

CHRONICLE

MIKHAIL IVANOVICH SUMGIN – THE FOUNDER OF GEOCRYOLOGY

(on the 150th anniversary of the birth)

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Information about the life and work of an outstanding scientist Mikhail Ivanovich Sumgin is presented. His contribution to the development of a young science of frozen rocks and related phenomena, geocryology, is discussed.

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There are people, whose life, like a magnet, attracts us with apparent originality of actions, thoughts, and deeds. Even years after such person has left this turbulent, mysterious world, his life continues to attract people over again, sometimes as an example of service to a noble goal and sometimes simply

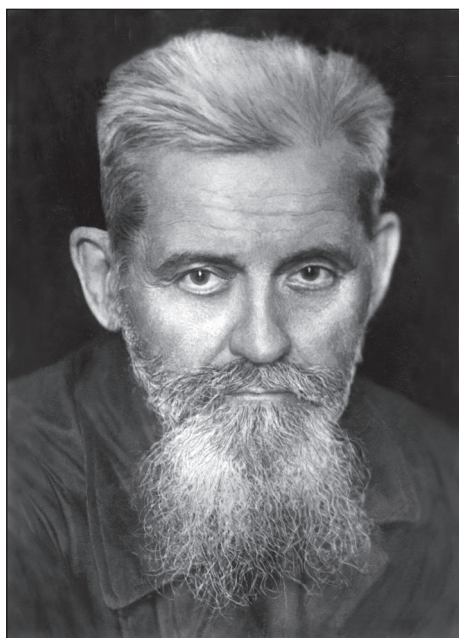


Fig. 1. Mikhail Ivanovich Sumgin (February 25, 1873–December 8, 1942).

as the behavior of an individual in the most difficult conditions of existence. They are people with an unshakable, iron will, obsessed with an idea or bright thoughts, capable of synthesizing their knowledge and putting it into practice. There are many such people in science. At all times, they have been followed, looked up to, and learned from. Such a person in permafrost science was Mikhail Ivanovich Sumgin (Fig. 1). The name of this man, an outstanding geographer, geologist, and engineer, occupies a strong place among the scientists, who have enriched Russian and world science. M.I. Sumgin's works have shaped the basis of many textbooks, projects, and engineering solutions and have been used in the construction methods and economies of nations living in cold regions of the globe. His books, articles, and ideas are still used today, not only to solve the current issues in the development of the North but also to assess the future development of our civilization under conditions of future climate change and the growing anthropogenic impact on the natural environment.

THE BEGINNING OF LIFE JOURNEY

Mikhail Ivanovich Sumgin was born on February 25, 1873 into the family of a Mordovian peasant in Krapivki village, Lukoyanov Uyezd of the former Nizhny Novgorod Governorate. His father, Ivan Ignatyevich, an energetic and inquisitive man, became a volost clerk after finishing a parochial school.

It was the rarest case among illiterate people of the Erzya¹. The mother of the future scientist, local

¹ Erzya is one of the ancient ethnic groups of the Mordovian people; among their representatives, there are many famous historical personas: Patriarch Nikon, Stepan Razin, Vladimir Lenin, Fyodor Chaliapin, Maxim Gorky, Lidiya Ruslanova, Vasilii Chapayev, etc.

beauty Anna Fedorovna Garankina, an intelligent and kind woman, could read, but she never learned to write. Misha's first teacher was his father. The boy inherited his curiosity, initiative, and practicality from him. The parents discovered their son's ability to learn and, despite financial difficulties, decided to give him an education. After graduating from a rural parochial school in the autumn of 1885, Misha entered the Lukoyanov secondary school, from which he graduated brilliantly two years later. Like his father, who had already died by this time, he became a clerk. He composed letters, petitions, and intercessions for peasants. He never took money following the example of his late parent. This fact raised reputation of the Sumgin family even more; the young clerk gained universal respect. In 1892, after the lean year with a bad harvest, misfortune came: his younger brother and sister died of scarlet fever, and his mother fell seriously ill. Misha was lucky; he survived. He continued his service, read a lot and educated himself.

The further life of the young man was largely determined by the fact that he met and communicated with kind and intelligent people. Not far from the village, where Misha lived, there was an estate of a relative of the famous artist, academician of painting V.I. Yakobi. The owner of the estate, Mrs. Yakobi, an educated woman, who voluntarily served as a local doctor, needed an assistant, who, in addition to the office business, would look after her son. Having heard from neighbors about the talented young man, she invited him to work, introduced him into her family, provided him with lodging, and allowed him to use their rich library. Sumgin spent four years in the family of V.I. Yakobi. Here he began to study French, Greek, and Latin and was determined to enter one of the Russian universities to become a "travelling professor" lecturing in villages and, thus, enlightening the illiterate underprivileged people.

However, several more difficult years had passed before he entered St. Petersburg University. It was necessary, at least for the start, to have some means of support, and his mother needed help. Leaving the Yakobi family, he went to Nizhny Novgorod and worked as a bath attendant, a barge loader, and a porter at a railroad station. It so happened that the young man met the famous statistician and journalist Nikolai Fedorovich Annensky, who was lived in an exile in the city on the Volga River and began to visit him. At the apartment of N.F. Annensky, he met the writer Vladimir Galaktionovich Korolenko. Misha impressed him with his stories, soulful character, biography, and attitude towards working people, especially the peasantry. N.F. Annensky and V.G. Korolenko appreciated the young man curiosity and recommended him to go to Moscow or Saint Petersburg, where he could enrich his knowledge in libraries and museums and to prepare for the university. N.F. Annensky wrote a recommendation letter to his brother,

the director of the Tsarskoye Selo Gymnasium, asking him to help the talented young man. But there was still not enough money for the trip, Then his mother sold her only cow, and the assembly of Kravivki village handed the fellow countryman a kind of a referral certificate, which stated that "there are no obstacles to Sumgin's admission to a higher educational institution".

