition to my mineralogy courses, I was asked to give a graduate course on a subject of my choosing, and I chose geochemistry. In 1950, I was approached by a publisher's representative. "I hear you're teaching a course in geochemistry" he said, "Would you write a book for us?" My concept of book writing was that the prospective author wore his feet down to the ankles trudging from publisher to publisher while peddling his manuscript—this was an entirely unexpected approach. I replied "If I write it, who will buy it?"—knowing that few if any universities were offering such a course, at least under the name geochemistry. He replied "That's our problem—you write it, we sell it". As a result I wrote *Principles of Geochemistry*. Published in 1952, I believe it was the first textbook of geochemistry in the English language.<sup>2</sup> Geochemistry is now an accepted subject in most universities and many colleges. The 1990 *Directory of Geoscience Departments in the United States and Canada* lists a total of 10,006 faculty members, of whom 1000 list their principal speciality as geochemistry.

In 1953 I accepted the position of Curator of Geology and Mineralogy at the American Museum of Natural History in New York. On my arrival I was interviewed by the then Director, Dr. Albert Parr (1900–1991). He was an expatriate Norwegian, and on learning I had been a research student with Goldschmidt he reminisced on his student days at the University of Oslo. He had taken the introductory course in mineralogy in 1926 as part of the requirements for a science degree, but was not seriously interested and did poorly on the final examination. He was interviewed by Goldschmidt, who said "Mr. Parr, you have not done well in my course; what do you intend to

become?" Parr explained that he intended to become a marine biologist. Goldschmidt then said "Mr. Parr, if you will promise never, never to take another course in mineralogy, I will pass you," a bargain that Parr was glad to accept.

I had a very amicable relationship with Albert Parr during my time at the American Museum of Natural History; we enjoyed recalling Goldschmidt stories. A favorite one concerned a student's oral examination, and went as follows: Goldschmidt: "Tell me, Mr. X, why is amazonstone green?" (Amazonstone is a rare green variety of potassium feldspar.) Mr. X, trying to bluff it out, replied: "Well, sir, I did know but I have forgotten." Goldschmidt: "That's really too bad, Mr. X. Nobody else knows, and you have forgotten!" (It is now known that the green color results from defects in the structure produced by natural irradiation and induced by the presence of  $Pb^{2+}$  ions replacing  $K^+$ .)

In 1971 Professor Denis Shaw, editor of *Geochimica et Cosmochimica Acta* from 1971 to 1988, began gathering archival material on Goldschmidt, and corresponded with those people who had been associated with him. I am greatly indebted to Dr. Shaw for this material and the opportunity to quote from the correspondence, some of which has been incorporated in earlier chapters.

V. V. Shcherbina (1907–1978), Russian geochemist, recalls:<sup>3</sup>

"I met V. M. Goldschmidt nearly every day from the middle of January until the middle of March 1933, when I was working in his institute under his direct supervision during my first scientific visit abroad in Germany (Berlin and Göttingen, September, 1932, to March 1933). Apart from a daily short oral report to Goldschmidt about my scientific work, I had the opportunity of meeting him and also questioning him about other problems in geochemistry. Frequently our discussions went beyond my topic of study (X-ray determination of the valency of V, Ti, and Fe in titanomagnetite and ilmenite) and Goldschmidt told me many interesting things. In particular, I recall the day when I was invited to his house for lunch—among the co-workers of his institute this was a common occurrence. A long scientific discussion ensued which was simultaneously my examination.

Once a week, in the institute's auditorium, Goldschmidt gave a two-hour geochemical lecture which was full of facts and ideas. Not many students of the university attended these lectures, since at that time Germany did not recognize a need for this new type of geologist. All his scientific coworkers (which included 12–15 people) attended these lectures, along with students from abroad—M. Balkoni from Italy, H. Berman from the U.S.A., and myself from Leningrad."

Professor Ivar Oftedal, a friend and colleague of Goldschmidt for nearly thirty years, wrote:<sup>4</sup>

"The totally dominant feature of the person Goldschmidt was his nearly incredible mental faculties: his fund of knowledge, as well as his memory of details, was truly enormous, and everything was fully ordered in his brain and ready for use at any instant. This gift was invaluable not only to himself, but to anyone who asked for his advice and help in scientific matters, for he always gave his answers gladly and promptly. I have never heard him say "I have no time now, wait until tomorrow." During such conversations with Goldschmidt I felt like a modest pupil before the great master; however, he was quite as unassuming himself and there was no feeling of distance between us. I have never had a similar feeling towards anyone. There are many manifestations of his astonishing mastery. Asking him about some specified matter he would usually refer you to one or more papers to be found in volume so-and-so, and you could look it up straight away. When the latest issue of a journal arrived I could see him turning the pages slowly and continuously during some minutes, and after that he obviously had a good idea of the essential contents, which were then stored in his brain. Although Goldschmidt knew almost everything I think mathematics were somewhat alien to him. At least he was highly impressed by the mathematical abilities of Zachariasen, and even by my own casual application of elementary calculus in crystal structure work.

