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# NEWSLETTER

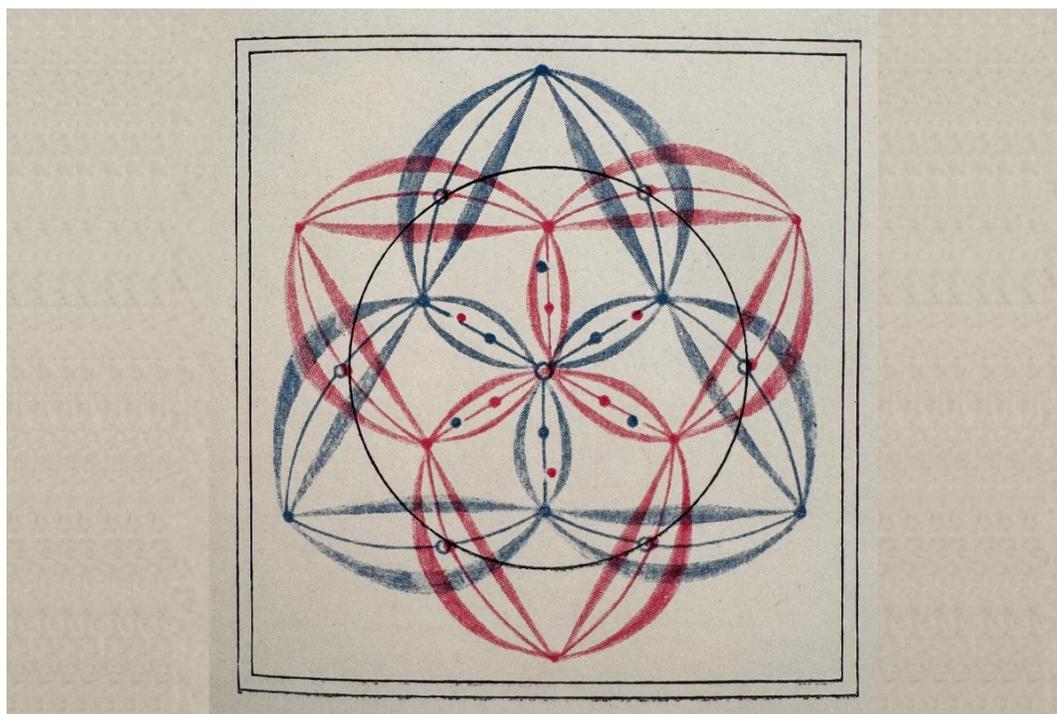
FEATURE ARTICLE

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## BEFORE X-RAY DIFFRACTION: CELEBRATING 115 YEARS OF A LANDMARK CRYSTALLOGRAPHIC MONOGRAPH

**Natalia Dubrovinskaia**

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Schematic stereographic projection of a diamond twin (from the monograph).

**Short annotation:**

*Der Diamant- eine Studie* ("The Diamond: A Study"), 1911: The history of a monograph preserved in the University Archive, authored by the world- renowned Heidelberg crystallographer

Viktor Goldschmidt and his young colleague, Alexander von Fersmann, who later became one of the most renowned mineralogists and geochemists in the USSR in the first half of the 20th century.

### **Epigraph:**

*"We will still have to struggle a great deal in order to secure for crystallography the place that rightfully belongs to it. However, we have already achieved much."* (from Goldschmidt's letter to Fersmann, Heidelberg, 20.06.1913)

Among all minerals in the natural kingdom, none possesses a greater power to stir the human heart and captivate the imagination than diamond. Surrounded since antiquity by an aura of mystery and superstition owing to its beauty and endurance, the diamond has long challenged scientists seeking to understand its genesis in the deep interior of the Earth and in the Universe, as well as to explain its exceptional properties, such as extreme hardness and brilliance.

The monograph *Der Diamant* by A. von Fersmann & V. Goldschmidt was published in Heidelberg exactly 115 years ago, in February 1911. It was the result of four years of intensive collaborative work between the world-renowned crystallographer, Professor Viktor Mordechai Goldschmidt (1853-1933), and his young colleague, Alexander Evgenjevich von Fersmann (1883-1945), who arrived in Heidelberg from Moscow in 1907 to study the crystallography of diamond at Goldschmidt's Institute. Fersmann, an exceptionally gifted young researcher, was at that time supervised at Moscow University by the eminent Russian scientist Professor Vladimir Vernadsky, widely regarded as one of the founders of geochemistry, biogeochemistry, and radiogeology.



