

## ALEXANDER EVGEN'EVICH FERSMAN IN THE ILMENY MOUNTAINS

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A.E. Fersman was connected to the Ilmeny Mountains for 30 years. There were several fields and periods in his activities. The first field involved the study of mineralogy and geochemistry of the Ilmeny region. It was started in 1912 by the Radium Expedition of the Academy of Sciences and continued until the mid-1930's. The second field was organizational. It involved three periods: foundation of the Ilmeny Reserve (1918–1920); conversion of the Reserve into a scientific center (1934–1937); and organization of mineralogical exploration in the Reserve (1934–1942).

4 photos, 5 references.

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The purpose of this article is to introduce readers to the survey works and organizational activities of A.E. Fersman that connected him to the Ilmeny Mountains.

In 1911, V.I. Vernadsky obtained substantial support from the Academy of Sciences (where he transferred after leaving his position at the Moscow University in 1909) for systematic study of radioactive occurrences on the vast territory of our country. The Radium Expedition started its work at the Urals, and Vladimir Ivanovich (Vernadsky) invited Alexander Evgen'evich (Fersman) to participate.

However, A.E. Fersman was not able to visit Urals in 1911. In spring of 1912, April 16, Alexander Evgen'evich wrote to Vernadsky: "Dear Vladimir Ivanovich... Would it be possible to arrange some kind of business trip to Urals for me through the Academy of Sciences (without pay)? I just need an official paper to show them. Because there no financial support for this summer?..." (Fersman, 1965, p. 441). Alexander Evgen'evich's wish was fulfilled. During summer of 1912, he traveled through a number of plants and mines at the Urals, got familiar with the ores of Kyshtym, visited the Ilmeny Mountains, where he collected specimens with the Radium Expedition, worked in the Kochkar region at the famous Sanarka River, and visited Murzinka. For the first time, Fersman described in detail his visit to the Ilmeny Mountains in his book "Gems of Russia" in a chapter "Ilmeny Mountains". The book was published in Petrograd in 1920.

This trip played a critical role in the life of the young scientist, sealing his interest in pegmatites and gems. In the Ilmeny, Fersman first observed the regularities of quartz and feldspar intergrowth, based on which he later on formulated several scientific laws. The

Urals with its nature and mineral treasures absorbed Alexander Evgen'evich for a long time. On July 5, 1912, he wrote to Vernadsky: "Dear Vladimir Ivanovich. I left Miass yesterday after spending 6 hours in the Kusinskaya marble quarry. Almost no minerals, but I still asked Fedorovsky to collect specimens of whatever available. From outside view, this quarry is colossal and very interesting. Kryzhanovsky returned to Miass and now works with enthusiasm. Sample analyses of granite and aeschynite produced remarkable results, and revealed the genetic relationship of the aeschynite with absolutely unusual conditions of origin in all deposits ..." (Fersman, 1965, p. 441).

Since June 1913, Alexander Evgen'evich continued his work at the Northern, Middle, and Southern Urals. "Chelyabinsk, 7/17/1913. Dear Vladimir Ivanovich! Now we are heading back to Ekaterinburg from the Ilmeny Mountains... We rode all over the northern part of the Ilmeny Mountains, collected interesting black mineral near Selyankino and examined a few mines by Ishkul. Today we visited the Saveliyev Log and are going to Ekaterinburg. We looked at the asbestos in the Miass valley..." (Fersman, 1965, p. 443).

In 1925, A.E. Fersman described some precious stone deposits in the second volume of his work "Precious Stones." The book provides a brief historical overview for the Ilmeny Mountains area starting from the Pallas time to the years of the Radium Expedition. Further given is a short geological description and then more detailed examination of the pegmatite veins.

In 1932, the second edition of the book "Pegmatites" by A.E. Fersman was published. This comprehensive study of the pegmatites covered different kinds of veins in the Ilmeny

Mountains (mostly those of granite type). Mineralization of the Blumovskaya Mine is studied in particular detail.