SAINT PETERSBURG: THE HARD WAY TO KNOWLEDGE

The capital greeted the young man unfriendly – there was nowhere to live, and it was difficult to find job. He spent some time sleeping under a bridge and at a train station. He managed to rent a small room in an attic and get a job at the Zincography Laboratory of Demchinsky. After a 12–14-hour workday he was exhausted. He had to get up early in the morning to study textbooks, but such studies were of little use. In the spring of 1894, he left the zincography business and began working as a self-employed man, which allowed him to change his work schedule and devote some of his free time to self-education. He loaded all sorts of things, carried boxes and suitcases at train stations, and sold tobacco, cigarettes, and matches.

One day he met V.I. Jacobi, member of the Academy of Arts, who, after hearing about the wanderings of his young friend, invited him to his studio. Sumgin posed for the artist in the costume of Emperor Alexander III for some time, read a lot, and prepared for exams. However, it did not last long. One of the visitors called Sumgin a "strange lackey", and he, offended, left the hospitable house. He began selling from a stall again, while loudly singing lines from the "Iliad" in Greek and the world-famous student song "Gaudemus igitur" in Latin. Finally, fate smiled on the tall and handsome guy. On the bank of the Neva River, near the university building, he met one of the students, Vikarii Petrovich Samsel, who was greatly surprised by erudition of the unusual salesman. They became friends, and this friendship lasted for the rest of their lives.

V.P. Samsel created all possible conditions for systematization of the accumulated knowledge of M.I. Sumgin and actually prepared him to enter university. To begin with, in May 1895, Mikhail brilliantly passed the examinations for the full gymnasium course. Eight out of eleven subjects, including physics, mathematics, Greek, Latin, French, history, and geography, were rated "excellent" by the teachers of the capital's educational institution. This was a really big and well-deserved victory! Soon Michael became a student at the Faculty of Physics and Mathematics of St. Petersburg University.

There was an exciting new world of knowledge to explore. He studied avidly and enthusiastically. Chemistry, physics, astronomy, mathematical analy-

sis – everything was interesting. In addition to lectures, he attended scientific gatherings and meetings and was considered the best chess player at the faculty. He lived modestly. He rented a room on the Neva River embankment, where his hostess provided him with breakfast and dinner. At first, the scholarship was not given. He had to earn money by giving lessons and taking part in loading and unloading work at the seaport. Some of the money was sent to his mother in the village. In spite of the difficulties of everyday life, he graduated from the first year with honors. V.I. Jacobi continued to follow the progress of his fellow countryman. On his initiative, M.I. Sumgin was exempted from tuition fees as “extremely poor”, and soon he was awarded the Rybin scholarship established by one of the city’s benefactors “for success and exemplary conduct”.

Misha had a smooth temper, sincerity, goodwill, and extremely hard-working nature. This captivated people around him. A lot of friends appeared; he earned attention and respect of teachers and professors. They predicted him a great future in science and promised to leave him at the university after graduation. Dreams of education were rapidly coming true.

No one knows how the future fate of Mikhail Sumgin would have turned out. Surely, he would have become a major scientist in the field of physical and mathematical sciences, just not a permafrost scientist. If not for one “but”. The political destiny of Russia had been bothering him for a long time. He wanted to devote himself to the struggle for “the happiness of people”. Communicating with leading intellectuals of St. Petersburg, attending student gatherings, reading forbidden literature, Mikhail Sumgin entered the spirit of freedom-loving ideas of that time. The ideology of populism, the struggle for the truth and for the overthrow of monarchy were closest to him. When M.I. Sumgin was in his third year of the university, the police became aware of his illegal activities. His rented apartment was searched and a forbidden brochure was found. A successful student was arrested, deprived of his scholarship, and expelled from the university.

The hard days began again. He had to change cheap housing and to live by casual earnings. Mikhail went to his mother in the village of Krapivki for the summer. In the autumn, he returned to the capital on the advice of friends and submitted a petition for reinstatement to the university. The petition was supported by professors K.A. Posse, O.D. Khvolson, and I.I. Borgman. On October 28, 1898, M.I. Sumgin returned to his classrooms and settled in the apartment of Professor N.A. Gezakhus, which offered him the perfect conditions for continuing his studies. What more could a poor student dream of? The exciting prospect of mastering the knowledge accumulated by mankind was once again at hand. But one cannot hide from fate, one cannot run away...

UNDER POLICE SUPERVISION

In February 1899, significant events occurred in St. Petersburg: students, preparing for a political demonstration, disrupted classes. A conflict with gendarmes took place, many young people were beaten, some were arrested and imprisoned. Among the victims, M. Sumgin was one of the first to be taken, because he was under suspicion. As a result, he was exiled to Nizhny Novgorod under police supervision and was deprived of the right to enter any institution of higher education in Russia.