V.M. Goldschmidt, 1930

Goldschmidt had founded his private Mineralogical-Crystallographic Institute ("Mineralogisch-Kristallographisches Institut") in Heidelberg in 1895 and financed it, along with several other institutes in the city, from his own and his wife's personal resources. Goldschmidt had a reputation as one of the leading crystallographers of his time. His name was closely associated with the development of crystallography and with the instruments known as the Goldschmidt-Stöe two-circle optical goniometers. The institute became known worldwide as a centre for crystal morphology studies and attracted hundreds of scholars during its years of operation in Heidelberg. Goldschmidt was visited by, and maintained active communication and scientific exchange with, the

most influential contemporary scientists, including such a leading figure in crystallography as Evgraf Stepanovich Fedorov (1853–1919).

The fate of Goldschmidt and his wife, Leontine, mirrors the tragic course of German history in the first half of the twentieth century. During the Nazi period, they were persecuted as Jews and Goldschmidt was dismissed from the University in 1933. His family was expropriated, and in 1939, his former private Institute was incorporated into the Mineralogical- Petrological Institute of the University of Heidelberg, whose successor is today's Institute of Earth Sciences. After the tragic death of Leontine in 1942, the family archive, including Goldschmidt's scientific legacy, was confiscated by the Gestapo. Following a petition by the Mineralogical- Petrological Institute, part of the documents was transferred to the Institute and later deposited at the University Archive Heidelberg, while another part was lost.

It is remarkable that the University Archive has preserved correspondence between Fersmann and Goldschmidt concerning their work on diamond crystallography and the preparation of the monograph *Der Diamant*. It is difficult to imagine that historians of science will, more than a century from now, be able to reconstruct in detail the circumstances surrounding the preparation of a scientific monograph written today, in an era dominated by computers and electronic communication. All the more fascinating, therefore, is the opportunity to glimpse how such work was conducted a hundred years ago.

Dozens of letters and postcards from Fersman to Goldschmidt, preserved by chance in the archive, allow a detailed tracing of the scientific process. Work on the crystallography of diamond required a representative collection of raw diamond crystals—that is, crystals not cut or polished, preserved in their natural form—for measurement and description. Fersman's correspondence documents his meticulous efforts to locate and select suitable crystals. He travelled widely across Europe—sending letters from Berlin, Munich, Vienna, Prague, Warsaw, and other cities—searching for noteworthy specimens in museums, university and private collections, as well as at mineral and diamond markets. On 10 August 1910, he wrote to Goldschmidt: "Yesterday and today I examined many thousands of diamond crystals. I purchased some exclusively for you for 24 marks. Among them are exceptionally

fine specimens that nicely complement our collection. There are also some entirely new features to be seen in them. The address of the Diamond Administration is: Behrenstrasse 7, Diamond Administration of the D.D.S., West African Protectorate." Ultimately, 289 crystals with a combined weight of 200 carats (40 grams), originating from various deposits, were investigated, characterised, and described in the monograph, which was illustrated with 168 original figures and accompanied by an atlas of morphological forms and light-reflection images.

In an undated letter, Fersman wrote: "The work on the diamond was truly colossal, and now at last the manuscript is finished... Perhaps it should be published as a separate book, since it has, in fact, become a complete monograph! I am only in favour of faster printing, without delays. Otherwise, in many respects, the work will become outdated; I feel this especially with regard to the historical aspects, as each month brings something new and important in various questions concerning the diamond."

In the summary of the published book, the authors stated: "The description of crystals exists for its own sake, in the sense that through it observers and readers may delight in the richness, beauty, diversity, and inherent order of nature. At the same time, it is an element within the system of comprehension of the nature of crystals." This sentiment proved entirely justified, as the book made substantial contributions across multiple areas of mineralogical science.

One of its most important achievements was the systematic investigation of diamond crystal morphology. Fersmann and Goldschmidt demonstrated that crystal forms are not accidental but reflect conditions of formation and subsequent geological history. They classified habits, twins, and surface features using extensive comparative material, arguing that morphology provides evidence for genetic interpretation. Equally significant was their insistence that diamond formation requires extraordinary pressure conditions. Although they could not yet quantify pressure–temperature fields, they rejected low-pressure surface-formation theories and framed diamond genesis as a problem governed by physical chemistry and thermodynamics. Their discussion of the diamond–graphite relationship introduced early concepts of metastability. The authors also emphasised the influence of geological environment on diamond characteristics, treating differences between diamonds

from kimberlite pipes, placer deposits, and various geographic regions as meaningful indicators rather than incidental variations.

