TENTATIVE LIST

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NAME OF PROPERTY: The Ilmensky mountains

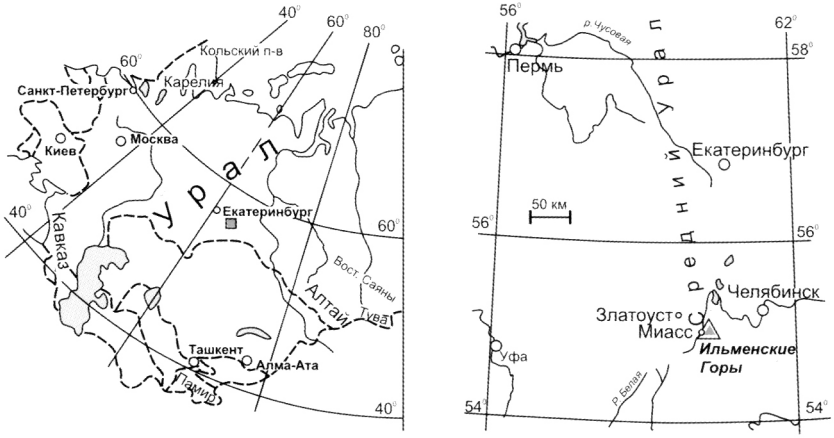
State, Province or Region: Russia, Chelyabinskaya oblast, Miass

Latitude and Longitude, or UTM coordinates: Pulkovo 54°58' -55°21'north 60°07'-60°22'east

DESCRIPTION:

Geographical position

The Ilmensky mountains are located in the Southern Urals between 54°58'-55°21' northern latitude and 60°07'-60°22' eastern longitude in the Chelyabiskaya oblast on the administrative territory of the city Miass in Chebarkulsky and Argayashsky regions. The nearest railway track is in Miass, and the nearest international airport is 100 km to the East, in Chelyabinsk. (Picture 1,2)



Geo-mineralogical characteristics of the Ilmenogorsky complex

The Ilmensky mountains are a unique geological phenomenon famous for its semiprecious and rare-metal mineralisation of the pegmatite lodes and wine spread of the rare for the Urals alkaline rocks – nepheline syenites. Different metamorphic and plutonic rocks, to this or that degree modified by deformational and metasomatic processes, are host to them. The diversity of Ilmesky mountain rocks are known as the **"Ilmenogorsky complex"** (Picture 3,4)

The Pegmatites of the Ilmenogorsky complex

The Pegmatites of the Ilmenogorsky complex are specific geological formations, which are coarse-grained or giant-grained rocks forming separate geological bodies. These bodies have specific shape, internal structure and mineral composition. As a rule they have contrasting borders with more fine-grained host rocks and can be clearly identified. Pegmatites present the greatest interest in the study of the Ilmenogorsky complex, since they contain the most interesting minerals and associations as well as the biggest and perfect mineral crystals.

According the main rock-forming minerals, there are three main pegmatite types: granitic, miascitic and syenitic. Granitic pegmatites contain the primary rockforming quartz; the miascitic pegmatites contain nepheline; the syenitic pegmatites do not contain neither quartz, nor nepheline, feldspar being the main mineral. The detailed studies of the pegmatites held in the 20th century helped to systematise them into the group of separate age groups and define their peculiarities of structure and mineral composition.

Group I is the earliest: ***pre-miascitic granitic pegmatites.*** The pegmatites of this group are coarse-grained, their graphic structure and zoning are not clear-cut, deformation is well-pronounced (boudinage, undulated textures, cartaclasis, quartz granulation). The quantity and diversity of the accessory minerals is relatively small: magnetite, zircon, allanite, betafite, much less mirror stone, fluor spar, apatite and some other minerals.

Group II comprises alkaline pegmatites: miascitic ans syenitic. Their formation is linked to the alkaline process in general. Due to the peculiarities of their composition and interrelations, they can be split into 3 subgroups identifying different phases of the alkaline process:

– **IIa:** ***feldspathic pegmatites and feldspatholites*** (syenitic) are linked to the early stages of the alkaline process. They have various bodies of very complex branchy form. The diversity of some accessory minerals is relatively small, but in certain lodes or their segments they are abundant and occasionally mineable (for example, molybdenite): magnetite, pyrochlore, aeschynite, zircon, allanite, titanite, apatite, molybdenite, ferrimolybdite, powellite, less frequently monazite and samarskite (Picture 5,6)

- **IIb:** ***miascitic pegmatites*** (nepheline is the dominating mineral) are linked to the maximal stage of the alkaline process. They have bodies of various and often very complex form. They are peculiar for the cavities containing accessory minerals in the form of big and perfect crystals. They used to be produced originally for commercial purposes (collections and faceting) and later on for scientific studies. The main are cancrinite, sodalite, wischnewite, titanite and magnetite, zircon, pyrochlore, aeschynite, columbite, apatite and others. (Picture 7,8)

– **IIc:** ***corundum- feldspathic pegmatites*** (syenitic, always contain corundum), are linked to the late phases of the alkaline process. The form of the pegmatite bodies and lodes is relatively simple, lens- or plate-like, sometimes zoning is well-pronounced. The corundum concentration and its quantities in some lodes are so big that in the 19th century it used to be produced as abrasive material. In some lodes corundum produces the asterism effect. The typical accessory minerals are zircon, columbite, samarskite, pyrochlore, aeschynite, monazite; spinel (pleonast-herzynite), granite, chrysoberyl (Pic. 9,10).