Mikhail did not stay in Nizhny Novgorod for long. At the end of June 1899, investigators found him in Samara, to where he had gone illegally. The Samara period of Sumgin’s life lasted with some interruptions for eight years. He worked in the statistics department of the zemstvo office, traveled extensively through villages and settlements and did not miss the opportunity to conduct revolutionary propaganda among the local population. Science took second place. He joined the Socialist-Revolutionary Party (SRP) illegally established in 1902. The political positions were close to him as a representative of the working peasantry. The time was uneasy; turbulent meetings, strikes, protest demonstrations, clashes with the police covered almost the entire country. The emotionally charged atmosphere increased dramatically after defeat of Russia in the Russian–Japanese War. The year 1905 was fateful for Mikhail Ivanovich. The police did not stop surveillance looking for a reason to bring him to trial. And such a reason was found. On December 18, Sumgin published the “Invitation to the Samara Peasant Congress” in the city newspaper, which the authorities considered as a call for a general protest against the tsarist autocracy. M.I. Sumgin was arrested and spent more than a year in prison. In December 1906, he was sentenced to three years of exile in Tobolsk Gubernia.

In January 1907, at the request of his friends, the exile to Tobolsk Gubernia was replaced by deportation abroad for two years. In the case of an earlier return to Russia, he was promised the full extent of his punishment. He was arrested and transported under guard to Odessa. Then, he was free to go to France, to Paris. Life in the “Capital of the World” was exciting, but did not suit Mikhail Ivanovich. He was not picky, could work, spoke French, and could adapt to any living conditions. But he was homesick! He felt nostalgia for his homeland and for his deed, which was taken away from him... and for his wife Liza Ovsyanaya, a graduate of the Institute of Noble Maidens, who, after his arrest, went to the future famous soil scientist Professor F.A. Petrov. Sumgin could not stand it and six months later returned to Russia illegally.

The joyful exhilaration of the struggle, the secret meetings, the hopes... All this did not last long. In March 1908, the police raided the secret house in

Kostroma, where the Socialist Revolutionaries were meeting. Again, he was arrested and imprisoned for six months; then, he was exiled to the remote Siberian village of Morozovka, 30 versts from Tobolsk. His mood dropped. Health deteriorated rapidly. Dark days came. There was no work in the village. Fishing and gardening on a small plot of land allotted by locals helped out in the first year. Then, he was transferred to the abandoned village of Alysanovo even further from the gubernia center – the authorities carefully protected the peasants from the influence of political exiles. Idleness, mental breakdown, stomach disease, rheumatism of the legs, and other misfortunes almost brought him to the grave. But something unexpected happened. A quick zig of fate brought him out of dead-end and determined the direction of his entire future life.

ON THE AMUR AND ZEYA RIVERS

In the summer of 1910, the expedition of the Pereselencheskoye (Resettlement) Department of the Ministry of Land Management and Agriculture of Russia worked in Irtysh Region. One of the teams was headed by an energetic young man, Professor Nikolai Ivanovich Prokhorov (1877–1930), the future founder of cryopedology (permafrost soil science) and road soil science. He paid attention to the educated settler and inspired him to study the virgin nature of the Far East. At the request of N.I. Prokhorov, M.I. Sumgin was included in the Zeya soil team after the end of his exile. He was appointed the head of the newly organized Bomnak weather station. This was a period, when the settlement of the Amur region dramatically intensified because of the railroad construction and the development of gold mining industry. It was believed that the Amur Region would become a kind of a locomotive for economic development in the east of Russia. According to the decree of the emperor, the Amur Comprehensive Expedition under the guidance of the Governor-General N.L. Gondatti was created to study the nature, assess land, and determine the possibilities for wide-scale colonization. The Zeya soil team of N.I. Prokhorov was part of it.

On March 14, 1911, Mikhail Sumgin, inspired by freedom and the opportunity to engage in science, left Tobolsk and went to the Amur region. The Bomnak weather station was located on the right bank of the Zeya River, about 230 km upstream from the merchant town of the same name. The water level in the Zeya River was very low in that year. Steamboats were anchored at piers, so it was not possible to reach the place of destination quickly. Sumgin had to spend more than a month at the Pikan agroclimatic station. And that was helpful. Mikhail Ivanovich met and made friends with young employees V.N. Aleksakhin and P.I. Koloskov, who also recently arrived in the

Amur Region and launched a wide range of experimental work. While waiting for the steamboat, M.I. Sumgin studied in detail the instrument base and methods of meteorological, soil-permafrost, and other stationary observations. He arrived in Bomnak already with a fully prepared research program. In addition to studying climatic features of the area, the program included the issues related to the water and ice regime of rivers, freezing and thawing of soils, assessment of wetlands, etc. To his great joy, M.I. Sumgin met his friend, Valerian Gavrilovich Petrov, member of the Socialist-Revolutionary Party, who was also exiled to Siberia in Bomnak. The last time they saw each other was on walks in Samara prison.

M.I. Sumgin stayed in Bomnak for about a year. N.I. Prokhorov appreciated his enthusiasm and interest in science and offered to head the newly organized Meteorological Bureau of the Amur Region, which was in charge of the observation stations of the Resettlement Department. In Blagoveshchensk, Mikhail was literally transformed. The best qualities of this talented extraordinary person were clearly revealed. Everything that had been hiding in his rebellious, restless soul in recent years suddenly erupted into a cascade of deeds and accomplishments. The Meteorological Bureau quickly turned into a kind of a research center under the leadership of M.I. Sumgin. The center was small in number of staff, but very effective in terms of its results with its own journal, traditions, and development prospects. It was the weather service not only for the Amur Region, but for the entire Russian Far East. Suffice it to say that the number of weather stations in this vast territory doubled during the period from 1913 to 1916.

