Nomination

THE ILMENSKY MOUNTAINS

(THE RUSSIAN FEDERATION)

Proposal for inscription on
THE UNESCO WORLD HERITAGE LIST

Prepared by:

- Ilmensky State Nature Reserve
- Natural Heritage Protection Fund
- Institute of Geography, RAS
- Institute for Cultural and Natural Heritage named after D.S. Likhachev

With the assistance of:

- The Urals Branch of the Russian Academy of Sciences
- Ministry for Radiological and Environmental Safety of the Chelyabinsk Region

2010

Table of Contents:

Executive summary

State Party	The Russian Federation
State, Province or Region	The Russian Federation, Chelyabinsk Region, Miass, Chebakulsky and Argayashsky districts
Name of Property	"The Ilmensky Mountains"
Geographical coordinates to the nearest second	Land corner coordinates (Pulkovo, 1942):
Textual description of the boundary (-ies) of the nominated property	

Point	Latitude	Longitude
1 (North)	N55° 20' 20"	E60° 15' 23"
50 (South)	N54° 58' 25"	E60° 16' 10"
84 (East)	N55° 13' 10"	E60° 21' 20"
43 (West)	N55° 02' 10"	E60° 07' 40"

A4-size map of the nominated property, showing the boundaries and buffer zone (if present)	Map showing exact boundaries of "The Ilmensky Mountains" and its buffer zone. Scale 1 : 150 000 (Annex A2).
Statement of Outstanding Universal Value	The nominated property can be recognized as being of outstanding universal value for the following reasons: 1. Due to a great diversity of mineral species (more than 370 varieties) the nominated property is one of the key mineralogical sites of the world. Taking into account a relatively small area of the site (approx. 304 sq.km), the Ilmensky Reserve has no equal in terms of the concentration of minerals. 2. The fact that a total of 18 new mineral species were discovered in the nominated territory enhances the geological value of the property. 3. Great contribution of the Ilmensky Reserve to the development of mineralogical sciences can be compared with scientific contribution of such well-known natural phenomena already inscribed on the WH List as Grand Canyon and Hawaiian Volcanoes (USA), Aeolian Islands (Italy), etc. Since mineralogical sites, in contrast to other geological sites (mountains, fossil sites, hydrogeological sites, etc.), remain under-represented on the UNESCO World Heritage List, the Ilmesky Reserve would become the first specialized mineralogical site of World Heritage.
Criteria under which property is nominated	**viii**
Name and contact information of official local institution/agency	The nature-conservation scientific research institution of Russian Academy of Sciences "Ilmensky State Reserve named after V.I. Lenin" of the Ural Branch of RAS. 456317, The Russian Federation, Chelyabinsk Region, Miass, Ilmensky Reserve Tel: 8(3513) 59-19-00 Fax: 8(3513) 57-35-62 E-mail: valizer@ilmeny.ac.ru www: http://igz.ilmeny.ac.ru/

1 Identification of the property

Photo by L.Veisman

1a Country (and State Party if different)

The Russian Federation

1b State, Province or Region

Russian Federation, Chelyabinsk Region, Miass, Chebakulsky and Argayashsky districts

1c Name of Property

The Ilmensky Mountains

1d Geographical coordinates to the nearest second

Land corner coordinates (Pulkovo, 1942):

Point	Latitude	Longitude
1 (North)	N55° 20' 20"	E60° 15' 23"
50 (South)	N54° 58' 25"	E60° 16' 10"
84 (East)	N55° 13' 10"	E60° 21' 20"
43 (West)	N55° 02' 10"	E60° 07' 40"