Interestingly, *Der Diamant* was never translated into languages other than Russian. In the Russian edition, *Kristallografiya Almaza* (Crystallography of Diamond) (1955), Fersman was listed as the sole author, while Goldschmidt's name was omitted. This omission likely reflects the ideological climate of the Stalinist "struggle against cosmopolitanism"—a mass ideological campaign launched after the Second World War to suppress pro-Western sentiments, eradicate so-called "anti-patriotic" tendencies among the intelligentsia, and assert the primacy of Russian science and culture. Nevertheless, the Russian edition played an important role in transmitting and systematising the ideas of the original monograph for Soviet science.

*Der Diamant* became, in its time, a comprehensive study of the morphology of diamond crystals, which was considered in the context of diamond genesis – a progressive view that led to a new direction in mineralogical crystallography at the very beginning of the 20th century: the genetic morphology of crystals.

#### EPILOGUE

It is a well-known human weakness to be fascinated by curious numerical coincidences, and the story of *Der Diamant* offers a particularly tempting example. The author of this paper graduated from Moscow University in 1983—exactly one hundred years after the birth of Alexander Fersman. In 2007, following her habilitation on nanodiamond, she arrived in Heidelberg to take up a position as *Privatdozent* at the Mineralogical Institute of the University of Heidelberg, precisely one hundred years after Fersman himself had arrived at Goldschmidt's institute. That same year, she began studying the relevant documents in the University Archive. Four years later, in 2011, she left Heidelberg—one hundred years after the publication of *Der Diamant*. Such alignments surely mean nothing at all, yet they are difficult to resist; or, as history occasionally reminds us, numbers sometimes seem to enjoy telling their own quiet jokes.

**Natalia Dubrovinskaia**

**University Professor**

**University of Bayreuth, Germany**



2 A. E. von Fersman in 1907 and on a Soviet stamp issued in 1966. Fersman became one of the most prominent mineralogists and geochemists in the USSR in the first half of the 20th century.

4173

Geehrten Herrn Professor,

Ich send folgende wichtigere Correctionen

1. Es sind viele Stellen bei der Nomenclatur der Troctopyrenen, die derselben jetzt ein andern Namen erhalten sein können. So Seite 127. Citat in Troct-67-108 Troctopyr 76. Seite 84 Citat Troctopyr 11-22 soll sein 17-11. Seite 117 Troctopyr 107-11 soll sein 10.
- 2) S. 73.0. „Diel Troct.“ — nur 34 soll sein.
- 3) S. 175 } Michael bei der chemischen Synthese sind die Mineralien ebenfalls B<sup>+</sup> B<sup>-</sup> u. s. w.
- 4) S. 152. Troctopyr 11 und 10 Veränderung der Zeichnungen von Troctopyr 11-22.
- 5) S. 152. „Bestehen die Troctopyrenen aus Troctopyr 11-22.“
- 6) S. 80 Troctopyr 22 — umkehren um 90°!
- 7) S. 105 Troctopyr 11 — umkehren um 90° im Witzgenstein!! Sie sind die Lage richtig zu stellen zum Vergleich mit einem Zinkstein.
- 8) S. 148 Troctopyr 11 — umkehren um 90° über Citat zu Troctopyr, dann wird richtig.

Sehrge Corollaren:

Seite 131 Troctopyr 66 umkehren um 90° im Witzgenstein.  
 " 123 " 67, 69 " " "  
 " 143 " 76, 78 " " "  
 " 144 " 76, 78 " " "  
 " 145 Troctopyr 129 umkehren um 180°!  
 " 171 Troctopyr 104 Sehr wichtig — Hier zeigen sich nicht von Rosa-Landsteck! Sie sind eine Zinkstein sein. Wenn Sie diese Eisen die angegebene Typen v. Rosenfeldstein haben, da sie sehr wichtig ist.

Hochachtung. A. E. Fersman.

9) S. 154. H. 88. Man geht, kann es sagen, dass die Beschreibung nicht von Bambusa beschrieben aber nicht geändert sein.

10. Ich glaube, dass man die Troctopyrenen in-Original von gebunden verkaufen könnte, wie es z. B. mit dem englischen Bismut-Äther ist. Der russische Bismut wird zur amerikanischen Beschreibung unserer Bücher einzusetzen.