Group III: ***postmiascitic granite pegmatites.*** They have quite thin bodies with simple plate-like form. Among the accessory minerals are zircon (malacone), fergusonite, betaphite chevkinite, apatite, thorite, titanite, titanic iron ore, hevine and others (Picture11).

Group IV: amazonite pegnatites. This is the best-known type of pegmatites and one of the first to be produced and studied in the Ilmensky mountains. It was the main commercial attraction of these mountains in the 19th century: precious topaz, beryl (including aquamarine) and phenacite (for faceting) were produced here, as well as amazonite - beautiful perfect green microlin crystals – for collections. Amazonite pegnatites have simple plate-like bodies, but the inner structure of many is rather complex, with big cavities and perfect crystals inside. The mineral composition of this group of pegmatites is very diverse: in total there are more than 60 minerals. The most usual (apart from rock-forming ones) are topaz, beryl, phenacite, tourmaline, columbite, monazite and others. Alumino-fluorides are quite rare (cryolithionite, pachnolite, ralstonite, prosopite, cryolite, chiolite, gearksutite, thomsenolite), astrophyllite— kupletskite and others (Pic. 12,13)

Rock associations of the Ilmenogorsky complex

Rock associations of the Ilmenogorsky complex are numerous and feature up to 70 types of plutonic and metamorphic mountain rocks.

Alkoline tocks of the Ilmenogorsky complex are among the most recurrent. They possess a diverse mineral composition, forming numerous varieties. The forms of the geological bodies that they compose and the peculiarities of their relationships with the host rocks are also diverse.

The biggest **Ilmenogorsky** massif of alkaline rocks is situated in the southern part of the Ilmensky ridge. It has a tear-shaped form with the dimensions 18x4,5 km stretching out in the submeridional direction. A series of relatively small and narrow alkaline rock bodies of the same type as the rocks of the Ilmenogorsky massif are submeridionally oriented to the north.

The nepheline syenites, which produced a big group of alkaline rocks, were for the first time in the world science described in the beginning of the 19th century by I. Menge in the Ilmensky mountains and got the name of "ilmensky granite" due to the external similarity with granite which contains nepheline instead of quartz. Starting from the second half of the 19th century I.V.Mushketov set into use their present name **"miascite"**.

The most recurrent types of alkaline rocks are biotite, biotite-amphibilite and amphibolite mioscites and syenites, miascitic and syenitic migmatites, sandyites and fenites.

The main rock-forming minerals are potass-sodium feldspars (usually with perthite or antiperthite structure), nepheline (in miascites), biotites and amphiboles. Among accessory minerals are titanites, zircon, apatite, les frequently pyrochlore and magnetite.

The data of the last 5-7 years give grounds to relate the alkaline rocks of the complex with inner alkaline-ultrabasic magmatism.

Associations of basic and ultra-basic rocks are mostly represented by small boudine-like and lens-like bodies and less frequently by relatively big massifs (Nyashevsky, Bayksky and others), which are randomly placed in the blastomylonite matrix and concentrated in chains along the junction zones of the tectonic plates. The ultrabasic rocks are represented by meta-hyperbasites: serpentinites in big bodies, talc-carbonate, talc-antophillite, talc-tremolite-antophillite, olivine-enstatite and other rocks, almost not containing the relicts of the primary minerals. The basic rocks are associated with meta-hyperbasites in tributary quantities, and are represented by garnet, zoisite, garnet- zoisite-corundum, cummingtonite and other amphibolites. Rarely do they display their primary magmatic structure (gabbroic rocks). According to the geochemical specificity these rocks are represented by Urazbaevskaya metabasite- peridotite association, which is formed by metasomatically transformed alkaline-ultrabasic rocks (from the ijolite-jacupirangitic series).

Associations of granitoids are spatially linked to the peripheralparts of the Ilmenogorsky complex, mostly to the eastern and southern ones. They formed between early Ordovician and Triassic periods. The main genetic groups are:

- *basalt and alkaline-basalt magma derivatives* (urazbaevsky, pustozerovsky, kundravinsky, ulvidinsky complexes);
- *ultrametamorphogenetic granitoids* (chashkovsky complex);
- *palingenetic crustal magma derivatives* (sabanaysky complex).