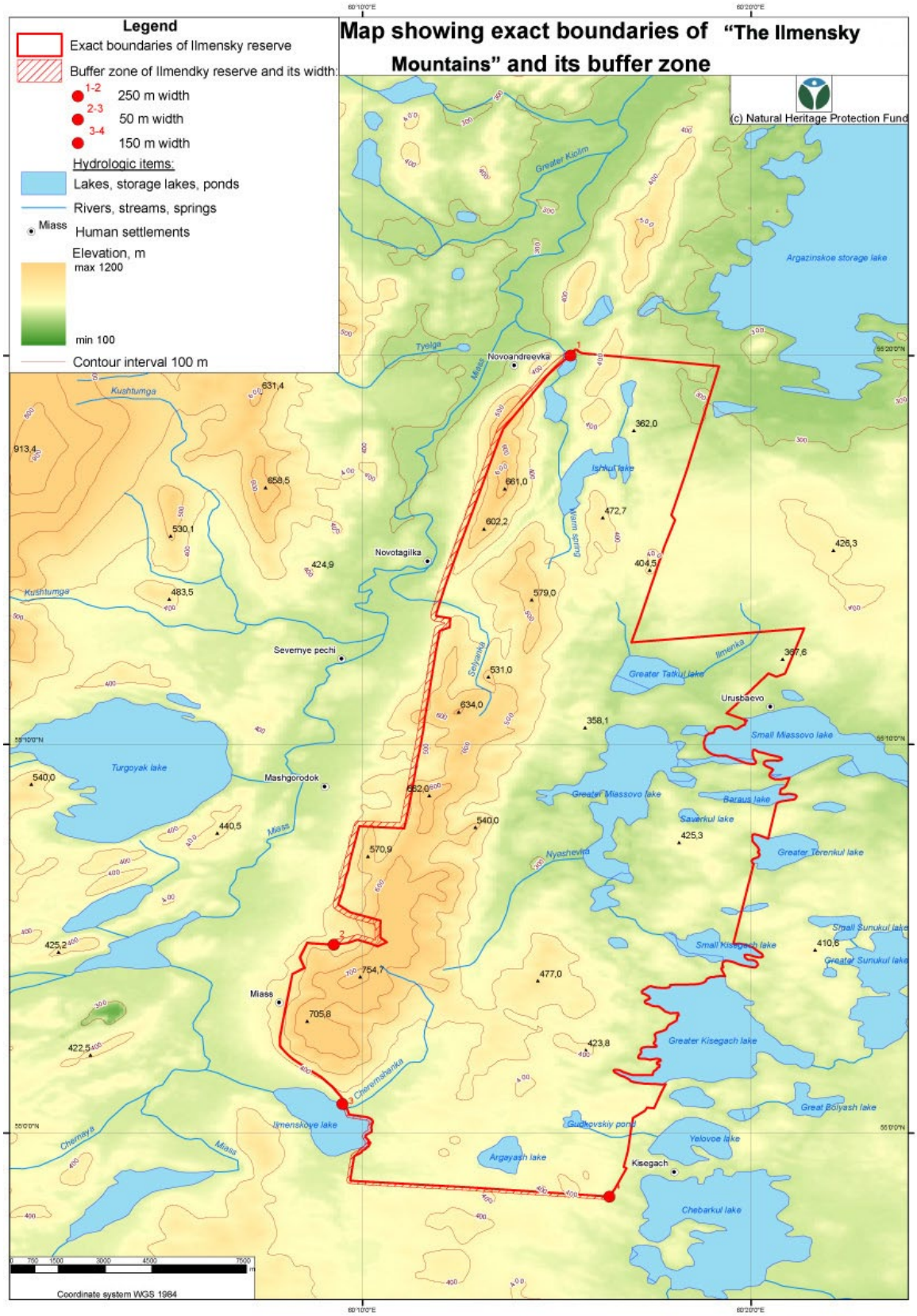
1e Maps and plans, showing the boundaries of the nominated property and buffer zone

Annex A contains the following maps and plans:

A1. “The Ilmensky Mountains” on map of the Russian Federation.
A2. Map showing exact boundaries of “The Ilmensky Mountains” and its buffer zone. Scale 1 : 150 000.
A3. Sketch map of Ilmensky Reserve functional zoning.
A4. Ranger districts of Ilmensky Reserve.

A1. “The Ilmensky Mountains” on map of the Russian Federation.

A2. Map showing exact boundaries of “The Ilmensky Mountains” and its buffer zone.



1f Area of nominated property (ha.) and proposed buffer zone (ha.)

Plan, showing the boundaries of the nominated property and its buffer zone.

The total area of the Ilmensky Reserve is 0,0304 mln. ha, the area of its buffer zone is 960 ha., including a 50-hectare area bordering the territory of the Miass city and a 910-hectare area bordeting the territory of the Miass Urban Area.

2 Description

Photo by L.Veisman

The Ilmensky Reserve is situated on the eastern macroslope of the South Urals between N54°58′–55°20′ and E60°07′–60°21′. It lies within the South Urals physiographic province of the Urals uplands. The unique features of this natural site are predetermined by its location in the centre of Eurasia close to the border between the Europe and Asia and on the border between two large landscape-geographical zones of the South Urals: mountain-forest zone and forest-steppe zone. The territory of the reserve includes the Ilmensky Mountains - one of the easternmost mountain chains of the South Urals – and a small piece of the adjacent abrasive-erosion Trans-Urals piedmont plain, which further south is followed by the Western-Siberian peneplain. The reserve's area is 303.8 square kilometers. Its territory is stretched submeridionally; it is up to 41 kilometers long, 12 kilometers wide in its southern portion and 5 kilometers wide in the north. According to the plan of geomorphological zoning of the Chelyabinsk Region (Sadovsky, 1957), the reserve is included into the zone of erosion-denudation terrain of the eastern piedmont of the Southern Urals. The zone is developed on the volcanic rock unit.

Geology

The Ilmensky Mountains are a unique geological phenomenon well-known for the semiprecious and rare-metal mineralisation of their pegmatite lodes and wide spread of nepheline sienites – the alkaline rocks, which are rare for the Urals. They are hosted by different metamorphic and plutonic rocks modified to this or that degree by deformation and metasomatism. The whole diversity of rocks of the Ilmensky Mountains is known as the **«Ilmenogorsky complex».**

History of geological studies of the Ilmensky Mountains

The first knowledge of geological aspects of the Ilmensky Mountains came from works of K.I. Lisenko (1832-1837), A.P. Karpinsky (1869), I.V. Mushketov (1876), M.P. Melnikov (1882). In these sources, gneissic granites, syenites and pegmatites were identified among the rocks forming the Ilmensky Mountains, with special emphasis placed on pegmatites.

The first schematic petrographic map of the Ilmensky Mountains was produced by D.S. Belyankin in 1915. That was a map of rock occurence. Petrographic essay attached to this map contained a detailed description of alkali rocks and a hypothesis for the genesis of «kyshtymites» (corundum-containing rocks) as a result of chrystallization of magmatic melts.

