

IN MEMORIAM Gregorii I. Karavaiko



Gregorii Ivanovich Karavaiko passed away on September 18, 2006, when he had just become 70. His passing is a great loss to all of us with interests on bacterial physiology, geological microbiology or biohydrometallurgy. Gregorii and his students and scientific collaborators made fundamental and lasting contributions in all these areas.

Gregorii was born in Kuchinovka, Chernigov area, on July 27, 1936. He studied microbiology at the University of Moscow and after obtaining his diploma as “Microbiologist” (corresponding to the present-day “Master of Science”) in 1959 he joined the Institute of Microbiology of the Soviet Academy of Sciences in Moscow. Gregorii had the great chance to start his scientific career as PhD-student in the famous Russian school of geological microbiology, which at that time was represented mainly by scientists working in this institute, in the Department of Geochemical Activity of Microorganisms headed by Prof. Sergei Kuznetsow. In 1982, a new department named Microbiology of Rocks was separated from the Department of Geochemical Activity of Microorganisms. This new department was then reorganized and named the Laboratory of Chemolithotrophic Microorganisms, with Gregorii Karavaiko as its Head. Gregorii held this post until the end of his life and his scientific career was directly connected with this laboratory. However, it must be noted that the universally recognized scientific activity and excellent talent for organization made Gregorii a Deputy Director of the Institute of Microbiology already in 1975.

The subjects studied by Gregorii and his collaborators are quite varied but can be related to three major groups: diversity of chemolithotrophic microorganisms under extreme acidophilic conditions, adaptive microevolution of chemolithotrophic bacteria, and biogeotechnology for processing different mineral raw materials (ores, concentrates, wastes). Some new microorganisms important for the biogeochemical transformations of iron, sulphur and sulphide minerals were described: the new Archaea-family *Ferroplasmaceae* of the order *Thermoplasmatales* with the new genus *Ferroplasma* and the new species *F. acidiphilium*, the new genus *Sulfobacillus* with the species *S. thermosulfidooxidans* and *S. sibiricus*, as well as the new species *Alicyclobacillus tolerans*, which is an intermediate between the genera *Sulfobacillus* and *Alicyclobacillus* and requires electron donors such as Fe^{2+} and S^0 for mixotrophic growth.

During the analysis of the structure of chromosomal DNA by pulse-electrophoresis and 16S rRNA sequencing, as well as by the study of plasmide profiles, it was demonstrated that the adaptation to new energy substrates changes the structure of chromosomal DNA of acidophilic chemolithotrophs. The irreversibility of these changes results in the appearance of new strains with new phenotypic characteristics. It was demonstrated that the changes in the chromosomal DNA structure and plasmid profiles depend on the crystallochemical and electrophysical properties of minerals.

Gregorii and his collaborators made several important contributions to both the theory and practice of bacterial oxidation of sulphide minerals. Various surface and intracytoplasmic membrane structures were studied in chemolithotrophs oxidizing Fe^{2+} , S^{2-}/S^0 , and sulphide minerals. It was demonstrated that the periplasmic space plays an important functional role both in sulphur generation during the oxidation of thiosulphate and in the initial oxidation of elemental sulphur, which dissolves in exolipids and enters the periplasmic space, where it is completely oxidized. The electrochemical character of bacterial oxidation of sulphide minerals was established. It was found that this oxidation depends on the crystallochemical properties of the sulphides.

The solid fundamental competence of Gregorii and his collaborators, in collaboration with scientists from the Moscow Institute of Steel and Alloys and Central Research Institute for Geological Explorations of Non-ferrous and Precious Metals, resulted in the development of several biotechnologies for processing various complex ores and concentrates by means of dump, heap or reactor leaching techniques. Some of these biotechnologies have been applied in commercial-scale operations.

The research activity of Gregorii has been reflected in about 300 papers, 10 patents and several books, including four monographs. Most of his publications are well known to all scientists who have interests in geological microbiology and biohydrometallurgy. These publications are characterized by a high level of novelty and are often used as reference sources by many other scientists all over the world.

Apart from his research activity, Gregorii was a very active academic teacher and for many years gave lectures to students in the Moscow State University. He bequeathed to his students his diligence and his will for knowledge and research. Most of them excel today as university professors, research scientists and microbiologists in Russia and abroad.

The scientific excellence of Gregorii Karavaiko was universally recognized. In 1990 he was elected as a Corresponding Member of the Russian Academy of Sciences, in 1991 he was awarded the Winogradsky Premium by the same Academy, and in 1997 he received the medal "In Memory of the 850 Years since the Foundation of Moscow".

Gregorii was a very active participant in the Symposia on Biohydrometallurgy. He was looking forward eagerly to this symposium in Frankfurt. His presence is sorely missed.

Stoyan Groudev