Here, in the Amur Region, Mikhail Ivanovich Sumgin became infected with an interest in the “Siberian Sphinx”. Already in Bomnak, he tried to find out the causes of permafrost formation through observations of soil temperature at experimental sites with different types of vegetation, peat layer, and snow cover. He discovered many amazing things while hiking in the valleys of local rivers and creeks, especially during a trip in January 1912 on a reindeer sledge to the mouth of the Kupuri River (about 160 km along ice and coastal areas of the Zeya River). In Blagoveshchensk, M.I. Sumgin studied all the available literature on frozen soils, from the work of A.F. Middendorf to the articles of V.B. Shostakovich and I.A. Lopatin. Even letters and petitions of the first explorers of the 17th century (V.D. Poyarkov, E.P. Khabarov, V. Yuriev and others) were not ignored. It turned out that this “unusual” natural phenomenon, known to science since the time of M.V. Lomonosov, had been studied insufficiently. There was not even a substantiated map of the permafrost distribution. Dozens, hundreds of issues about the origin, history of development, properties, nature and forms, and behavior of frozen ground and soils under the in-

fluence of natural factors and human activity came up before the inquisitive physicist-meteorologist.

M.I. Sumgin decided to study the Siberian phenomenon thoroughly. First of all, he organized systematic observations of freezing and thawing of soils at the sites of existing and newly organized stations. Then, he began to collect data on the distribution of permafrost in the Amur Region by bits and pieces. He used a proven method of questioning of the population in addition to personal observations during inspections and business trips. His questionnaire was addressed mostly to people involved in mining work at gold mines. This method proved to be justified. A year later, Mikhail Ivanovich had material, which, along with the previously known data, allowed him to prepare and publish a special paper "Geographical distribution of permafrost in the Amur region" [Sumgin, 1914]. This paper provided information on long-term freezing of rocks at 71 points, analyzed the conditions and causes of the permafrost formation, determined the southern boundary of the permafrost distribution, and raised the question of organizing a special permafrost station. This work became a milestone in the history of permafrost science. The time of systematic accumulation and analysis of geocryological data, necessary for formulating the principles of the organization and development of a new scientific field, can be counted from this paper.

The life of Mikhail Ivanovich in Blagoveshchensk developed rapidly and interestingly. Long explorer's trips, meetings, processing observational and experimental data, preparing scientific articles and essays, editing collections, and friendly business meetings took up all his time. There was no time to be bored. He still lived alone, without a family, but he did not feel lonely.

IN THE FLAME OF REVOLUTIONS

Nearly five years passed like this. The fatal year of 1917 came for Russia. M.I. Sumgin once again could not stand it and immediately after the February events left for his homeland in Lukoyanovsky district and became involved into the political struggle. The Socialist-Revolutionaries did not forget the merits of their colleague to the party and elected him to the Central Committee, where he headed the Peasant Department. Sumgin represented the Socialist-Revolutionary Party at the First All-Russia Congress of Soviets of Peasant Deputies held in Petrograd from May 4 to May 28, 1917. At this congress, the Socialist Revolutionaries succeeded in carrying out their proposals for support of the Coalition Provisional Government on the matter of war and peace, national policy, etc. Solving the land question was postponed until the Constituent Assembly, but the resolution included the provision "All lands without exception

must go under the jurisdiction of Land Committees". M.I. Sumgin played an important role in the preparation of this decision. In November, Mikhail Ivanovich was elected a member of the Constituent Assembly, the representative body of Russia, which had to adopt a constitution. However, on January 6 (19), the Constituent Assembly was dismissed by the Decree of the Council of People's Commissars.

Sumgin fell into the millstone of two revolutions, which almost took his life. In March 1917, in Nizhny Novgorod, the post of governor with all attributes of the old government, including chancellery, board, servants, etc., was eliminated. Instead of the former governing structure, the Executive Provincial Committee of the Provisional Government headed by the gubernia commissar was established. At the end of July 1917, Mikhail Ivanovich was elected to this high position. He held it until the beginning of 1918. It was a very difficult, unpredictable, and bloody time. Events developed rapidly and were mostly spontaneous. The chaos of authority unleashed pogroms of estates, land seizures, robbery and murder throughout the gubernia. M.I. Sumgin, extremely concerned about the current situation, could do nothing to normalize it.

The situation in the country was critical. According to the Social Revolutionaries, the Bolsheviks could not cope with the situation. Something had to be done. In February 1918, the Central Committee of the Socialist-Revolutionary Party (SRP) discussed the need for terror. V.M. Chernov, Minister of Agriculture in the Provisional Government of A.F. Kerensky, was especially passionate in defending this way. Mikhail Ivanovich Sumgin was categorically against it, considering this method of political struggle impossible, including the struggle against the Bolsheviks and the Soviets. He did not manage to defend his point of view, and left the Central Committee in protest. Then, he left the Socialist-Revolutionary Party; the break was based on fundamental positions. Mikhail Ivanovich stepped back from political activity deciding to devote himself entirely to science. However, he did not manage to return to his old occupation right away. He went to his homeland, took up farming, prepared and read reports for the locals, and worked with young people.

After the murder of V. Volodarsky and M.S. Uritsky, the attempted murder of V.I. Lenin, and a number of other anti-Bolshevik acts, many members of the SRP were persecuted because of their "counter-revolutionary essence". In 1919, members of the Central Committee of the SRP were arrested. The district government was also going to arrest M.I. Sumgin, but he was warned, and he escaped to the village of Sarbaevo in Simbirsk Gubernia under the name of Petr Ivanovich Demin. There he worked as an accountant and rural teacher for two years.