Goldschmidt was very kind-hearted and always willing to help where he could. It is important to remember this in view of certain facts which seem to contradict it. Combined with his kindness and friendliness was a high degree of suspiciousness and also a nearly explosive temper. I believe he had little knowledge of human nature and therefore felt uncertain towards new acquaintances. I have heard him say "I am glad for every person I do not get acquainted with." His temper did not show up very often, but sometimes he got into quite uncontrolled fury, expressing his rage and contempt in exaggerated terms which the "victim" could hardly take seriously. In most such cases I think Goldschmidt had misunderstood or at least exaggerated the situation and he often begged pardon afterwards. It was impossible to work with Goldschmidt for anyone who took his occasional scoldings seriously and got offended. The situation might certainly be very unpleasant indeed, but usually the sun was shining again the next day or sooner. But it is true that some of his "victims" did never get on friendly terms with him again. Goldschmidt himself was not very willing to forget about more serious quarrels, and therefore he had a number of "enemies," not least among well-known scientists. I do not usually know the reasons for his hatred towards certain persons, but sometimes he actually boasted about such situations. I have heard himself tell about several cases. During a discussion at a meeting of our Academy of Science he got so excited that the wound after a recent

operation opened up ("I got so angry that I burst"). Also, at a faculty meeting in the university many years ago he got irritated over a statement by a woman professor: "Now we must finally take care to get rid of this damned petticoat government." He liked to tell us that the lady got so angry that she spat like a cat. This aspect of Goldschmidt's personality was well known among scientists and others, and it was often commented on, mostly with a smile. A distinguished Swedish professor used to ask, when meeting Norwegian geologists: "Now, has Goldschmidt got any new enemies?". It is true that his suspicious mind could easily destroy his contact with other people, but I believe the aversion was mostly on his own side—the "enemy" did not usually feel an equally intense hatred towards him. It was difficult for an "enemy" to restore good terms with Goldschmidt, but I have seen cases where this actually happened, especially in his later years. You will see that even in Goldschmidt's attitude towards his "enemies" there was an element of humour. In fact he was very fond of making jokes (not what you call practical jokes), sometimes highly grotesque, sometimes offensive, but mostly quite harmless or even cheap. For example: an excursion led us close to a rifle range, and suddenly we heard shooting. Then Goldschmidt said "If a bullet comes along you must step aside." To us Norwegians Goldschmidt's various remarks had an extra comic flavour; he knew Norwegian perfectly well, but he had a curious accent and used an almost literary syntax.

When assistants were carrying out laboratory work for his research programme he was often impatient like a child. He might stand outside the darkroom door during film development, shouting now and then: "How is it getting on? Have you soon finished?" But his undisguised delight at every successfully completed research detail was a real reward to any assistant or coworker.

My conversations with Goldschmidt scarcely touched on purely human, social, or political matters, so I know very little about his general attitude. Apart from his predominantly kind and benevolent nature I noticed his very strict obedience to law, his perfect honesty and reliability. He had a certain gift of foresight, which admittedly sometimes seemed too pessimistic to me. All the same he said, several months before World War II, that large-scale fission of uranium would certainly come before long, and that Hitler's troops would certainly invade Norway" (original English).

Mrs. L. W. Strock, fifty years after her stay in Norway, wrote:<sup>5</sup>

"I would like to include a few words on what a wonderful person Prof. Goldschmidt was to my husband and me. He befriended us in Göttingen even tho we had never met him before. In order to have my husband as a research co-worker, he paid for our living expenses the first six months until my husband was able

to obtain a research grant for one year from U.S.A. He prolonged our stay for almost three years until Hitler made life so unbearable for the Prof. that he finally left Göttingen in Sept. 1935 and went to Oslo, Norway, making my husband promise that he would join him there as soon as possible. It wasn't until May 1937 that we came to Oslo, bringing along our 11-month old daughter. He gave us a royal welcome—treated us like we were close relatives. The plan was that we were to stay for three years, but we were advised to leave earlier and did so in Dec. 1938."

Dr. Leiv Gjessing (see Appendix C) gave a memorial address on Goldschmidt (VMG) to the Videnskaps-Akademi on January 27, 1988, the centenary of his birth, and has kindly provided the following translation.