In a number of complexes different types of migmatites have been identified (metasomatic, injection-metasomatic and injection types), reflexing the stages of their formation. All the granitoid associations go together with dyke complex.

Metamorphic rocks are numerous and diverse. They compose a thick stratum, which can be split into 3 structural-substantial segments: selyakinsky block, ilmensky and saitovsky series. They host plutonic rocks. The most recurrent are gneisses, amphibolites, crystal slates, quartzites. The formation of the metamorphic rocks strata passed several stages over a long period of time: the most ancient are 2,2 bn years old, the youngest are 150m years old. Metamorphism went on with brittle-ductile deformations, and its high level corresponds to the granulite and amphibolite factions.

Relief

The area around the Ilmensky mountains is one of the highest mountain ranges of the eastern foothill of the northern part of the Southern Urals. This mountain range runs meridian-wards up to lake Kundravinsky in the south, and in the north to the group of lakes: Silach, Irtyash, Kasli, Ulvidy. The Southern part of the mountains situated between the lakes Kundravinsky and Ilmensky, is called the Chashkovsky mountains; to the north from them is the Ilmensky ridge and further to the north – the Vishnevy and Sysertsky mountains. The Chashkovsky and Ilmensky mountains are separated from the main chain of the Urals by the wide valley of the river Miass.

The Ilmensky mountains represent a system of ridges which go down from 754,1m above the sea level in the South (mount Ilmentau) to 364m in the North. The central ridge runs 28km from lake Ilmensky in the south to lake Ishkul in the north. The side western ridge 11km long in the region of lake Ishkul is called the Ishkul ridge (mount Ishkul, 661m). In this region the Ilmensky ridge, crossed by rivers and springs, is scarcely pronounced. (Picture 1). The average height of the ridge between lake Ishku and lake Terenkul is about 400m asl. In the northern part

of the Ilmensky mountains between lake Terenkul and Argazinsky reservoir (14km) there are 2 parallel ridges of low mountains.

The major part of the Ilmensky mountains belong to Lenin Ilmensky state Reserve, the Ural division of the Russian Academy of Sciences (the Reserve) with the area of 303,8km^2. The typical feature of the zonal-geographic position of the Reserve is its location in the transitional territory between the mountainous woodland of the Urals to the plain wooded steppe of the Zauralie and Western-Siberian lowland. (Picture 2, photo 1,3)

Climate

The climate is acutely continental with hot summer and cold winter. January with its average monthly temperature -20,8 °C is the coldest month in the year, July with average monthly temperature +18,4 °C is the warmest. Late frosts are quite common. The weather is unstable: dry and rainy summers can come in turns, as well as frosty winters with little snow and mild winters with much snow. The precipitation level fluctuates between 500-800mm per year, the maximum is reached in warm season. The depth of the snow cover reaches 1m and can stay up to 195 days running. The frost-free period lasts 80-90 days, but morning frosts occur throughout the year.

Water

There are more than 40 rivers on the territory of the Reserve, most of them flow from the Ilmensky ridge. The rivers are short, shallow, with steep falls in rocky shores and beds. In winter when the snow melts or after a strong rain the rivers turn into foamy streams. In summer they usually dry up, water remains only in the deepest holes, under the placers and in the strong springs feeding the rivers. The longest river is Bolshaya Cheremshanka (9,8 km).

There are about 30 lakes on the territory which make part of the Kaslinsko-Kyshtymski lake system. There are 2 types of lakes: deep-water lakes with clear water in firm rocky shores, with scarce vegetation and little biomass stores (Bolshoy and Maly Kisegachi, Bolshoy Miassovo (photo 2,4), Bolshoy Ishkul, Terenkul, Baraus, Savelkul, Karmakkul) and numerous shallow lakes with well-developed water and earth vegetation and big biomass reserves.

Flora

The territory of the Reserve makes part of the Vishnevogorsko-Ilmenogorsky geo-botanical district of the pine-birch forest sub-zone. More than 82,3%of the territory is covered with forests, 50% are pine-woods, 44% are birch woods, and the rest are deciduous aspen and alder forests. Pine dominates in the southern half of the Reserve, starting from the latitude at Selyankino-Miassovo and near lakes B. Ishkul, Karmakkul, Araktaban, Sharankul. On the rest of the forest territory birch prevails. Other species are mixed with these two or form there own massifs on small spots.

On the territory of the Reserve one can come across coniferous taiga forests and patches of herbal-poaceous steppes, northern sphagnous marshes and bushy steppes, light birch forests and shady riparian forests, tall-grass mountainous meadows, lowland ling marshes and stony placers with lichen stains.

The specific feature of the Reserve flora is its mosaic character. There are no large areas of homogeneous forests; all of them feature numerous glades and meadows of different size.

The Reserve's flora counts about 927 vascular plants (50 relicts, 23 endemic species), about 140 moss species, 483 algae species and 566 mushroom species (photo 7).