Later, in 1937-1939, A.N. Zavarnitsky produced a schematic geologic map, which was a graphical addition to his monography *Geological and petrographic essay on the Ilmensky mineralogical reserve and its mines* (1939). The map for the first time showed the pattern of the north-south strike of structures and the distribution of alkali magmatic intrusions and their host rocks.

In late 1960's – early 1970's the 1:25 000 geological map was produced. The map was the outcome of geological survey carried out by experts of the Ilmensky reserve in cooperation with researchers of the Moscow State Geological Prospecting Institute.

The standard 1:50 000 geological map – an outcome of joint work of geoscientists of the reserve and the Chelyabinsk exploration crew - was published in 1982. The map was based on Kelman's gneissic dome hypothesis (1974) and on the idea of stratification of metamorphic rocks. In the framework of this concept, the Ilmensky Mountains were generally considered as the southern part of the Ilmeno-Sysertsky mega-anticlinorium. However, as early as at this stage of investigation the tectonic nature of borders between different structural-substantial segments was established, and the specifity of fold morphology within these units was mentioned. The chapter on stratigraphy in the report attached to this map contains the description of suites and series belonging to a wide age range from the Archaean to Mesozoic era. The Pre-Cambian age of rocks are proved by A.A. Krasnobajev using zircons from the Selyankinsky gneisses. Alkali rocks are classified as products of abyssal magmatism. Also, the wide-spread occurence of fenitization is reported.

Published in 2000, the schematic geological map by Lennyh V.I. is based on the most recent concept of geological structure of the area. Based on this concept, the Ilmensky Mountains are considered as the southern fragment of a regional shear structure. Granitic blastomylonites constitute the major part of rocks; they contain relic nucleus of primary rocks. The Ilmensky Mountains are divided into the following structural-substantial segments:

Selyankinsky block. Gneissic rocks of Pre-Cambian age prevail. Rocks included into this block can be interpreted as the rocks of ancient crystalline basement of the platform.

Ilmensky block is a composition of gneissic and amphibolic rocks.

Saitovsky block mainly consists of quartz and shale rocks. The block can be interpreted as a complex of meta-terrigenous rocks of a thinned mantle of a continental margin.

Apointrusive rocks are represented by 3 rock associations, namely mafit-ultramafit, alkali-ultrabasic and miaskite-carbonatite. At the post-collisional stage, metasomatism and granitoid injection are well-developed. There are proofs of Pre-Cambian age of ultra-basic protolytes. Minerals reflecting the process of metasomatism are dated to the Permo-Triassic.

Today, it can reliably be expected that apointrusive rocks formed a single central intrusion comparable to the intrusions of the Khibiny Mountains and Maimecha-Kotyi Province. During the post-collisional stretching of orogenic belt (late Permian – early Mesozoic periods), the intrusion and its host rocks were «torn» and deformed. As a result, the Ilmen-Vishnevogorsky complex was formed, which is elongated in north-northwest direction and includes the Ilmensky Mountains in the south and the Vishnevije Mountains in the north.

However, taking into account the widespread development of carbonation and numerous thermal phenomena of long-living shear zone, careful selection of facts and reasoned reconstruction of geologic events are required. The Ilmensky Mountains are a unique object for the investigation and clearification of geologic events occurred at various stages of the development of the Ural fold system as well as for geologic excursions and field practice for students.

Rock associations of the Ilmenogorsky complex

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

One of the most common rocks in **the Ilmenogorsky complex are alkaline rocks**. Since they are featured by great diversity of mineral compositions, they exist in numerous varieties. The forms of geological bodies they compose and the character of the bond between the bodies and their host rocks are also very diverse. The biggest massif of alkaline rocks – the **Ilmenogorsky** Massif - lies in the southern part of the Ilmensky Ridge. It has a form of a drop with dimensions of 18x4,5 km, stretched out in the submeridional direction. Further north there is a series of submeridionally oriented, relatively small and narrow alkaline rock bodies, which in general are similar to those of the Ilmenogorsky Massif.

The nepheline sienites, which produced a big group of alkaline rocks, were for the first time described in the beginning of the 19th century by I. Menge in the Ilmensky Mountains and were named «ilmensky granite» due to their formal recemblance with granite rocks (but the latter contain quartz instead of nepheline). In the second half of the 19th century I.V.Mushketov brought into use their present name «**miaskite**».

The most wide-spread types of alkaline rocks are biotite, biotite-amphibolite and amphibolite miaskites and sienites, miaskitic and syenitic migmatites, sandyites and fenites. The main rock-forming minerals are potassium-sodium feldspars (usually of perthite or antiperthite structure), nepheline (in miaskites), biotites and amphiboles. Among accessory minerals are titanites, zircon, apatite, less frequently - pyrochlore and magnetite. The scientific research data obtained within the last 5-7 years suggest that the genesis of the alkaline rocks may be related to the abyssal alkaline-ultrabasic magmatism.