"In 1939 I studied chemistry at the University of Oslo. When I was reading about the lanthanide contraction I asked a fellow student "What is that?" He answered "It is not part of the usual curriculum and therefore without interest. But if you absolutely wish to know more about it you should go and listen to the lectures of Professor Goldschmidt." So I did.

VMG was 51 years old in 1939 and gave lectures on crystal chemistry and crystal structure in such a way that I became fascinated both with him and his subjects.

One day at the end of his lecture VMG mentioned that if any student was interested in crystal structure analysis he was welcome at his institûte at the Geological Museum, where he could learn how to synthesize crystals and measure their structure by means of X-rays. Of the 20 students present I was the youngest, only 20 years old, with only one year of chemistry and physics for medical students and one year of pure chemistry. But I was the only one who, with great pleasure, accepted this exciting offer. The world—famous VMG was going to be my tutor.

The foreign students of VMG left Norway in the fall of 1939, due to the war, and I became his only Norwegian student, doing research at his institute from September 1939 to July 1940. Strangely enough Brian Mason came from New Zealand to VMG in January 1940, but he left at the beginning of April the same year. Unfortunately we never met. That was probably due to the fact that I studied mathematics and philosophy at the same time and did most of my laboratory and X-ray work in the afternoon and evening.

VMG instructed me how to make  $\text{CaNiSi}_2\text{O}_6$  crystals and compare the structure with that of diopside,  $\text{CaMgSi}_2\text{O}_6$ . On the proposal of VMG the results were published in *Norsk Geologisk Tidsskrift* in 1940: "Contributions à l'étude des metasilicates."

VMG treated me very well, not only as his pupil but also as his friend. He gave me his classic work *Die Kontaktmetamorphose in Kristianiagebeit*, dedicated with the wish that I should not forget

geology. He invited me to join him at the meetings of the Academy of Sciences, where he introduced me to the Nobel Prize winner George de Hevesy and other famous scientists. Later he was so kind as to engage me in the preparation of the third edition of his lectures in mineralogy, and in addition he hired me as his assistant during his lectures.

The work with crystal structures enhanced my interest in this field, and in July 1940 my friends Tollef Larsson and Harald Major joined me in a new project to exchange aluminum with indium, gallium, chromium, and iron in the mineral chrysoberyl,  $\text{BeAl}_2\text{O}_4$ . We formed a sort of triumvirate, under the guidance of VMG, resulting in the publication of the paper "Isomorphous substitution for  $\text{Al}^{3+}$  in the compound  $\text{BeAl}_2\text{O}_4$ " in the *Norsk Geologisk Tidsskrift* for 1942. I also passed the examination in mineralogy and crystallography.

VMG arranged many geological excursions in the Oslo region, studying the contact metamorphism and visiting iron, copper, and bismuth mines. We were also invited to parties in his home. On these occasions he was very lively, charming, and witty, telling interesting stories and funny jokes.

In the fall of 1942 VMG was arrested by the Germans, but he had a heart attack in the prison camp and was therefore admitted to a hospital. Later he escaped to Sweden, and from there he got to England by air. He returned to Norway in June 1946, but he was then weakened by his heart disease and the many difficulties during and after the war related to his return to Norway. One evening he became very ill with pulmonary edema due to heart failure. He was admitted to the National Hospital in Oslo in the middle of the night. I, as a medical student, happened to be on duty that night. I was very sorry to see my good friend and teacher in such a miserable condition. I was thankful to have this opportunity to help him, as he had helped me so much and so frequently over many years.

In 1946 I mentioned to VMG that I was going tramping in Iceland, Scotland, and England. He gave me the addresses to many of his good friends and asked me to visit them and bring greetings from him. That brought me in contact with many famous scientists. The Nobel Prize winner Max Born and his wife Hedi who lived at that time in Edinburgh, the geneticist Professor John Burdon Haldane, who brought me in contact with Professor S. L. Penrose, and Dame Kathleen Lonsdale, the crystallographer, in London. They were all very kind to me, and very much interested to hear news of VMG, about his health, and how he was adapting himself to Norway again.

When I went to Italy in 1947, VMG asked me to visit the Papal Observatory at Castel Gandolfo outside Rome. There I had the pleasure of meeting Father Junke and his coworkers in their spec-

trographic laboratory, famous for their work on the spectrum of the sun.

We who were his close pupils admired and respected him, both as a warm human being and as an eminent scientist. We well understood that his intellectual capacity was at an unusually high level. His classmate in high school, Dagfinn Dahl, characterized him in this way: "VMG learned everything quick as lightning, understood everything, and remembered everything."

Professor Victor Moritz Goldschmidt was a genius. In addition, he was an outstanding teacher and a good and faithful friend. We are very grateful for having been his pupils."