On the territory of the Reserve there are a number of species included into the Red Book of Russia: feather grass, downy-leaved feather grass, Zalessky feather grass, moccasin flower (photo 6), ladies'-slipper (photo 5), neottianthe cucullata, Baltic orchis, fen orchis, helmeted orchis, dark-winged orchis, Gelma sandwart, Krasheninnikov sandwart, Clare astragalus. Besides 35 plant species are included into the red Book of the Chelyabinkaya oblast. (photo 16).

Fauna

The fauna of the vertebrate animals in the Reserve counts 19 fish, 5 amphibian, 5 reptile, 174 bird and 48 mammal species.

The territory is inhabited by elks, roe deer, boars, foxes, wolves, lynxes, badgers, common weasels, least weasels, forest ferrets, Siberian striped weasel, common marten, American mink. Squirrels, beavers, muskrats, hares, dibblers, moles, hedgehogs, voles are quite common, as well as chiropterans: pond bat, water bat, Brandt's bat, whiskered bat, northern bat, long-eared bat, parti-coloured bat, Nathusius' pipistrelle.

Bird species feature white-tailed eagles, honey hawks, boreal owls, gnome owls, hawk owls, tawny owls (photo 15), common scoters, cuckoos, wookcocks, common grouses, wood grouses, hazel grouses, common partridges, shrikes, golden mountain thrushes, black-throated loons and others

Among the invertibrates the most diverse are the anthropoids (3389 species), rotifers – 166, flat worms (125 species), ostraceans (24 species).

In the Reserve there are insects included in the Red Book of Russia (Calosoma sycophanta, Rimn blue, Apollo butterfly, Bombus mastrucatus Gerstaecker and Bombus paradoxus); birds (eagle owls, peregrine falcons, ernes, lesser white-fronted geese). The regional Red Book counts 73 animal species. (photos 13,14)

JUSTIFICATION FOR OUTSTANDING UNIVERSAL VALUE

Criteria met (see Paragraph 77 of the *Operational Guidelines*):

i	ii	iii	iv	v	***vi***	***vii***	***viii***	ix	x

Criterion viii: This is a unique specimen which reflexes the main stages of the history of the Earth and the on-going geological processes of the earth surface formation.

The mineralogy of the Ilmenogorsky complex

«Every mineralogist dreams of visiting this mineralogical "paradise", which is unique in its wealth, diversity and specificity of the fossils ».
Academician A.E.Fersman (1928)
"The Ilmensky mountains have a global mineralogist importance"
Academician N.M. Fedorovsky
"This relatively small area contains a wealth of various minerals; the mountains resemble a natural museum, where the most precious minerals are put on display here by the nature"
Gustav Rose (1829)
(photo 9,10,11)

In mineralogical sense the Ilmenogorsky complex is undoubtedly a unique geological object in the world. It is the mineral variety that gave the stimulus for the creation of the world's first mineralogical reserve here in 1920.

At present there are 277 mineral species (more than 360 including varieties) on the territory of the Reserve. Compare: 1109 mineral species are registered on the whole territory of the Urals, 120 of them were described in the Ilmensky mountains for the first time in the Urals. Besides 18 species, new for the global mineral taxonomy were discovered in the Ilmensky mountains: ilmenite (1827), aeschynite (1828), monazite (1829), cancrinite (1839), chevkinite (1840), chiolite (1846), samarskite (1847), ilmenorutile (1856), fergusonite-beta-(C)(1965), ushkovite (1983), svyazhinite (1984), makarochkinite (1986), fluororichterite (1993), fluor magnesiumarfedsonite (1998), kaliumsadanagait (1999), polyakovite (2000), makarachkinit (2005), ferriwinchite (2005).

The minerals of the basic systematic groups are widely represented in the Ilmenogorsky complex: feldspars, amphiboles, pyroxenes, mica, as well as minerals of rare, rare-earth and radioactive elements. In particular, it has been found out as a result of special research that the group of amphiboles which counts around 110 species in the world taxonomy, is represented by 38 in the Ilmenogorsky complex (almost one third of all known amphiboles).

Criterion vi: The complex is directly related to the global-scale scientific discoveries

In 1912 on personal request from the academician V.I. Vernandsky the Ilmensky mountains were banned from private mining (photo 8).

N.M.Fedorovsky, Head of the mining direction All-Union Council for National Economy of the Russian Soviet Federative Socialist Republic, delivered a report in 1919 at the meeting of the RSFSR technical society on the scientific value of the Ilmensky mountains in the Urals. He called for its recognition as a national park similar to the Yellowstone national park in the USA in order to ban all kinds of mining on the territory and to preserve the exclusive in its diversity and wealth natural mineralogical museum (photo 9, 12).

On 14 May 1920 V.I. Lenin signed a decree of the RSFSR Council of People's Commissars which granted the Southern part of the Ilmensky mountains the status of mineralogical reserve.