Alexander Evgen'evich also wrote about the pegmatites in the 5<sup>th</sup> issue of the Transactions of the Ilmeny Reserve in 1936. In 1922, he reported detailed data on zeolites of the Ilmeny Mountains in his work on Russian zeolites (result of his work in 1909 – 1916).

Alexander Evgen'evich combined his research work with his broad government and society service. In 1919, at the age of 36, A.E. Fersman was elected Academician. He was content with the attention of the Soviet Government to the development of science and natural protection. Later, he repeatedly mentioned in central press the foundation of the Ilmeny Reserve as a remarkable conservation measure. "I remember us – all members of the Radium Expedition – gathering at the school balcony near the Miass station and dreaming about the future. This was in the very beginning of the first imperialistic war, years of the dire tsar reaction and bureaucratic corruption. I remember saying to my comrades in radium: "I picture the future of the Ilmenys in a somewhat fantastic light. There is a resort in a magical pine forest on the top of the Ilmeny Mountain, far from the dust and troubles of the valley. There is a cable railroad from the station of the Siberian transit to the top of the mountain. Powerful mines of the pegmatite veins with pure feldspar and nepheline prepare material for the largest-scale ceramic industry in Miass and Cherbarkul. Down the mountain, on the lakeshore, in place of the old forest roadblock, there will be Natural and Historical Station, which will be a center for managing the mines of the Ilmeny Mountain and protection of its treasures, museum, library, laboratory... This is the vision of the faraway future. But we have to fight for it. It is needed for science, industrial prosperity, culture, and progress of the whole South Urals... One should not be afraid that the beauty of the Ilmeny Mountains will be lost along with their wilderness and hospitality. The beauty of the whole is not separable from those lost mines and piles, dreadful mountain roads, the wicker on the logs, and the plain beauty of the campfire with the pot on a piece of blue amazonite. The intricate combination of these small things creates the present. It bears not only poetry and virgin beauty, but also an incentive for work, creation, and revealing the mysteries of nature". I was saying that when the scientific studies were carried out under very hard conditions.

Our expedition made stops in abandoned Bashkirian villages.

... People remember the hard year of 1920. In those years of titanic struggle, Vladimir Il'ich (Lenin) finds time to listen and to discuss an absolutely untimely project, as it then seemed, presented to Sovnarkom by the Head of the Mining Division N.M. Fedorovsky – to create the first in the world reserve of mineral treasures in the South Urals, near the station of Miass. On May 14<sup>th</sup>, 1920, Lenin signed a remarkable document that in the epoch of a great fight for mineral resources, strengthened the idea of their protection and required wise and efficient utilization of the productive forces of the country.

This is how with the genius of Vladimir Il'ich, the world's first reserve of earth interior was founded in the Ilmeny (Fersman, 1935).

One of the tendencies of the academic science in the Soviet Union in the early 1930s was "technologization" and "de-centralization". The territorial network of the scientific institutes, in which the academic science was emphasized, started to develop.

The Committee for Bases of the Academy of Sciences, which was established in October 1931, led the organization of local stationary scientific cells. A.E. Fersman was part of this Committee. The Committee worked in close collaboration with local political and Soviet governing organs. The opening of the Ural Division of the Academy of Sciences was preceded by substantial preparatory work. Fersman played a special role in the creation of the Ural Division. On this issue, he consulted with Sergo Ordzhonikidze and Party and Soviet leaders at the Urals. A.E. Fersman was appointed the Head of the Ural Division of the Academy of Sciences.