Associations of basic and ultra-basic rocks are represented mostly by small boudine- like and lens-like bodies and less frequently by relatively big massifs (Nyashevsky, Bayksky and others), which are randomly situated in the blastomylonite matrix and concentrated in chains along the junction zones of the tectonic plates. The ultrabasic rocks are represented by various meta-hyperbasites: in big bodies - by serpentinites, in the small ones - by talc-carbonate, talc-antophillite, talc-tremolite-antophillite, olivine-enstatite, enstatite and other rocks, almost not containing the relicts of the primary minerals. The basic rocks are associated with meta-hyperbasites in smaller quantities and are represented by garnet, zoisite, garnet-zoisite-corundum, cummingtonite and other amphibolites. In some cases they are marked by primary magmatic (gabbroic) structure. In terms of geochemical specificity, among these rock associations the Urazbaevskaya metabasite-peridotite association deserves special attention since it has probably been formed from metasomatically transformed alkaline- ultrabasic rocks (of the ijolite-jacupirangitic series).

Associations of granitoids are located in the peripheral (first of all in the eastern and southern) portions of the Ilmenogorsky complex. They were formed between the early Ordovician and Triassic periods. The main genetic groups are:

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

In a number of complexes the types of migmatites reflecting the stages of their formation have been identified, including metasomatic, injection-metasomatic and injection migmatites. All the granitoid associations are accompanied by the dyke complex.

The metamorphic rocks **are numerous and diverse. They form a thick stratum, which can be divided into 3 structural-material units: selyankinsky, ilmensky and saitovsky.They host plutonic rocks. The most common are gneisses, amphibolites, schis and quartzites. The formation of the metamorphic rock strata included several stages and took a long period of time: the most ancient rocks are 2,2 bln. years old while the youngest are 150 mln. years old. Metamorphism took place under the conditions of brittle-ductile deformations and has developed to the quite high level of granulite and amphibolite factions.**

Fig. 1

Fig. 2

Fig. 3

Fig. 4

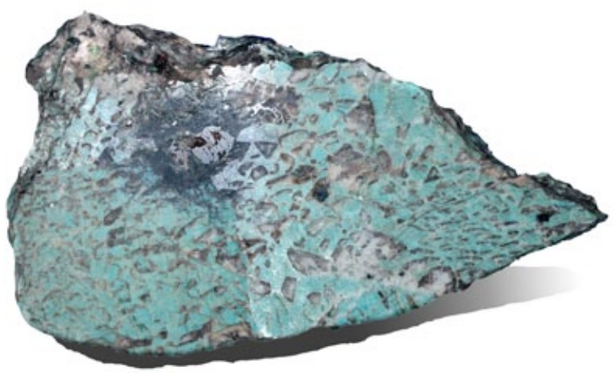


Fig. 5

Fig. 1. Zirconium silicate
Fig. 2. Muscovy glass
Fig. 3. Ilmenit
Fig. 4. Aeschynite
Fig. 5. Pegmatite
Photo by Y. Okulov

The Pegmatites of the Ilmenogorsky complex

Pegmatites of the Ilmenogorsky complex are specific geological formations, which are coarse-grained or giant-grained rocks forming separate geological bodies. These bodies are featured by specific shape, internal structure and mineral composition. Usually they have a well-defined border with more fine-grained host rocks and so can be clearly identified. Pegmatites present the greatest interest in the history of study of the Ilmenogorsky complex because they contain the most interesting minerals and associations as well as the biggest and the most perfect mineral crystals. In terms of the basic rock-forming minerals, there are three main pegmatite types: granitic, miaskitic and sienitic pegmatites. Granitic pegmatites contain quartz as the primary rock-forming mineral; the miaskitic pegmatites contain nepheline; the sienitic pegmatites contain neither quartz nor nepheline but feldspar as the main mineral. The results of detailed studies of the pegmatites held in the 20th century made it possible to systematize them identifying the series of individual age groups and specifying their distinctive structural features and mineral composition.

Group I, the earliest: **pre-miaskitic granite pegmatites**. Pegmatites of this group are coarse-grained; their graphic structure and zoning are not well-defined while deformation structures (boudinage, undulated textures, cataclasis, quartz granulation) are well-developed. The quantity and diversity of accessory minerals are moderate: magnetite, zircon, allanite, betafite and much rarer – muscovite, fluorite, apatite and some other minerals.

Group II is comprised of alkaline pegmatites: miaskitic ans sienitic. Their formation is related to a complex alkaline process. In terms of their composition and interrelations they can be divided into 3 subgroups characterizing different stages of the alkaline process:

- IIa: feldspatltic pegmntites and feldspatholites (sienitic) are formed at the early stages of the alkaline process. They have bodies of various, often very complex (branchy), forms. The diversity of accessory minerals is relatively moderate, but in certain lodes or lode segments they are abundant up to the economic quantities (for example, molybdenite).This group includes magnetite, pyrochlore, aeschynite, zircon, allanite, titanite, apatite, molybdenite, ferrimolybdite, powellite and less frequently – monazite and sarnarskite.

- IIb: miaskitic pegmatites (always contain nepheline as the main rock-forming mineral) are formed at the peak of the alkaline process. They have bodies of various and often of very complex form. Their specific feature is the presence of cavities containing accessory minerals in the form of big and perfect crystals. They have been actively extracted, first for commercial purposes (collecting and faceting) and later for scientific purposes. The main miaskitic pegmatites are cancrinite, sodalite, wischnewite, ilmenite and magnetite, zircon, pyrochlore, aeschynite, columbite, apatite and some others.