MOSCOW: THE BIRTH OF SCIENCE

It was disgusting and offensive for him to live under someone else's name, because he had committed no crime. In the hope of being officially legalized, Mikhail Ivanovich moved to Moscow in 1922. He worked as a janitor, as an office clerk in knitwear warehouses, and as a head of the fire statistics section. He lived in the countryside or in a small janitor's closet under the stairs. In his free time, he visited libraries, where he collected materials on the permafrost distribution and on cryogenic phenomena in Russia, enjoying silence and comfort of reading-rooms. Sometimes, he met with his old friend Vicary Samsel, in whose family he found comfort and understanding. But there was no peace of mind, because every day he could be arrested and charged in the case of terrorist activities of the SRP, of which he had once been a member of the Central Committee. At the end of March 1925, the question of his legalization based on the application submitted long ago was finally resolved. M.I. Sumgin visited the office of V.R. Menzhinsky, Deputy Chairman of the Joint State Political Directorate. A conversation took place in the presence of F.E. Dzerzhinsky, during which Mikhail Ivanovich confirmed his decision not to engage in politics. He kept this promise until the end of his life.

In the same year, 1925, he met with a colleague from the Amur business P.I. Koloskov, who at that time headed the Far Eastern Geophysical Observatory and appeared in Moscow as a delegate to the Geographical Congress. Pavel Ivanovich warmly supported Sumgin's desire to create a large generalizing monograph on permafrost and in 1927 published it in Vladivostok [*Sumgin, 1927*] at the expense of the Observatory and even paid the author a small fee. It was a success! The great Russian scientist V.I. Vernadsky said about the publication of Sumgin's book: "The appearance of this work should be considered the starting point for the formation of permafrost science".

Indeed, this book by Sumgin was the first theoretical and regional work on the study of frozen rocks. It summarized all the data known at that time about the geographic distribution of permafrost, its thickness, temperature regime and physical properties, and provided two permafrost maps, which differed dramatically from the previously created cartographic schemes by G.I. Vild, V.B. Shostakovich, and L.A. Yachevsky. In this work, M.I. Sumgin developed the scientific terminology of permafrost studies, evaluated the role of cryogenic processes in human economic activity, and outlined a broad program for studying permafrost. The confident ascent of M.I. Sumgin to the heights of new knowledge began owing to the publication of this book. He himself and many Russian scientists and engineers were the fathers of this new knowledge.

During his work on the monograph, M.I. Sumgin established contacts with institutions interested in solving the problems of growing construction on permafrost. The Leningrad Research Road Bureau of the Central Administration for Road Transport (subsequently People's Commissariat for Railway Transport – PCRT) was one of such organizations. At that time, specialists were focused on stability of a road-bed in harsh climatic conditions. Soil heave, subsidence, and phenomena of icing created extremely unfavorable and sometimes catastrophic situations on the roads. The Bureau proposed M.I. Sumgin to organize a permafrost laboratory to develop methods to control dangerous cryogenic phenomena and to study the structure and physical and mechanical properties of frozen rocks. This initiative of road workers was greatly stimulated by the Fifth International Road Congress held in Milan in September 1925. The congress was accompanied by an exhibition of achievements in road construction. Mikhail Ivanovich sent his report "Roads and Permafrost Soils in the USSR" and two maps "Permafrost Distribution in the USSR" and "A Schematic Map of Permafrost according to the Types of its Geographic Distribution" to Italy. The materials were submitted on behalf of the PCRT and the Department of Local Transport. The "exhibits" made a stunning impression. Since then, M.I. Sumgin's authority as a permafrost scientist constantly grew and did not weaken until the end of his life, not only in Russia but also in many other countries.

In 1927, M.I. Sumgin moved to Leningrad, where he served as a head of the Road Geophysics Department at the Road Bureau of the PCRT. His talent of a scientist and an organizer, an experimenter and a teacher of new scientific disciplines was revealed even more vividly. On the basis of experiments carried out in laboratory conditions, he developed a number of theoretical concepts, which helped to explain many phenomena in frozen grounds and soils. Soil heaving, moisture migration during freezing and thawing of moistened mineral mass, behavior of thin films of water on the surface of rock particles, delayed movement of the freezing front (a so-called zero curtain), formation of ice inclusions of various shapes and sizes, and other cryogenic phenomena. became understandable in a first approximation. Compared to the research of S. Taber [*Taber, 1916, 1917*], a great step forward was made in the field of studying the mechanics of frozen rocks. This work was very important for calculating the bearing capacity of foundations of the engineering structures designed on permafrost soils. The experiments were carried out by M.I. Sumgin with the help of a talented young engineer N.A. Tsytovich, with whom he worked in creative collaboration for many years. Together they created the fundamental work "Foundations of the Mechanics of Frozen Soils" [*Tsytovich, Sumgin, 1937*], which gained world significance and determined the priority of Russian science in the field of engineering geocryology.

Sumgin suggested a number of ideas about the possibility of controlling permafrost processes; in particular, about the use of natural cold to strengthen the foundations, the creation of artificial structures made of ice and frozen soils, the construction of underground warehouses and storage facilities, and the building of dams and temporary winter roads. He initiated a special study of icings on the newly built Amur–Yakutsk Highway. For this important work, M.I. Sumgin invited his friend V.G. Petrov, who brilliantly fulfilled his task. In 1930, M.I. Sumgin edited Petrov's monograph "Icings on the Amur–Yakutsk Highway", which became a classic monograph on the subject, and also prepared several albums of magnificent author's photographs. Articles about the features of the distribution, origin, and development of dangerous icing phenomena appeared in the scientific and industry journals; ideas about the possibility of controlling icings on roads, railroads, and in populated areas of the permafrost zone were clearly stated.