Institutes and expeditions were organized; works of the Ural Division of the Academy of Sciences were published. At that time Fersman worked hard to build the material and scientific base of the Ilmeny State Reserve. In 1927, during his next visit to the South Urals, Academician Fersman noted the high intensity of the works that were carried out in the reserve. In that year, the newspapers "Proletarskaya Mysl" ("Working Class Thought") and "Uralsky Rabochy" ("Ural Worker") published reviews by A.E. Fersman, in which he noted the excellent progress in the area. In the guest register of the Ilmeny Reserve of 1929, there is a record by Alexander Evgen'evich saying that in the very start of the expedition for search of the radium ores, its members could not even dream of the

working conditions that present now at the Ilmeny mineral deposits following and changes over the last one and half decades. Now the Ilmeny Mountains became more accessible for mineralogical studies, and the Reserve appears as a cultural center. Old, collapsed mines were cleared and brought to "museum condition". Mysteries of the underground world, previously hidden, are now readily presented to an inquisitive eye of mineralogist, thanks to the efforts of the Reserve personnel. The Russian mineralogy can be proud of how the treasures of the Ilmeny Mountains are managed.

Alexander Evgen'evich dreamt of turning the Ilmeny Reserve into the leading research institution in the South Urals. He published a number of articles in newspapers, communicated to the government representatives of the Soviet organs both personally and in writing, spoke at various meetings, science conference, and regional Soviet Congress.

In summer of 1934, A.E. Fersman wrote to Koscheyev, the Director of the Ilmeny Reserve, about his disappointment with how difficult it was to promote a very clear and important idea of creation of a strong unified scientific center at the Urals. He proposed to make the Ilmeny a scientific interface connecting Chelyabinsk and Magnitogorsk with the all-round support of the Chelyabinsk Ispolkom (Executive Committee). "The Ilmeny idea is very serious, and it is now easier to get things going with organization of a scientific center of the South Urals, which will be the first research institution of the Chelyabinsk Ispolkom. I have no doubts, he will seize this idea, since Chelyabinsk now sits without scientific support. Who is there in the Ispolkom? Could you give me the first and last name of the Representative? I will write him about the role that well-established laboratories and the institute can play in the development of the whole South Urals. I am now more and more convinced that such connection of the institute to the industrial zone will be particularly important" (This and further presented quotes of A.E. Fersman were taken from Butorina, 1992).

In 1934–1935, A.E. Fersman worked very hard to solve this problem. Here is the list of some documents related to the issue: Resolution of the Soviet Organizing Committee of the Chelyabinsk District of April 11, 1934, № 330 "On the Organization of the Ilmeny Research Field Station"; Resolution of the Organizing Committee of

the Chelyabinsk District of August 15, 1934, № 1220 "On the Status of the Ilmeny Mineralogical Reserve"; letter from A.E. Fersman of September 5, 1934 to the Deputy Director of the Chelyabinsk District Planning Committee M.P. Korolkov; letter from A.E. Fersman of October 20, 1934, to the Committee on Reserves about appending the Argazin area to the Ilmeny Reserve; extract from the protocol of the meeting of the Council of the Academy of Sciences of the USSR of November 25, 1934, about A.E. Fersman's report on the Ural Division, which acknowledges the necessity of including the Ilmeny Reserve to the Academy of Sciences as a complex research institution in the South Urals, providing budget funds for construction in 1935–1937, and including it in the expedition plan SOPS for 1935; protocol of the meeting of the extended Council on Reserves of May 4, 1935, about the development and reconstruction of the Ilmeny Reserve into a complex institution (report by A.E. Fersman); letter from A.E. Fersman of December 22, 1935 to the Representative of the Chelyabinsk District Executive Committee M.A. Sovetnikov about providing funds in 1936 for the construction of a scientific station in the Ilmeny Mountains (Butorina, 1992, pp. 59–71).

In 1934, A.E. Fersman made the first steps towards the establishment of the Ilmeny



Fig. 1. At the conference in the Ilmeny Reserve. July 1934 (left to right): N.M. Fedorovsky, A.E. Fersman, E.M. Fersman, and V.I. Kryzhanovsky. Photo from the Ilmeny Reserve archive.

Reserve scientific center. From the July 28<sup>th</sup> to July 31<sup>st</sup>, 1934, the first scientific conference worked in the Ilmeny. It was related to the problems of geochemistry of basic magmas of the Urals and was based on the results of long-term scientific studies of the genesis of mineral deposits (Fig. 1).