Fig. 6

Fig. 7

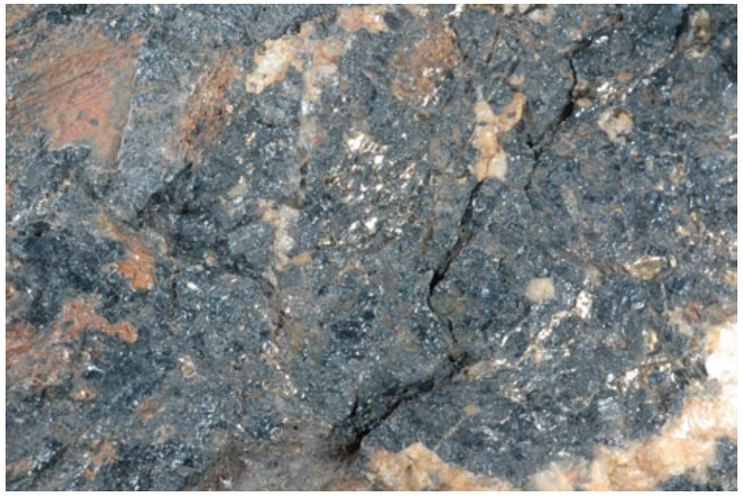


Fig. 8

Fig. 6. Samarskite
Fig. 7. Cancrinite
Fig. 8. Makarochkinite
Fig. 9. Ftormagnezioarfvedsonite
Fig. 10. Potassic magneziogastingite
Photo by Y. Okulov

Fig. 9

Fig. 10

- IIc: corundum- feldspathic pegmatites (sienitic; always contain corundum) are formed at the late stages of the alkaline process. Pegmatite bodies and lodes have relatively simple, lens-like or plate-like (tabular) form, sometimes with pronounced zoning. The concentration of corundum and its quantities in some lodes are so high that in the 19th century it was extracted for industrial use as abrasive material. Some lodes contain corundum displaying asterism. The typical accessory minerals are zircon, columbite, samarskite, pyrochlore, aeschynite, monazite; less common are spinel (pleonast-herzynite), garnet, chrysoberyl.

Group III: post-miaskitic granite pegmatites. They have quite thin bodies of simple plate-like form. Among the accessory minerals are zircon (malacon), fergusonite, betaphite, chevkinite, apatite, thorite, titanite, ilmenite, helvite and others.

Group IV: amazonite pegmatites. This is the best-known type of pegmatites and one of the first extracted and studied pegmatite types in the Ilmensky mountains. It was the main commercial attraction of these mountains in the 19th century: precious topaz, beryl (including aquamarine), phenacite (for faceting) and perfect green microcline crystals of amazonite (for collections) were extracted here. Amazonite pegmatites have simple plate-like bodies, but some of them are featured by rather complex internal structure, 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 common (besides rock-forming minerals) are topaz, beryl, phenacite, tourmaline, columbite, monazite and others. Alumo-fluorides (incl. cryolithionite, pachnolite, ralstonite, prosopite, cryolite, chiolite, gearksutite, thomsenolite), astrophyllite kupletskite and some other minerals are quite rare.

Fig. 11

Fig. 12

Fig. 13

Fig. 11. Monazite
Fig. 12. Topaz
Fig. 13. Beryl
Fig. 14. Chevkinite
Fig. 15. Elaeolite
Fig. 16. Amazonite
Photo by Y. Okulov

Fig. 14

Fig. 15

Due to the evolution of the term «pegmatite» in recent years, the number of pegmatite minerals has increased. Because of that and also based on new data obtained in the couse of the ongoing studies of the Ilmenogorsky complex, some scientists say about two more groups of «exotic» pegmatites. These groups are **alkali-ultrabasic pegmatites** and **«carbonatite» pegmatites**. Like «traditional» pegmatites, minerals of these groups are marked by sharp contacts with their host rocks, the presence of coarse- and giant-grained aggregates of rock-forming minerals, geometric selection in certain parts of the structure, inductive surfaces of individual minerals (evidence of partially simultaneous growth) and by some other features. The minerals form comparatively small lodes / series of small lodes of a few tens of centimeters - a few meters thick or large lenticular bodies of tens of meters in extent. The alkali-ultrabasic pegmatites are subdivided into ***phlogopite-amphibolic*** pegmatites (with phlogopite and alkalic amphibole or sometimes enstatite and forsterite as rock-forming minerals) and ***phlogopite-richterite-forsteritic pegmatites*** (rock-forming minerals are listed in the name of the sub-group). «Carbonatite» pegmatites are also divided into two sub-groups, namely, ***richterite–phlogopite-dolomite-calcite*** pegmatites and ***phlogopite-dolomite-calcite*** pegmatites (rock-forming minerals are according to the sub-group name). These pegmatites are distinguished from «traditional» pegmatites by unusual set of accessory minerals that include clinohumite, rosy-red corundum, monacite-(Ce), pyrrhotine, polyakovite-(Ce), thorite, fergusonite-(Ce), fluor apatite, chromite, scheelite, pink spinel, aeschynite-(Ce) and others. The age rank of these «exotic» pegmatites against the «traditional» ones is not quite clear. However, it has been observed that alkali-ultrabasic pegmatites cross the lodes of pre-miaskitic granitic pegmatites (age group I) and feldspatholites (group IIa). In their turn, the alkali-ultrabasic pegmatites are crossed by «carbonatite» pegmatite lodes. Most probably they are between the groups II and III of traditional pegmatites (based on the accessory minerals, they may be at level IIв).