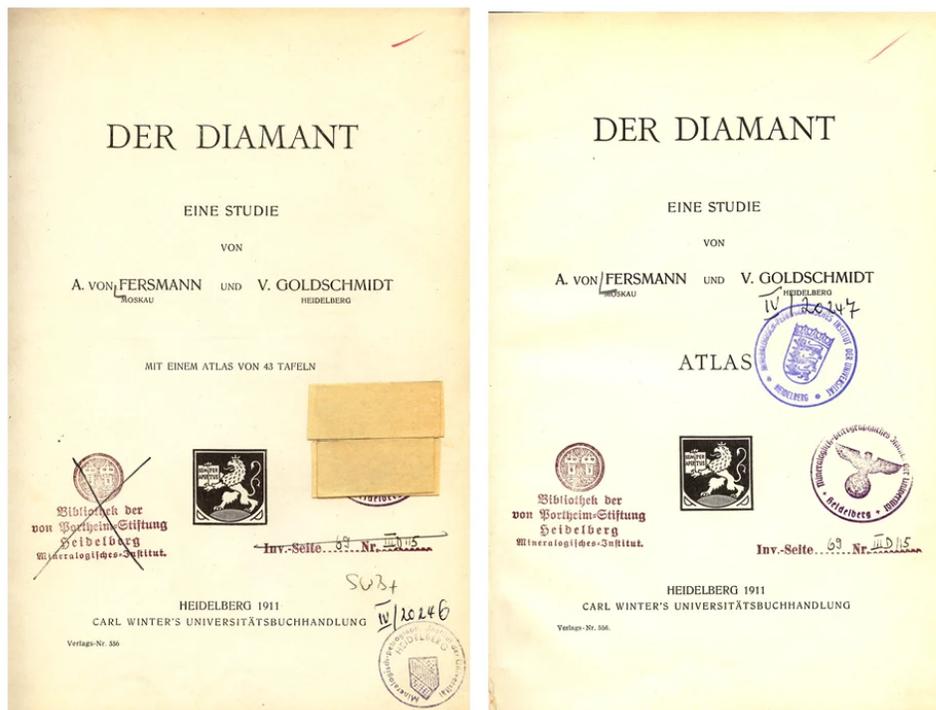
11. Sehr interessant ich noch auf die Art auf welche sie den Witzgen bearbeitet haben, wenn ich in das ganze überblicke, fällt das eine Zusammenstellung und Mischung der Troctopyrenen. Im speziellen Theil gehen wir sehr in Licht und man versteht sich leicht.

12. Auch wie zusammengefasst ist eine Zusammenstellung der beschriebenen Kristalle nach den Vorlesungen, ich glaube, dass wir eine solche gemacht haben.

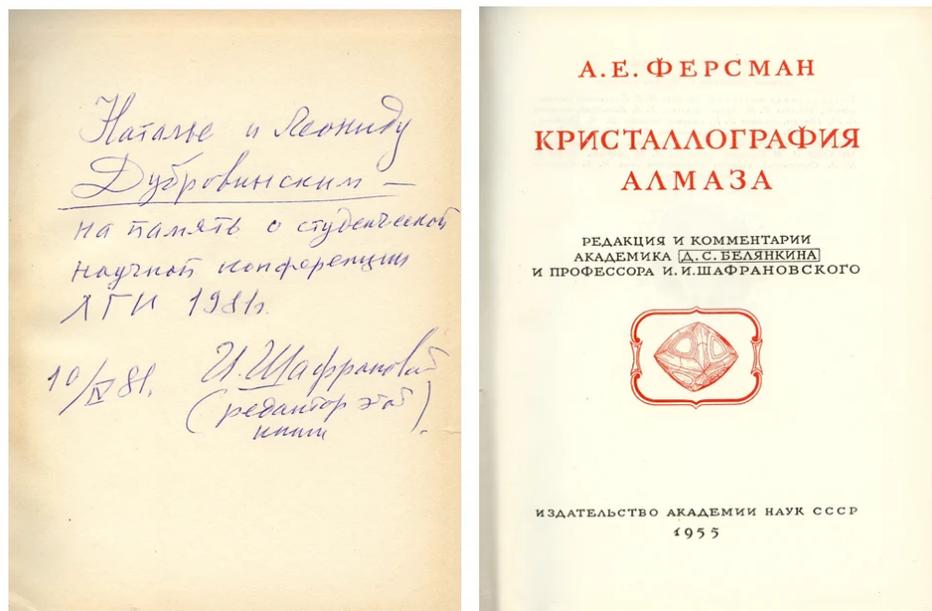
Hochachtung. A. E. Fersman.

Bitte auf der Rückseite und schicke im Zug.

A copy of the correction of the manuscript *Der Diamant*.



Title pages of the monograph *Der Diamant* and the Atlas from the original 1911 edition. The stamps reflect the complex history not only of these particular copies, but also of the society itself.



Title page of *Kristallografiya Almaza* (1955), presented to me in 1981 by its editor, I. I. Shafranovsky, who at that time was a professor at the Mining Institute in Leningrad. A dedicatory inscription on the front flyleaf (in Russian) reads: "To Natalia and Leonid Dubrovinsky, in memory of the student scientific conference at the Mining Institute, 1981. I. Shafranovsky, editor of this book."

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27 January 2026

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