After the conference, despite feeling sick, Fersman went to Chelyabinsk for participation in the meeting of the Council of the District Deputy Soviet Organizing Committee, where he made a presentation on the productive forces of the South Urals.

In the same year, on November 10<sup>th</sup>, a conference on coal chemistry of the Chelyabinsk basin was held at the Ilmeny Reserve. The conference gathered geologists, mining engineers, chemists, technologists and was chaired by A.E. Fersman. When opening the conference, Alexander Evgen'evich said that the future of the Urals will primarily depend on how we use the coal resources. In this respect, the Chelyabinsk area is the pride of the Urals. In 1935, A.E. Fersman was the editor of the a special volume of scientific papers of the Ural Division of the Academy of Sciences of the USSR, Ilmeny Series "Chelyabinsk Coals", published by the decision of the Academy of Sciences of the USSR. Alexander Evgen'evich wrote the preface and conclusions to this edition.

At the 1<sup>st</sup> Soviet Congress of the Chelyabinsk District in January 1935, A.E. Fersman greeted the delegates and emphasized three main tasks: exposure of the natural resources, their proper utilization, and including science and technology into the base for the organization of the productive forces in the district. Special attention was paid to the need of establishment of a scientific center on the border between Europe and Asia. Alexander Evgen'evich wrote to M.A. Sovetnikov about the Ilmeny Reserve and its future prospects: "This is a natural science center that serves the whole South Urals with laboratorial and field studies, and we would like to turn it into a major research institute with permanent staff and permanently equipped laboratory, library, and museum. Even now (with its own facilities and equipment), it can help the development of the mining industry in the South Urals.

This spring, after finishing my medical treatment abroad, I plan spending some time in the Ilmeny Reserve and do several scientific studies there. With best regards – Academician A.E. Fersman. 26.03.34."

Alexander Evgen'evich made a significant contribution to the establishment of the material base of the Ilmeny Reserve. November 5, 1934, he wrote to V.I. Vernadsky from Miass: "Dear Vladimir Ivanovich! I am now in the Ilmeny, where big construction has started. It is not so cozy here now, but some contours of the big project can already be seen! In Sverdlovsk, finally, after 22 fruitless projects, they have come up with the 23<sup>rd</sup>, so we will demonstrate it in Moscow at the November session..."

Designing the buildings for the "mining station of Academy of Sciences" was carried out in Leningrad with Fersman's personal involvement in defining technical specifications and preparing the explanatory note. The main building was supposed to include museum and scientific library; the second construction object would include a scientist and international tourist hall. The buildings were planned for completion by 1937 – by the arrival of the delegates of the International Geological Congress.

The project involved the creation of a research station, a laboratory, a museum, and centers for scientific ideas, expedition ideas, field works, where one could receive a consultation, study mineral samples, and perform any other research. The same complex would include the central science club, conference hall, and scientist residence hall, where meetings for staff could be convened.

Work in the Urals in 1932–1934 convinced Fersman that a large complex expedition should be organized here by the Academy of Sciences of the USSR for solving two major tasks: study of the rock formations related to mineral deposits and complex agricultural assessment. The crews cruised over a large territory from Bashkiria and Chelyabinsk district in the north to the Orenburg district and Western Kazakhstan in the south (Fig. 2).

On February 4<sup>th</sup>, 1935, A.E. Fersman was a chairman of the meeting with the representatives of the Chelyabinsk district who were delegated to the 7<sup>th</sup> Soviet Congress and were in Moscow. The meeting was related to the works and studies at the South Urals and was held in the Lomonosov Institute of Academy of Sciences of the USSR in Moscow. The participants from the Academy of Sciences introduced the Chelyabinsk representatives to the research that was underway or planned at the South Urals and outlined the general picture of the future prospects (OGAChO, v. 10-a, p. 20). The Ilmeny Reserve was a separate topic. The project of the building complex of



*Fig. 2. In the Ilmeny Reserve, 1935. The photo is a gift of Elsukov, the former student of the Sverdlovsk Mining Institute (previously unpublished).*

the central base of the Reserve — research station, scientist hall, museum, tourist hall on the shore of the Ilmeny Lake was shown to the guests. A.E. Fersman announced that all should be prepared for the reception of the participants of the International Geological Congress in the fall of 1937.