Fig. 16

Fig. 17. Eastern slope of Ilmensky Ridge. View of central part of Reserve
Photo by A.Butorin

Fig. 17

Terrain

According to the Ural Mountains geomorphological zoning plan, the Ilmensky State Nature Reserve is located at the eastern border between the Ural Ridge zone and the peneplain zone. The Ilmensky Ridge, which occupies the biggest part of the Reserve, and the Ishkulsky Ridge are residual mountains of the Urals' eastern macroslope and are aged bogen structure – Ilmen anticline with submeridional trend, which is made of alkali rocks (Shoob V.S., 1976). Mountains of the Ilmensky Reserve have flattened peaks and smooth slopes. River valleys are slightly terraced and heavily swamped. The eastern portion of the Reserve includes the zone of submontane depression with numerous lakes and boggy hollows and the zone of eastern piedmont, which, beyond the Reserve's border, is followed by the Trans-Urals peneplain zone and further up to the east – by the West Siberian Plain.

The main landform is the Ilmensky Ridge. It has a sharp, undulating ridge line and well-defined bottoms. Due to the heterogeneity of geological material the ridge has a complicated geomorphological structure. The western slope facing towards the Miass River valley is much steeper than the eastern slope. The highest peak of the Ilmensky Ridge (and of the Reserve) is the Ilmen-Tau Mountain (747.3 meters ASL) located in its southern portion. Other peaks of the ridge don't exceed 600 meters ASL. They rise about 300 meters above the level of protected Kisegach-Miass low-flow-through lake system, which is located in the piedmont depression. The southern edge of the Ilmensky Ridge is a gentle, terrace-type slope, which ends on the bank of the Lake Ilmen where the reserve's museum and research station are situated. The slopes of the Ilmensky Ridge are cut by narrows and valleys of mountain streams and rivers: River Cheremshanka, River Belaya, Demidova River and others. The Ishkulsky Ridge runs through the northern part of the area. It is lower than the Ilmensky Ridge and like in the case of the latter, there is a piedmont depression with a chain of tectonic lakes – Ishkul, Sirikkul, Karmatkul and Lake Araktaban – near its eastern foot.

Fig. 18

Fig. 18. Day stone of rock base near Baraus Lake. Photo by M. Kladovschikova

Photo by M. Kladovschikova

Fig. 19. Ridge-top residual outcrops of Lysaya Mountain

Fig. 20. Single cliff on Osiny Cape, Ishkul Lake

Photo by A. Butorin

Fig. 19

Within the territory of the Ilmensky Reserve we can find 5 basic types of land forms, as follows:

1. Ridge-top residual outcrops – at the top of the Ilmensky Ridge (740-450 м.a.s.l.). The key relief-forming factors here are physical weathering and, to a small extent, chemical erosion accompanied by mass movement of fragmented material downslope. Geomorphologically, the locality is represented by miaskite exposures with comb-like or discrete residual rocky outcrops. Eluvial deposits consist of blocks up to 1 meter and larger, interlayed with chipping and landwaste.

2. Low-gradient slopes (450-350 м.a.s.l.) This type of land forms is well defined on the slopes having an easterly aspect. Its formation is predetermined by different weathering resistance of various rock outcrops - fenites, syenits and miaskits that come out to the surface in the form of stripes. Often there are bogged hollows between positive landforms; the hollows are covered with tall-grass aspen forests and high-moor oligotrophic bogs. Depressions are located in crush zones of micaceous-carbonate zones of transformation of alkali rocks. There are also weak deluvial argillo-arenaceous deposits with 0.3–0.8 meter deep inclusions of parent rock debris near the eastern foot of mountain slopes.

3. Longitudinal ridge steeply-sloping relief (400-300 м.a.s.l., depending on the level of lakes) can be found in southern and south-eastern portions of the reserve (banks of Bolshoi Kisegach, Maly Kisegach, and eastern bank of the Lake Bolshoe Miassovo). Its main features are specific weathering landforms – single mountains (Mount Sokolinaya), and very picturesque mesorelief formations in pine forests, which are gneissic granite coarse deposits having the form of so-called «stone tents» or «stone mattresses». Terrain in this portion of the reserve mirrors a specific feature of the geological structure of the area - a dense series of minor granite intrusions with remaining patches of gneiss units in between.

Fig. 20

Fig. 21. Panorama of the Ilmensky Reserve
Photo by L.Veisman

Fig. 21

4. Longitudinal ridge steeply-sloping relief (300-(350) 450 м.а.s.l.) is identified at the bottom of the Ilmensky Ridge. It is an eluvial-deluvial cone, which, as a topographic feature, is an epigenetic body camouflaging the relief-forming role of structire and composition of underlying bedrocks.

5. Swampy gently ridged relief (at the lake level of 275-375 м.а.s.l.) can be seen in the Nyashevsko-Ilmenogorskaya Depression in the eastern piedmont of Ilmensky Ridge. It's made of Quaternary argillaceous pebble deposits.

The above-listed types of land forms appear at their respective altitudes in the form of belts of various widths dressing the ridge along its strike.

Erosion and denudation exert a selective effect on the above-mentioned types of land forms. The topographic lows (in particular, Nyashevsko-Ilmenogorskaya structural-denudation depression) are formed in the places of tectonic depressions, which are presently covered by unconsolidated Quaternary deposits but can be traced by river valleys and lakebeds and swampbeds.