By the early 1930s, M.I. Sumgin published about 30 works, in which he clearly and understandably revealed the functions of permafrost and seasonally freezing rocks and soils as the most important elements of the geological and geographical environment. The great role of permafrost in the organization of the national economy and in the development of nature became so obvious that the specific large-scale studies of the permafrost distribution, structure, and properties became an urgent issue. The accumulated information no longer satisfied the growing demands of practice. The circle of people involved in studying

cryogenic phenomena on the vast permafrost territory also expanded. For example, Professor N.I. Prokhorov, who served as a scientific secretary of the newly established Soil Science Institute named after V.V. Dokuchaev, initiated studies of permafrost soils at the agronomical station on the Kola Peninsula. P.I. Koloskov intensified the experiments and tests on thermal reclamation of soils and grounds in the Far East. Permafrost on the Arctic coast of the country was studied extensively. There was a need to create a coordinating center that would determine the strategic positions, tasks, and methods of expeditionary and stationary research. M.I. Sumgin dreamed about this for a long time. He came to the conclusion that it would be most reasonable to establish such a center within the structure of the USSR Academy of Sciences.

M.I. Sumgin shared his thoughts with Academician V.I. Vernadsky, who actively supported the idea. At the end of December 1929, the General Meeting of the USSR Academy of Sciences decided to create a Commission for the Study of Permafrost headed by the famous geologist and geographer Academician Vladimir Afanasyevich Obruchev. Mikhail Sumgin was appointed Scientific Secretary and then Deputy Chairman of the Commission. Sumgin became a soul and an actual head of the new structure. Professors N.I. Prokhorov, A.V. Lvov, A.A. Grigoriev, B.N. Gorodkov, V.B. Shostakovich, A.A. Petrovsky and the future famous scientists N.A. Tsytovich, N.I. Tolstikhin, A.V. Liverovsky, M.Y. Chernyshev, A.M. Chekottillo, and others became members of the coordination center (Fig. 2). Since that moment, the life of



Fig. 2. Active members of the Commission for the Study of Permafrost, Academy of Sciences of the USSR. From left to right: N.I. Tolstikhin, A.V. Liverovsky, M.I. Sumgin, P.N. Kapterev. Far right standing N.A. Tsytovich (Moscow, 1934).

M.I. Sumgin found new breath and meaning. He became the initiator, conductor, and ideological inspirer of the unique works focused on the integrated study of the unique phenomenon of nature, permafrost.

THE GOLDEN DECADE

The Permafrost Commission started extensive regional and theoretical research and soon outgrew its capabilities. In 1936, it was reorganized into the Committee for the Study of Permafrost (CSP). By that time, Mikhail Ivanovich was awarded the degree of Doctor of Geological Sciences without defending his dissertation. In 1939, the CSP was transformed into a full-fledged academic structure – the V.A. Ob-ruchev Institute of Permafrost Science of the USSR Academy of Sciences. Mikhail Ivanovich took the position of a deputy director for the scientific research. In fact, until the end of his days, he acted as the head of the institute (formally, the director was Academician V.A. Obruchev). Outstanding scientists, who eventually created their own scientific schools – N.A. Tsyto- vich, V.A. Kudryavtsev, P.I. Koloskov, M.M. Krylov, V.P. Dadykin, and others – started working in this institute. The new academic institution included the Department of General Permafrost Science with an Agrobiological Direction, the Department of Engineering Permafrost Science, Permafrost Laboratory, Administrative and Economic Department, and the Igarka and Anadyr permafrost stations.

Sumgin impressed people by his bubbling energy and breadth of outlook. He created an excellent school of Soviet permafrost scientists in a relatively

short using his attractive power and ability to group people of different ages and different specialties around him. Most of them were young people (geographers, geologists, engineers), who grew up under his unflagging attention and care – N.A. Grave, S.P. Kachurin, V.A. Kudryavtsev, A.I. Popov, V.K. Yanovsky, I.Y. Baranov, V.F. Tumel, P.I. Melnikov, I.D. Belokrylov, etc. M.I. Sumgin prepared and delivered (for the first time in the history of education) a course of lectures on permafrost science; special courses were introduced on his initiative in a number of higher educational institutions of the country. He also established the first permafrost graduate school. The formation of the school of Soviet permafrost scientists was stimulated by the organization of annual scientific meetings, seminars, public speeches on permafrost studies, and even a weekly tea party, at which current issues and tasks of upcoming research were actively discussed.

Mikhail Ivanovich paid much attention to organize field works in different areas of permafrost distribution. In 1931, he organized two small expeditions to the European North (to the basins of the Pechora and Usa rivers) and to the Angara region (in the area of the proposed cascade of future hydroelectric power plants). Then, he initiated expeditionary works in other regions of the country. He supervised the Yakut Expedition, which studied the permafrost-hydrogeological conditions of the Yakutsk artesian basin, giant ice fields in the northeast of the USSR, permafrost soils, agriculture, and construction conditions in the Yakut ASSR (Fig. 3). In the Far East (in the area of the future Baikal-Amur Mainline), 10 permafrost



Fig. 3. M.I. Sumgin with the staff of the expedition of the Council for the Study of Production Forces, Academy of Sciences of the USSR in Yakutsk (1939).

teams worked to study the geographic distribution of frozen rocks and their engineering and geological properties. To clarify the southern boundary of permafrost, studies were carried out on the Kola Peninsula, in the basins of the Severnaya Dvina and Pechora rivers, and in the Urals. M.I. Sumgin was eager to visit almost every established expedition. He participated in studying the cryogenic structure and temperature regime of soils, in identifying peculiarities of the occurrence and properties of ground ice, and in solving specific practical problems faced by explorers, designers, and builders. He advised, lectured, and selflessly passed on his experience and knowledge, inspiring those around him with interest in the phenomena of permafrost.