In August of 1935, Alexander Evgen'evich offered to Professor V.I. Kryzhanovskiy, the director of the Ilmeny mineralogical crew of the complex expedition of the Academy of Sciences, to take part in the automobile race Ilmenys-Orsk. Fersman's substitute in the expedition, I.N. Shinkarev and E.M. Rozhanskaya also participated. The course went through the work places of seven crews of the South Ural Complex Expedition. They traveled in two vehicles: a car (Ford type) and a 1.5-ton truck. For 16 days, the participants covered 2374 km, visited 27 most important mineral deposits, collected about two tons of specimens for museums and scientific studies. While on the road, they organized several meetings with the expedition crews and local officials.

Obtained scientific materials were very significant. Some lost and forgotten deposits were searched and found. The mineralogical collections were later presented at a special exhibition in the Mineralogical Museum of the Academy of Sciences of the USSR in Moscow. The publishing house of the Academy of Sciences issued a separate book "Our Auto Race through the South Urals". (Fersman, Kryzhanovskiy, 1936).

In his organizational work, A.E. Fersman was supported by geoscientists and his collaborators from the Radium Expedition of the pre-Revolution Academy of Sciences. The Organizational Committee of the Chelyabinsk District passed the resolution for the establishment of the Ilmeny scientific station and by scientists' request applied to VTsIK USSR for changing the status of the Ilmeny Mineralogical Reserve to "complex". The Reserve received additional funds from the local budget.

A.E. Fersman's applications and the resolution of the Chelyabinsk District Executive Committee set the ground for the government document. The Resolution of VTsIK of the Russian Federation of December 1<sup>st</sup>, 1935, the Ilmeny Reserve was assigned the title "Complex", on which territory any industrial activity is prohibited. However, the Reserve was transferred to the authority of the Committee for Reserves, and became a scientific center only in 1970s.

Alexander Evgen'evich came to the Ilmeny Reserve once again in September of 1936 to prepare for the International Geological Congress. He chaired at the meeting of the Reserve personnel, listened to some presentations, provided some practical advice, and formulated the tasks for the future research and development in the Reserve. Unfortunately, because of illness, Alexander Evgen'evich could not participate in the work of the International Geological Congress in the Ilmenys in 1937.

The Second World War began. Having finished the evacuation of the Khibiny Division, Alexander Evgen'evich led four defense committees and organized three expeditions. Under his leadership, very diverse assignments were carried out in close contact with the military. But the main area developed by Fersman and his co-workers was the strategic natural resources. At the Urals, he verified the results of the previous years and obtained new data. "The war did not stop the exploration works. On the contrary, it enhanced them, made them more intense, " – Alexander Evgen'evich noted in his brochure "Urals – the Treasury of the Soviet Union", published by Profizdat in 1942. In parallel, he spoke in hospitals, universities, and factories. Only in 1942, Alexander Evgen'evich gave 21 lectures, in addition to his speeches in some parts of the Western front.

During those severe days, Alexander Evgen'evich did not forget the Ilmeny. The Institute of Geosciences, in which he was the Director, was evacuated to the Urals, partially to the Ilmeny Reserve. Fersman repeatedly came there during the hard war times (Fig. 3).

I found some records in the Reserve archives from the meeting of the Reserve personnel with Academician A.E. Fersman on July 27, 1942, on the "scientific areas of

research for the geologists of the Reserve." During his visit to Sverdlovsk to chair the meeting of Ural geologists, Fersman found time to stop by at Ilmeny and discuss the research topics developed by the geologists in the Reserve. At that meeting, among the attending personnel were the Director of the Ilmeny Reserve M.Ya. Barabashkin, Deputy Director for Science V. A. Vasnetsov, Manager of the Mine Station A.I. Simonov, geologists M.S. Afanasiev and L.N. Subbotina, and two scientists from the evacuated Institute of Geosciences of Academy of Sciences, Professor V.I. Kryzhanovskiy and Fersman's co-worker A.A. Saukov.