"On the account of the outstanding value of the Ilmensky mountains in the Urals on the river Miass and in order to preserve their natural mineral wealth, the Council of People's Commissars rules: People's Commissariat for education is to be granted the right to announce in coordination with the Mining council of All-Union Council for National Economy to ascribe to certain areas of the Ilmensky mountains in the Urals on the Miass river the status of the State mineralogical reserve, i.e. an object of national patrimony meant exclusively for scientific and technical purposes. The exploitation of the Reserve in practical purposes is allowed exclusively on permission of the Council of People's Commissars."

On 7 January 1924, All-Russian General Executive Committee and the RSFSR Council of People's Commissars issued a decree on the preservation of the monuments of art, antiquity and nature. In this decree the reserves are described as areas of land liable to total protection and withdrawn from any economic use. On 6 May 1924 Minor Council of People's Commissars passed the decision on including the Ilmensky Mineralogical Reserve into the network of scientific and research institutions of the People's Commissariat for education. A.E. Fersman got in change of the scientific and research coordination of the works in the Reserve.

The input of the Ilmenogorsky complex in the development of the geo-mineralogical sciences

1. A great input of the Ilmensky minerals in the studies of the radioactivity is related to the discovery of the samarskite mineral in the Ilmensky mountains in 1847, from which the element samarium was extracted further on. At the beginning of the 20th century in the framework of the Radium expedition of the Russian Academy of Sciences in the Ilmesky mountains the specimen of radioactive metals were selected for the research by Skladovskaya-Curie.

2. One of the most important contributions of the Ilmensky mountains into the world science is the **mineralogical (crystallographic) induction law,** formulated in the first half of the 20th century by A.E. Fersman. Investigating the pegmatites, Fersman observed the processes described by this law in different mines. But it was only on the material from the Ilmensky mountains that the law got its final form as the essence of these processes became obvious. This is one of the fundamental laws in mineralogy, which allows to identify the age correlations between minerals in mineral aggregates and bodies, thus synchronising the processes of mineral formation and pinpointing their succession.

3. The pegmatites are the major object of the Ilmensky mountains due to their diversity in this area. The investigation identified several patterns of their formation. Certainly, other mines were used for the creation of these patterns but the Ilmensky material either played the defining role in the creation of a pattern or showed the "original" (a lode or an object), which gave the best display of this or that pattern. According to Fersman's pattern, the pegmatites formed in the cavities through solution-melts decrystallisation. In the 1930s A.N. Zavaritsky worked out a pattern of pegmatite formation through fine-grained rocks recrystallisation with the "grain" enlargement. And in the 1960s N.M. Uspensky backed the metasomatic nature of the pegmatites. In the 1970s-1980s the research carried out by the staff of the Ilmensky reserve helped to formulate a forth vision of the pegmatite formation mechanism, that is similar to that of Alpine-type lodes, but in the high-temperature and pressure conditions with the participation of melts, fluids, gases and solutions. At the same time the pattern of the fenite formation was worked out, which helped to get a deeper understanding of the alkaline processes taking pace in the Imenogorsky complex.

4. The materials drawn from the Ilmensky studies were used by Zavaritsy and D.S. Korzhinsky in the development of certain points in the theory of metamorphism.

5. In the 1970s-1980s the research led by V.A. Popov made a significant input into the crystallographic studies, a number of respective forms of the mineral crystals. Besides, he compiled a crystallomorphic definer, based, according to Popov, on the "vastest crystallographic material of the Ilmensky pegmatites…".

6. Over the last decades the staff of the Ilmensky reserve have been carrying out a research on the classification of separate groups of minerals in the system of mineralogy (groups of amphiboles, mica, pyroxenes etc.) The returns of this research provided the basis for the thorough nomenclature analysis of the mineral material stored up in almost two-century history of the geo-mineralogical studies in the complex. As a result, mineral inventories of the Ilmenogorsky complex (2000), the amphiboles of the Ilmenogorsky complex (2000), and the amphiboles of the Urals (2004) were prepared and published. Although this analysis was carried out on the comparative basis with the material from all over the Urals, in 2006-2007 the opportunity to compile an inventory of the Ural minerals came up. This work has a global significance, since this has been the first time that mineral inventories for the greatest taxons of the scale of the Ural fold system have been compiled.

The above-mentioned facts testify to the fact that the Ilmenogorsky complex is a model geo-mineralogical complex of world significance and its potential is not limited to the mentioned works, but leaves much room for further research.

Criterion vii: The Ilmenogorsky complex is an outstanding natural phenomenon and possesses a wonderful natural beauty (photo 1,2,3,4)

Many scientists and writers around the world used imagery extensively to describe their first impressions of the Ilmensky mountains.