While writing his first book, Mr. Sumgin thoroughly substantiated the necessity of organizing permanent observation points – special research stations – in the permafrost zone. This idea was not new. It had been discussed by the Russian Geographical Society since the 1890s. During the Amur Expedition, permafrost stations were supposed to be established in the Upper Amur region, but World War I and the bloody confrontation of the divided Russian society interfered.

Sumgin developed two variants of the program of permafrost stations considering them to be a kind of experimental and expeditionary bases for the future fundamental research. The minimum program involved studying patterns of the geographical distribution of permafrost, processes of seasonal freezing and thawing of rocks, conditions and factors of the development of dangerous cryogenic phenomena, and physical and mechanical properties of frozen soils and ice. These fields of research had to provide the choice of optimum methods and techniques for engineering development of the area, to identify opportunities and ways of thermal reclamation of cold soils, to solve the problems of water supply, etc. In addition to the aforementioned aspects, the maximum program included the extensive theoretical and experimental work, on the basis of which the crucial issues of the economic development of the entire frozen zone of the lithosphere could be solved.

The establishment of the first permafrost station in the Amur Region in Tygan-Urkan settlement or at Skovorodino station (formerly Rukhlovo) was to be discussed in April 1926 in Khabarovsk at the meeting on the development of productive resources of the Far East. It was planned to create a special committee of representatives of the interested institutions, leading scientists and engineers who possessed the necessary information. Unfortunately, M.I. Sumgin was unable to participate in that meeting, and the question of organizing the permafrost station was temporarily dismissed. However, M.I. Sumgin did not despair. Together with N.A. Tsytoovich, he compiled a detailed instruction for the study of permafrost for

construction purposes at reference stations [*Sumgin, Tsytoovich, 1931*]. He started negotiations on the development of the stations with the heads of interested institutions, primarily with those who had encountered negative forms of permafrost. At the same time, he actively promoted his idea in articles, lectures, and during numerous meetings with the heads of industrial organizations.

As a result, research permafrost stations (RPS) began to appear “like mushrooms after the rain”. In 1927, Skovorodino Permafrost Station began operating within a system of the People’s Commissariat for Railway Transport. In the following year, the Leningrad Engineering and Construction Institute (LECI) opened the station in Petrovsk-Zabaikalsk. In 1931, a permafrost station was established in Bratsk under guidance of the Central Institute for Geological Prospecting. By the beginning of the war, there were more than ten such stations in the USSR: Igarka (IRPS, 1930), Anadyr (ARPS, 1935), Vorkuta (VRPS, 1936), Yakutsk (YRPS, 1941), as well as stations on Spitsbergen, in Ust-Port, in Amderma, etc.

The programs of these stations with a wide range of geological-geographical and engineering tasks were always prepared by Mikhail Ivanovich or under his control. One of these scientific cells eventually turned into the world-famous Permafrost Institute of the Siberian Branch of the Academy of Sciences of the USSR (Yakutsk). Today, it bears the name of its founder, Academician Pavel Ivanovich Melnikov. M.I. Sumgin visited practically all permafrost stations and expeditions, where he held consultations and unique seminars on research of cryogenic phenomena in the field. The most important area of Sumgin’s activity was studying the physical and mechanical properties of frozen and freezing rocks. This work was carried out according to the original methodology both at permafrost stations and in laboratories of Moscow and Leningrad. The tested methodology was introduced at the first opportunity into the programs of the construction and geological exploration departments of higher educational institutions. M.I. Sumgin himself often conducted classes with students or disclosed methodological approaches in his lectures and speeches.

Sumgin initiated many scientific discussions and conferences on permafrost. Instructions and programs for studying frozen rocks were prepared, ambitious experiments and tests were conducted, and works were published under his supervision. Under his editorship, almost every year, materials of various geocryological studies were published: from 1932 to 1940, 10 issues of Proceedings of the Commission on Permafrost Study and the Committee on Permafrost Study were published. He himself followed the motto “Not a day without a line”. In a decade, M.I. Sumgin published over 50 detailed articles and four monographs (two of them co-authored). Several all-time

popular books on permafrost [Sumgin, 1931, 1938; Sumgin, Demchinsky, 1940], written in a lively, fascinating, and accessible manner, as well as the world's first textbook “General Permafrost Science” [Sumgin et al., 1940] prepared in collaboration with his students and colleagues N.I. Tolstikhin, V.F. Tumel, and S.P. Kachurin were published. These books, rich in interesting information, still have not lost their educational and scientific significance (Fig. 4).

Sumgin worked hard and enthusiastically. That is why his creative legacy is unusually large. He not only skillfully, comprehensively and timely generalized the incoming information on the distribution and specific features of the development of permafrost but also created and constantly improved the theory of many cryogenic processes and tried to present his conclusions in mathematical terms and immediately put them into practice. M.I. Sumgin substantiated the hypothesis of the origin of permafrost, introduced the concepts of degradation and aggradation of permafrost, developed some elements of the theory of the icing formation processes, proposed a number of constructive methods to control harmful cryogenic phenomena, laid the foundation for the physics and mechanics of permafrost soils, suggested the idea and created the project of a museum-refrigerator in the thickness of permafrost, etc. The list of Sumgin's scientific works on permafrost issues significantly exceeds 100 titles.