The first item on the agenda was "Inventory and Passportization of the mines". This work had been done in the Reserve for years, but had stopped because of the war. It was noted that "the Summary on the Reserve mines, which was convenient for daily use in research and organizational activities" was missing in the Reserve's 1942 Annual Report; only the obsolete and incomplete guide for 1935 was included. The need for passportization of mines was pointed out by Academician A.E. Fersman. His request to compile a summary on the mineralogical mines of the Reserve, based on the pre-war studies of B.A. Berezin, T.I. Ustinova, and A.N. Zavarits-

Fig. 3. A.E. Fersman with the staff of the Ilmeny Reserve, 1942. Photo from the archive of the Ural Division of the RAS.



ky, and concurrent updating the Reserve specimen collections, was fulfilled.

The next question on the agenda was about ore mineral studies. In the records, the first task is formulated as follows: "Watch for and collect materials on zircon and Mine 28. Delegate V.I. Kryzhanovsky to supervise this work and to report monthly on the results". "Zircon have been used as cutting stone, beautiful gem, sparkling with fire. Now it is needed for different areas of military industry, — A.E. Fersman wrote in his book "Urals — the Treasury of the Soviet Union".

The second task was related to the study of molybdenite from the Chernoe Lake region. In spring of 1942, the Sverdlovsk geological survey was permitted to develop molybdenum on the territory of the Reserve. A.E. Fersman recommended the Reserve personnel "to provide mineralogy and characterization of the ore body of the molybdenum deposit" near the Chernoe Lake and "raised a question about the completion of the survey of the deposit by the Sverdlovsk survey crew". This work was finished by the end of the year. Fersman noted that development of the deposit can be done only manually.

Development of the Selyankin niobium deposit was also discussed. In 1934, the Institute of Applied Mineralogy (Sverdlovsk Division) discovered a large niobium deposit in the Selyankin region (which then was out of the reserved territory). In 1942, A.E. Fersman wrote: "Now the South Urals produces the world's only niobium ore in the form of ilmenorutile. The name of the mineral connects it to the famous Ilmeny Mountains, which are true mineralogical paradise in the South Urals. This niobium ore is the future metal of steel airplanes" ("Urals — the Treasury of the Soviet Union").

The third series of questions was related to the non-ore resources — mica, ceramic materials, quartz sands. Certain people were assigned responsible for the "evaluation of the mica content of the pegmatite veins", utilization of the nepheline-feldspar rocks (consumers — Bishkil, abrasive plant, tank Kirov plant, Chelyabinsk etc.), work on "Quartz molding sands in Miass region". The sands were necessary for the automobile plant that was evacuated to Miass from Moscow.

Recommendations of the Alexander Evgen'evich Fersman given at his last meeting with the Ilmeny geologists on June 27, 1942, were fulfilled. His words from the book "Urals — the Treasury of the Soviet Union" were confirmed: "Scientists and researchers of the



Fig. 4. Memorial board on the Administration Building of the Ilmeny Reserve; established in 1986.

Urals were ranked high among the Ural fighters of the labor front".

One cannot talk about the Urals, its past, present, and future without remembering the true singer of its glory — Academician A.E. Fersman. The present-day Lenin Ilmeny State Reserve, Ural Division of Russian Academy of Sciences, which was founded by dedication of A.Fersman, preserves the memory of him. This involves not only the memorial board with the dates when the scientist worked in the Ilmeny Mountains (Fig. 4) and a special stand in the Reserve Museum, but also the white buildings of the laboratory and museum, which were constructed in the early 1980s at the central base of the Reserve, where Alexander Evgen'evich envisioned them.

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