Fig. 22

Fig. 22. Swampy gently ridged relief of Nyashevsko-Ilmenogorskaya Depression
Photo by A. Butorin

Hydrographic network of the reserve includes 30 large and small lakes, more than 40 brooks and rivers and many springs and sources. Rivers on the western slope flow along the latitudinal direction; they are marked by steep gradient of the riverbed in the headwaters, by gentle gradient in the lower reaches, and have a large alluvial-deluvial cone in their lower reaches - in the place where the rivers run out of the ridge area and start meandering through the wide valley of the Miass River. Rivers of the eastern slope

of the Ilmensky Ridge run in tectonic fractures. They deeply cut into the massive-christaline rock slopes and abundant in water (River Belaya, Demidovka, Uskov Klyuch). On the eastern slope the upper parts of river valleys are gently inclined (5-10 degrees) and have grassed slopes; in the middle part the valleys often have V-shaped profile of riverbed with canyon-type benchs and steep stony banks. The valleys are 10-15 meters wide. In the lower reaches the valleys become wider and have well-defined 5-50-meter wide benchs of denudation on their slopes. The lower bench can be observed on both slopes of the valleys, its height is 3-8 meters.

The gydrographic network of the Reserve and of its neighboring areas exists in its present appearance since the Neogene Period. The Quaternary alluvial deposits are found everywhere in the river and brook valleys. The deposits are up to 3 meters depth; they consist of boulders, pebble, sand and gravel with silt impurity. Lake-marsh landscape is common for tectonic fractires, where one can find erosion-tectonic lakes having lakebeds of complex structure, significant depths, broken shoreline and abrupt stony shore. Areally, the lakes fall in the category of small and middle-size lakes (up to 15 sq. km); in terms of depth, they are among medium-depth and deep lakes (maximum depth is 25 meters). The Kisegach-Miass lake system holds a central position in the reserve. It is situated at altitudes between 270-375 meters above sea level. Most of the reserve's bogs are floating bogs developed in shallow bays of the lakes. Bogs occupy 8 per cents of the reserve's area, total area of lake water surface amounts to 19 per cents of the reserve's area. Within this type of landscape the Quaternary deposits are represented by fine argillaceous material composed of surrounding rocks. The deposits are covered with bog soil or peat layer. Thus, the depth of peat accumulation in the Klukvennoe Bog is 7 meters (the bog is a derivate of shallow bays that previously connected Lake Bolshoye Miassovo to Lake Bolshoi Tatkul).

In the Ilmensky Reserve the diversity of landforms predetermines a unique combination of microclimatic conditions thus resulting in the formation of various natural complexes featured by high biodiversity.

Fig. 23

Hydrography

Hydrographic network of the reserve includes 30 large and small lakes, more than 40 brooks and rivers and many springs and sources. The reserve's eastern boundary and the center of the reserve's area are cut almost along their whole length by a complex river-lake system located on the eastern slope of the Ilmensky Ridge. It's known as Kisegach-Miass by the name of the largest lakes in the system. The system is a nearly closed ring consisting of ten large and middle-size lakes connected by little rivers and channels. The most of these water bodies flow into the Miass River, which transports the influent water to the River Iset, and the latter – to the River Tobol.

Lakes of the Ilmenskaya Group are situated within the limits of the low mountain and the piedmont zones at altitudes between 270–375 meters above sea level. The lakes lie in rows along meridionally oriented montain ridges. All the lakes are of erosion-tectonic origin though they are at different stages of evolution. Consequently, most of them have a complicated structure of lakebeds, significant depths, broken shoreline and abrupt stony shore. The lakes of this group can be classified as small and middle-size lakes (up to 15 sq. km), and in terms of depth - as medium-depth and deep lakes.

Fig. 23. Big Miassovo Lake
Fig. 24. View of Araktaban Lake from fire tower
Photo by A. Butorin

Fig. 24

The lakes are nourished by rain, melt and ground waters. The lakes may be classified in two main groups according to the type of water exchange: running-water lakes and open lakes. The flowage has periodical character due to the fluctuation of water level. The intra-annual amplitude of water-level fluctuations is presently up to 1 meter.

In terms of the chemical composition of water, the lakes' waters are hydrocarbonate, calcium and magnesium waters of various types (Alekin O.A.). pH level is variable depending on the season, and in the epilimnion from May to September it varies from 8.0 to 8.6. The pH level and gas conditions (oxygen, carbon dioxide) are closely related to thermal conditions of water reservoirs, and the thermal conditions, in their turn, depend directly on the depth of the lakes. Other important features of the lakes are low salinity of water (0.1–0.3 g/l), the predominance of hydrocarbonate ions and rich micloelement composition of water.

Bogs cover 8% of the reserve's area. Among them, according to K.V. Gornovsky, moss bogs occupy 270 hectares, ligneous moors – 2302 ha, grass bogs – 690 ha, mixed bogs – 130 ha, peat moss treeless bogs – 120 hectares. Most of the bogs are of lacustrine origin. They are concentrated in so called «lake zone» at altitudes between 280-350 meters. They lie close to lakeshores, to the bottomes and slopes of river valleys or to wet meadows. Size and configuration of the bogs are predetermined by the terrain features. The largest bogs are those that replaced plant-filled lake bays (the bogs in the Shtannaya Kur'ya near the Lake Bolshoye Miassovo, Nyashevskoye Bog, bogs in Bitkulovskaya Kur'ya and Khalitovskaya Kur'ya of the Lake Bolshoi Ishkul).