The 1930s were fundamental for permafrost science. A giant breakthrough in the accumulation of knowledge about the frozen layers of the earth took place: the conceptual and terminological apparatus of the new scientific field was formed; maps of the permafrost distribution were compiled; physical and mechanical properties of frozen soils were studied; basic principles of the design, construction, and operation of engineering structures in the permafrost zone were formulated; and much, much more. Permafrost science became on a par with fundamental natural science disciplines, such as soil science, climatology, geobotany, geomorphology, and others. General recognition of the achievements of the young science was largely ensured by the solution of pressing geocryological engineering problems. All this happened on the initiative, under the leadership, and with direct participation of Mikhail Ivanovich Sumgin.

PERSONAL QUALITIES OF M.I. SUMGIN

Sumgin was an outstanding person not only for his scientific and organizational abilities but also for his excellent spiritual qualities. Everyone who knew him enthusiastically noted sensitivity, responsiveness, crystal honesty, and good-nature of “Uncle Misha” (as his colleagues and friends respectfully called him). He was a modest, unassuming man, who professes a kind of personal asceticism. He did not have



Fig. 4. Covers of M.I. Sumgin's books on permafrost science, climatology, and geophysics.

large savings, rich apartment, expensive furniture, or expensive clothes. He had books, magazines, and files of notes and documents. These were his main possessions. He bequeathed books to his brainchild, the Permafrost Institute of the USSR Academy of Sciences, and most of his savings were used to pay prizes for the best scientific work in the field of geocryology without mentioning his name. As for ideas, intellectual property, projects and plans, they are all in his articles and books. After the death of Mikhail Sumgin, there were no unfinished manuscripts left.

MOSCOW–TASHKENT: THE LAST DAYS OF LIFE

World War II abruptly changed plans and lives of many people and the entire country. From the very beginning, the Permafrost Institute of the USSR Academy of Sciences paid much attention to defense issues, designing military airfields, warehouses, underground communications. In the war years, the tasks expanded and became particularly relevant in connection with the creation of defensive line. M.I. Sumgin spent almost all his time at Bolshoi Cherkassky Lane 2. Despite worsening illness, he often traveled to the sites, advised and gave instructions. During the first German air raid on Moscow,

Mikhail Ivanovich received a contusion from a bomb that exploded nearby. The injuries aggravated his already painful condition. By decision of the Presidium of the USSR Academy of Sciences, the heads of many institutions together with their families were evacuated to the deep rear – it was necessary to preserve the potential of science. M.I. Sumgin was sent to the north, to Vorkuta, but then, given his state of health, he was sent to Tashkent together with the staff of the Soil Science Institute of the USSR Academy of Sciences, which was headed by his friend A.A. Rode. Already on the way to Tashkent, M.I. Sumgin began to make plans for his activities at the new site of his settlement. He decided to study the seasonal freezing of soils in the plains of Central Asia and Kazakhstan, as well as to reveal patterns of the permafrost distribution in the Pamir and Tien-Shan mountains. Having arrived in Tashkent, he outlined dozens of sites for personal visits, developed the program of field research, and with the onset of winter began to observe cryogenic processes in the vicinity of the city. However, his health condition worsened. “The disease comes in by poods and comes out by zolotniks”, he wrote in one of his letters. Nevertheless, M.I. Sumgin continued to work. Weak and exhausted, he wrote letters almost every day, got acquainted with the reports of the permafrost teams and stations, wrote reviews and notes, and read a lot. Already quite helpless, he prepared a large article “Prospects for Studying Permafrost in the Yakut Republic” and a generalizing work “Permafrost Science” for the collection “Advances in Geological and Geographical Sciences over 25 Years”. In these works, he summarized the results of his studies of permafrost and outlined the ways for further research. Both articles were published after Mikhail Ivanovich’s death.

M.I. Sumgin tried to behave like a healthy person for a long time, did not surrender to the disease, was cheerful, dreamed of creating a general monograph in two volumes: general and engineering permafrost science, but the disease worsened every day. Friends and colleagues helped with food and medicines. But Mikhail Ivanovich could not be saved. He died on December 8, 1942. He was buried at the Botkin Cemetery near Tashkent.

Science, like life itself, does not die and does not stand still. The ideological and informational foundations of permafrost science shaped by M.I. Sumgin

have turned into a powerful branch of natural science, without which no practical issue of developing the cold regions of the globe can be resolved today. Numerous students and followers continue the work of M.I. Sumgin. His image is embodied in the works of writers, artists, and sculptors. A peninsula in the southwestern part of the Franz Josef Land Archipelago, a crater on the planet Mars with a diameter of 22 km, a glacier in the Buordakh massif near the Peak Pobedy (Chersky Ridge), a stream in the vicinity of the village of Bomnak in the Amur region, a school in his native village of Krapivki were named after M.I. Sumgin. The best students of the Permafrost Department of the North-Eastern Federal University (Yakutsk) and of the Geocryology Department of Moscow State University were awarded the M.I. Sumgin scholarship. Seminars, meetings, and conferences are regularly held in memory of the outstanding permafrost researcher. The scientific feat of Mikhail Ivanovich Sumgin has become a source of inspiration and a role model for many people.

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