From the article by I.R. Lisenko "Geognostic observations in the region of the Zlatoustovsky factories and the adjacent places" ("The Mining Journal", 1834, book 1)

"The Zlatoustovsky Urals appear in their formidable grandeur from the Ilmensky mountains near the Kyshtymsky factories. Their natural is gloomy and wild here. Majestic forests, still almost intact, transparent springs noisily running down the rocky river-beds; lonely mountain lakes; poor stray yurts of the semi-settled Bashkirs; their uncultivated fields and, finally, wild bold peaks of Urma, Taganay, ural, Itsyl, eman-Tuba rising at right angle, bare or covered with forests - give the full picture of the local natural beauty".

From the article by I.R. Lisenko "Geognostic observations in the region of the Zlatoustovsky factories and the adjacent places ("The Mining Journal", 1834, №3, part 1)

«Closely observing the nearby area one can't but notice the exquisite forms and their wonderful combinations… Quaint object forms and their qualities produce a stunning effect on the beholder, which last for years. The same is true about the micaceous and pure quartz placers, generously scattered along the main ridge. Crowning the mountains, they give a majestic and formidable look the range. The placers of Iremel, Taganay, Uytash, Uvalyak and others inspire awe, while the placers of Urma are wonderfully regular in form. Delight and reverence to the Lord filled my heart at the sight of this admirable picture".

From the article by I.R. Lisenko "Geognostic observations in the region of the Zlatoustovsky factories and the adjacent places ("The Mining Journal", 1835, book 1)

«While the mountain peaks still provoke highbrow and sometimes gloomy contemplations, their slopes are a feast to the eye and soul. Long ravines and lovely valleys washed by mountain springs, bright forest greenery, light cool air, birds' singing, hum of the grazing herds and discordant cries of the nonchalant Magomet followers, who roam here from early spring till late autumn, - all this gives a very special feeling, which is hard to define, but so familiar to those, who have admired the light southern skies of our blessed motherland".

Most often the Ilmeny mountains have been compared to the best regions of Switzerland. Among the mountains covered in dark coniferous and deciduous forests, in the wide lowlands lie beautiful lakes with sparkling blue-green transparent water.

Sergey Karatov: "The nature of the Southern Urals is unique in its beauty and diversity: mountain chains covered with coniferous and deciduous forests, intricately interweave or move apart to form valleys with rivers; deep tectonic lakes sparkle here and there, the rocks rise up high among the blooming the meadows and the green arrow-woods, bird cherry trees and alders".

The territory of the Reserve is a wonderful natural laboratory. It has all the conditions necessary for the floristic, ecological, geo-botanic and soil research work, which reveal the specificity of the natural processes free from human intervention, which is of paramount importance. The intensive industrial development, especially in the Urals, often entails significant and at times irreversible alterations of the live nature. There is a danger of rare plant species extinction and destruction of precious plant associations. Thus the significance of the reserve status for the Ilmensky mountains can hardly be overvalued. Preserved from the destructive influence on the soil and flora, the Reserve represents a natural model of highly productive and self-regenerating plant associations (photo 5,6,7).

The mineral treasures of the Ilmensky reserve have been unlocked by 330 mines in more than 600 mine workings, which serve as showcases of a natural geo-mineralogical museum available for observation and exploration by students (photo 18) and specialists (photo 9,10,12).

A.E. Academician Fersman: "I have seen a lot of gemstones deposits – in the sunny south, in gloomy Switzerland, in Altay, in Zabaikaliye, in Mongolia, in Sayany – but no where have I experience the same admiration as in these amazonite mines…I've never seen anything as

fascinating. I couldn't take my eyes off the blue dumps of the green-blue Amazonian spar… I couldn't conceal my delight at these riches" (photo 10).

S.T. Aksakov: «A wonderful, blessed land, The store of earthly treasures...»

The beauty of the Ilmensky mountains is glorified in may literary works, paintings, photos and videos (photos 1,2,3,4).

A vast bibliography of scientific research works on the Ilmenogorsky complex (it counts more than 200 publications in different languages from 18th century till nowadays), as well as the exposition of scientific collections and specimen from the Ilmensky mountains in the biggest museums of the world can guarantee the authenticity of the input of the Ilmensky mountains in the world. The main stages of the exploration of the Ilmensky mountains are presented in the table below.

