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DMITRY P. GRIGOR'EV: ONE OF THE FOUNDERS OF MODERN MINERALOGY

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Dmitry Pavlovich Grigor'ev
(1909–2003).

Dmitry Pavlovich Grigor'ev was one of the world's leading mineralogists, whose works and scientific organizational activities have laid the basis for new research avenues that are currently broadly acknowledged and fruitfully explored. I strongly believe that the two brightest and most fruitful branches of mineralogy during its rapid progress in the second half of the 20th century were studying the physics and ontogeny of minerals. Because of this, we refer to the modern evolution of mineralogy as a physical-ontogenetic stage (Pavlishin and Dovgyi, 2008), and this stage was inseparably connected to D.P. Grigor'ev, his ideas and studies, which shed light onto a principally new approach to the study subjects of mineralogy.

Among the founders of modern mineralogy, one of the leading roles was played by my contemporary, Dmitry Pavlovich Grigor'ev, a professor at the Leningrad (nowadays St. Petersburg) Mining Institute, an extremely motivated and committed mineralogist, who devoted all of his long and fruitful creative life to minerals and mineralogy. Another remarkable touch of D.P. Grigor'ev nature was his loyalty and devotion to the Mining Institute, into which he entered in for the first time as a twenty-years-old student and with which he then bound his whole life and creative activities. Moreover, he gave all 70 years of his fruitful work to a single department at the Institute, the Department of Mineralogy, at which he professionally grew from student to postgraduate student, assistant and full professor, and eventually the head of this department.

Historically, D.S. Grigor'ev started his creative work with experimental mineralogy. He organized in 1934–1935 a laboratory of experimental mineralogy and petrology at the Department of Mineralogy of the Leningrad Mining Institute, and original studies at the laboratory are nowadays worldwide renowned. He experimentally studied silicate melts and the crystallization of some rock-forming minerals from melts, reproduced liquid immiscibility in melts, and proved that these phenomena do occur in nature. D.P. Grigor'ev was the first to synthesize amphiboles and Mg-Fe micas from F-bearing melts by substituting OH in these minerals for F. His discoveries provided a basis for industrially used technologies for synthesis of these minerals. This and other D.P. Grigor'ev's studies in 1934–1942 triggered launching extensive experimental mineralogical research in the Soviet Union. These studies were also the subject matter of his doctoral thesis *"Synthesis and Studies of Major Volatile-Bearing Silicates"*, which was successfully defended in 1942 and was highly estimated by Acads. V.I. Vernadsky, D.S. Belyankin, V.A. Obruchev, A.E. Fersman, and D.S. Korzhinskii. Obviously, D.P. Grigor'ev was one of the actual founders of experimental mineralogy.

It is interesting to mention that the main authority in experimental mineralogy for then-young experimentalist Dmitry Grigor'ev and the main (among Soviet researchers) inspirer of his work in this field was P.N. Chirvinskii and his book *"Synthesis of Minerals in the 19th Century"* (1906, 1995), which was written even before he started studying at St. Vladimir Kiev University. In his paper *"P.N. Chirvinskii and Synthesis of Minerals"* (published in the collection of papers *"P.N. Chirvinskii and Problems of Geological Sciences"*, 1970), D.P. Grigor'ev wrote that *"...the very first research publication by P.N. Chirvinskii <...> opened the doors to a very interesting avenue of research* (experimental mineralogy – V.P.). *I remember the sequences of experiments and my excitement when holding the still-warm fused experimental products with mica books in them <...>. And now I sent my first published paper to Chirvinskii himself <...> and received his inspiring response."* (p. 25).

D.P. Grigor'ev's fundamental contribution to mineralogy was to launch research that explored a new field of mineralogy: the ontogenesis (ontogeny) of minerals. The very first brief essay on the ontogeny of minerals was published by D.P. Grigor'ev in 1947. He coined the term ontogeny of minerals in 1955, and published (thanks to initiative and assistance from E.K Lazarenko) the fundamental monograph *"Ontogeny of Minerals"* in 1961. Four years later, the monograph was translated and published into English. Together with A.G. Zhabin, D.P. Grigor'ev reworked and appended the book and published it under the name *"Ontogeny of Minerals: Individuals"* in 1975. D.P. Grigor'ev's ontogenetic ideas, including those on mineral as a crystalline organism, were widely acknowledged and published in educational books on mineralogy worldwide.