18th century	
60s	Mica and gemstones mining led by V.O. Razderishin Prutov finds first topazes
1770	P.S. Pallas visits the Ilmensky mountains
1789	First mention of the Ilmensky mountains in the book of German scholar I.F. Herman
19th century	
1800-1815	Kochevoy A. And Trubeev I. find topaz deposits
1826	I. Menge visits the Ilmensky mountains, a collection of minerals is compiled
1826	I. Menge publishes the first geological description of the Ilmensky mountains in "The Mining Journal"
1827	The discovery of the new mineral ILMENITE (found by I.Menge, defined by G.Rose, A. Kupfer)
1828	The discovery of the new mineral ESHINITE (found by I.Menge, defined by I.I. Bortselius)
1829	A.Gumboldt, G.Rose visit the Ilmensky mountains with a scientific expedition
1829	The discovery of the new mineral MONAZITE (found by I.Menge, defined by Y. Breitgaupt)
1828-1849	The search groups of the Mining Directorate of the Zlatoustinsky district start works in the Ilmensky mountains
1839	The discovery of the new mineral CANCRINITE (G. Rose)
1840	The discovery of the new mineral CHEVKINITE (G. Rose)
1842	Description of 20 Ilmensky minerals (G. Rose)
1846	The discovery of the new mineral CHIOLITE (P.German, A.B. Auerbach)
1847	The discovery of the new mineral SAMARSKITE (G. Rose)
1856	The discovery of the new mineral ILMENORUTILE (N.I. Koksharov)
1858	I.I. Redikortsev compiles a map of mineralogical mines
1876-1877	I.V.Mushketov compiles the first lithologic map of the Ilmensky mountains
1882	M.P. Melnikov compiles the first description of the mines and their numeration is introduced
1897	The participants of II International geological congress visit the Ilmensky mountains
20th century	
1911-1917	The Radium expedition of the Academy of Sciences carries out research in the Ilmensky mountains
14 May 1920	RSFSR Council of Peoples' Commissioners Decree on the creation of the Ilmensky State Mineralogical Reserve

20 June1924	RSFSR Council of Peoples' Commissioners Regulation on the inclusion of the Reserve into the People's Commissariat for Education with financial provision. D.I. Pudenko is appointed Director.
1925	Start of the scientific life of the Reserve: L.N. Tulina, S.I. Snigirevsky, A.A. Kazakova, A.G.Titov, N.N. Smirnov
1926	Forest management in action, the borders of the Reserve are set
1927	The first book about the Reserve is published: "State Ilmesky mineralogical Reserve" N.N. Smirnov
1933	The Reserve is referred to the Ural department of the Russian Academy of sciences
1934	The first scientific conference on magmatic geochemistry is held by the USSR Academy of Sciences
1 December 1935	By All-Russian Central Executive Commission and the USSR Council of Peoples' Commissioners regulation the Reserve is attributed the status of a complex
1936	The first scientific collection "The works of the Ilmensky Reserve" is published
1936	The first building of the museum is constructed
1936	The first registration of the hoofed animals
1937	The XVII International Geological Congress takes an excursion in the Ilmensky mountains
1938-1939	Б.А. Berezin, Ustinova T.I. make an inventory of the Reserve mines
1939	"Geological and petrographocal description of the Ilmensky reserve and its mines" by A.N. Zavaritsky is published; T.I.Ustinova finalises "The description of the Southern part of the Ilmensky reserve"; A.I.Volzhenkov makes up the petrographical map of the Ilmensky mountains
16 May 1940	The Reserve is named after V.Lenin
1941-1943	The staff of the Institute of geological sciences of the Aademy of Sciences, in particular A.N. Zavaritsky are evacuated to the Reserve
1943	The Reserve launches the programme "Cronicles of nature"
1949	The scientific collection "The minerals of the Ilmensky reserve" is published
1956-1964	The department of the Institute of Biology, Ural department of the Academy of Sciences, works under the supervision of N.B. Timofeev-Resovsky, associate professor of biological sciences.
1959	The publication of "The works of the Ilmensky reserve" collection is resumed
1964	Detailed geological survey of the southern and middle parts of the Reserve is completed
1965	The discovery of the new mineral FERGUSONITE-BETA- (SE) (B.A. Makarochkin)
1971	The Reserve is granted autonomy as a scientific and research institution of the Ural scientific centre of the Academy of Sciences
1973	V.A. Popov supervises the inventory of the Reserve mines
1980	The discovery of the new mineral USHKOVITE (B.V. Chesnokov)
1984	The discovery of the new mineral SVYAZhINITE (B.V. Chesnokov)
1986	The discovery of the new mineral MAKAROCHKINITE (V.O. Polyakov)
1988	The Academy of Sciences Institute of Mineralogy is established on the base of the Reserve

1986	The discovery of the new mineral KALUGINITE (B.V. Chesnokov) *
1986	The discovery of the new mineral MATVEEVITE (B.V. Chesnokov) *
1990	The museum of natural science is open for public (total area 4500 sq m, about 30000 exhibits in the museum stores with about 9000 are on display in 7 rooms)
1993	The discovery of the new mineral FTORORICHTERITE (A.G.Bazhenov)
1998	The discovery of the new mineral FTOROMAGNESIUMARFVEDSONITE (A.G.Bazhenov)
1999	The discovery of the new mineral KALIUMFERRISADANAGAIT (A.G.Bazhenov)
2000	The discovery of the new mineral POLYAKOVITE (V.A.Popov)
2000	A new mineralogical inventory is compiled, which contains 268 mineral species and 94 varieties (S.N. Nikandrov, U.S.Kobyashev)
2000	V.I. Lennych makes the geological map of the Ilmensky reserve
2005	The discovery of 2 new minerals MAKARACHKINITE and FERRIVINCHITE (A.G.Bazhenov)
2006	The mineralogical miscellany "The pegmatite mineralogy of the Ilmensky mountains" is published (V.A. Popov, V.I.Popova)
2006	The collection of the scientific works on the Reserve "Geology and Mineralogy of the Ilmensky complex: situation and problems" is published