After fundamental mineralogical ontogenetic studies conducted by D.P. Grigor'ev and his school, it is not appropriate anymore (although, sadly, still happens from time to time) to define the genesis of minerals with a single adjective, such as magmatic, pneumatolytic, or hydrothermal. An important part in mineralogical studies belongs to the ontogeny of minerals, a study of the laws governing the origin, transformations, and destruction and decomposition of mineral individuals and their aggregates. This study covers such processes as the nucleation, growth, and transformations of minerals, mechanisms responsible for their origin, and geological mineral-forming processes. This laid a basis for the productive progress in mineralogical science and practice. This research avenue of mineralogy is lightened by new examples and ideas presented in the monograph *"Ontogenetic Method in Mineralogy"* (1988) by V.I. Pavlishin, N.P. Yushkin, and V.A. Popov (the editor was D.P. Grigor'ev).

Another pathway, which was pursued nearly simultaneously with the ontogeny of minerals, is the constitution of minerals, a branch of mineralogy remarkably widened and thoroughly explored by D.P. Grigor'ev. His book *"Fundamentals of the Constitution of minerals"* was published in 1962 and 1966, and then translated and published in English in 1964.

The concept of minerals newly developed by D.P. Grigor'ev combined modern understanding of the chemical composition and crystal lattice of minerals and also, partly, of their morphologies. Much attention was focused on the electron structure of minerals and the internal structure of mineral individuals. This concept was further developed (see, for example, *"Extended Understanding of the Constitution of Minerals"* in *"Crystallography and Mineralogy"*, 1972) from the standpoint of the unity of the electron, atomic, and microstructure of minerals, i.e., the unity of their anatomy and morphology. The core concept was focused on their anatomy, which was introduced into science by D.P. Grigor'ev, who also formulated the principal laws of the anatomy of crystals, suggested methods for their studying, and demonstrated the academic and applied importance of anatomic mineralogical research.

In 1962, D.P. Grigor'ev put forth new ideas in his fundamental paper *"Cosmic Mineralogy: A New Branch of Science"* (in The Herald of the Academy of Sciences of the USSR), which marked the beginning of studies in still another research field: cosmic mineralogy (the term suggested by D.P. Grigor'ev himself). This avenue was actively pursued by D.P. Grigor'ev when he worked as the chairman of the Preparatory Committee on Meteorites of the International Mineralogical Association (IMA) and as the chairman of the Commission on Cosmic Mineralogy at IMA.

Prof. D.P. Grigor'ev remarkably contributed to the development of mineralogical museums and to the popularization of mineralogy. He was the head of research at the world-famous Mining Museum at the Leningrad Mining Institute and gave widely known lecturing tours devoted to the history of ornamental stone and gems in the Hermitage and natural construction and ornamental stone in St. Petersburg–Petrograd–Leningrad.

D.P. Grigor'ev is also widely renowned as a historian of science. Many of his papers and his book *"Russia's Outstanding Mineralogists"* in co-authorship with I.I. Shafranovskii are important for understanding the history of mineralogy. D.P. Grigor'ev has published essays devoted to practically all world's most outstanding mineralogists. He also productively worked in the field of applied mineralogy (both exploration and technological mineralogy).

D.P. Grigor'ev considered his scientific pedagogical activities to be among the most important one in his life. In this context, I recall his numerous talks at various conferences and presentations in the literature, as well as personal communications, in which Dmitry Pavlovich expressed his new ideas of how to make the educational process more efficient and rational: education should be based on deeds but not words alone. Starting in 1990, he published his splendid essays *"Experience in Teaching Mineralogy"* in *"The Notes of the All-*