Statements of authenticity and/or integrity [see Paragraphs 78-95 of the *Operational Guidelines*]**:**

Lenin Ilmensky State Reserve of the Chelyabinsky scientific centre at the Ural division of the Russian Academy of Sciences is the oldest research and development institution in this division and one of the first reserves in Russia. In 1935 by All-Russian Central Executive Commission and the USSR Council of Peoples' Commissioners regulation the Reserve was granted the status of a complex. The regulation says that "the former Ilmensky mineralogical Reserve…is to preserve and study the mineral riches, the flora and fauna of the Southern Urals". In 1936 a new regulation on the Ilmensky complex is issued which prescribes a more rigid regime. It bans all activity changing the natural conditions: mining and minerals collecting, lumbering, cutting and damaging trees and bushes, hunting, enticing animals and birds, nest ravaging, fishing, grass cutting, cattle pasturage, as well as damaging the flora by berry and mushroom gathering, staying on the Reserve territory with rifles, traps, snares, nets etc. Fires, littering and staying off the main routes without special approval of the administration are also banned.

By 2008 the staff of the Reserve counts 112 people. The scientific work is carried out by the 20 scientific employees of the biologic and geo-mineralogical departments of the museum (17 PhDs employees). The defense of the borders and the provision of the reserve regime is secured by 30 guards of the State Security division (photo 17). The structure of the Reserve is made up of the scientific library, the archive, the developmental scientific basis for the student practice, information and publication centre. The Reserve museum of natural sciences (total area over 2000 sq m, 7 rooms) (photo 19-22) is the regional centre of ecological education, visited annually by more than 50000 people, including foreigners.

Foreign visitors of the Reserve museum of natural science in 2007

Country	Number of visitants	Country	Number of visitants
France	12	Guyane	1
Yemen	2	Bulgaria	1
USA	25	Sweden	2
Ethiopia	3	Brasil	5
Germany	136	Nigeria	5
Angola	4	Mongolia	4
England	7	Kazakhstan	132
Edypt	2	Ukraine	90
Spain	2	Uzbekistan	24
Romania	4	Kyrgyzstan	7
The Netherlands	1	Belorus	30
China	125	Armenia	3
Austria	3	Latvia	10
Holland	1	Estonia	2
Macedonia	1	Moldova	6
Canada	5	Turkmenistan	1
Israel	6	Greece	4
Italy	6	Poland	4

The territory is banned for visits, only some of the study routes for student practice are available in summer for the major higher institutions, such as Moscow State University, St Petersburg state University (photo 18). But the Reserve can be visited virtually though an automised information system “The Ilmensky reserve – a natural mineralogical museum”, where one can find the description of the mines, the lists of the minerals and rocks, the bibliography of the Ilmenogorsky complex, take a video-excursion. The system is available through the web-site of the Reserve www.ilmeny.ac.ru

Comparison with other similar properties:

The geological composition and mineralogical diversity of the Ilmensky mountains is usually compared to such places as Vishnevy mountains (the Southern Urals), Sakharioksky massif (Kola Peninsula), Blue-Mountain (Canada, Ontario), Langesundfiord (Norway), Magnet-Cove (Arkansas, USA), Sri-Lanka, Madagascar.

A very peculiar type of complexes in geo-morphological and petrologic concern sets apart the Ilmenogorsky massif of alkaline rocks among other alkaline massifs in the world.

In the geo-morphological sense there are 5-10 types of alkaline massifs in the word (according to different authors): forces and laccoliths, intrusions of central type, circular, laminated etc. The Ilmenogorsky massif exemplifies the type **"concordant bodies".**

In the petrologic concern the world alkaline rocks form a class with over 80 varieties of intrusive rocks (and over 150 with effusive rocks) according to their chemical and mineral composition. The group of 20 main varieties is called **"nephelite syenites"**. According to a number of structural features this group has a sub-group of **"miaskitic nephelite syenites" (miaskite, laurdalite, litchfieldite** etc) and a subgroup of **"agpaite nephelite syenites"**(foyaite, lujaurite etc). There is a subgroup of transitional nephelite syenites (uvite, mariupolite, tinguaite etc.) between them. The alkaline rocks of the Ilmenogorsky massif exemplify the subgroup of "miaskite nephelite syenites", which are called nephelite syenites of the Ilmeny type in some publications.

Therefore, the Ilmenogorsky massif is typomorphic, and thus is includes in all the major geological guides and synoptic works in the world.