The main features of ***rivers of the western slope*** are: latitudinal direction, steep gradient in the headwaters, gentle gradient in the lower reaches, the presence of heavy alluvial deposits of the Miass River valley in their lower reaches, large alluvial-deluvial cone at the point where the rivers run out of the ridge zone, short high-water period, and heavy rainfall runoffs.

Rivers of the eastern slope flow along both latitudinal and meridional directions; in the headwarters they deeply cut into massive-cristalline rock slopes of the Ilmensky Ridge. Their main features are nonequilibrium longitudinal profile, assimetric transversal profile, beheadings, a significant share of groundwater alimentation (condensational alimentation, in particular) and strong intra-annual fluctuations of water flow (from drying up in the summer to through-freezing in winter). Inter-lake river channels have more well-balanced longitudinal profile with gentle gradient from the upper to the lower reaches. The rivers are tortuous and meandering low flowing streams mainly nourished by lake water. Their main features are highly regulated run-off, low amplitudes of water level fluctuations during the high-water periods, close relationship between the temperatures of water in the river and in the lake from which the river is fed, relatively low altitude of river source and well-developed river valleys.

Fig. 25

There are more than 30 outlets of ***underground waters*** (springs) in the reserve's area. They are situated at different heighs (from 270,0 to 490,0 m.a.s.l.). The territory of the reserve is rich in vein waters and seepage waters. Both quartz rocks and shale rocks are water-bearing because they obtain relatively high cleavage as a result of weathering.

Within the reserve's area, where precipitation is low and evaporation is sharply increased, the salinity of subsurface waters increases and lies within 0.4–1.0 g/l reaching 4 g/l in some particular drainless hollows. As regards the chemical composition, hydrocarbonate calcium waters are common while hydrocarbonate-sulphate, calcium-magnesium and sodium-calcium waters occur more rarely. Hydrocarbonate-magnesium water is common in intrusive rocks. Highly mineralized and salty waters belong to sodium chloride type or chloride-sulphate sodium-calcium type of water. In particular zones waters with specific composition are found, containing radon and arsenites.

Fig. 26

Fig. 25.
Photo by S. Malkov
Fig. 26. Coarse-grained slide rocks of Ishkul Lake coast
Photo by A. Butorin

Climate

The Ilmenogorsky nature complex lies in the remotest part of Eurasia at the border between the Atlantic-continental zone and southern subregion of the Western Siberia's continental forest region (Alisov, 1956). Climatic parameters of the reserve's territory are largely determined by the location of the Ilmen Mountains in the shadow of dividing ridge zone of the South Urals against the warm and humid Atlantic air masses. Climatic regime of the area is formed by interchanging influence of Altantic coastal circulations of air masses dominating the East European Plain and typical Siberia continental-type circulations. Arctic air coming from the Arctic Ocean also exerts a certain effect.

Local climate is unstable in long-term dynamics; climatic regimes are contrasting for different seasons. Average yearly temperature (for the last 80 years) is +2° C. Secular amplitude of fluctuations of this parameter is 4°C while the minimum is 0.3° C (1941) and the maximum is + 4.3° C (1995). The long-term trend of annual temperature is positive (1.3° C), that can be regarded as a local (regional) effect of global warming (Gordienko, 2007). The main reason for this is the rise of winter temperatures. January is the coldest month (mean annual temperature is – 15.1° C), and the warmest is July (+ 17° C). Long-term absolute minimum and maximum are - 47° C and +38° C, respectively.

Moisture conditions, in seasonal and long-term dynamics, are not less variable than the temperature. The mean annual precipitation is about 440 mm but the yearly distribution of precipitation is disproportional (from 210 to 714 mm), with nearly equal number of dry and wet years. Summer precipitation, having its peak in July (92 mm), accounts for 47 per cents of annual precipitation. In winter months (December-February) only 11 per cents of annual precipitation come, on average.

Recurrent spring-summer droughts are typical of the reserve; their frequency is 6-14 years. Vegetation period is quite long (150-160 days). Regular positive-going zero-crossing of average diurnal temperature occurs in the third decade of March; the same crossing of the +5°C level occurs in the second decade of April. Average duration of frost-free period in the reserve amounts to 118 days, but it ranges widely (from 82 to 150 days) in different years. In the course of a year, south-westerly winds (22 %) and north-westerly winds (22 %) predominate. Average wind speed does not exceed 1.8 m/sec.

The alternation of seasons is well-defined and matches the characteristics of the continental type of climate of middle latitudes of the Northern hemisphere with simple annual distribution of temperature and precipitation. In winter season most of the time the center of the Siberian anticyclon dominates the area (January isobars - 900–1000 mbar). Snow cover is stable for 159 days when its average thickness in the open sites is 25–26 cm. The average depth of soil freezing is up to 76 cm. The lakes are covered with ice for six months a year. They thaw out by late April – the second decade of May.

Fig. 27. Ilmensky Ridge
Photo by S. Malkov

Fig. 27

In spring the area is influenced by cyclically interchanging Black Sea and Mediterrannian cyclons. South-westerly winds blow often. The change of south-westerly winds to the northerly winds causes abrupt jumps of temperature thus making the weather unstable. Intensive snow melting lasts to the mid-April. In May the influence of the cyclones reduces. The average monthly growth of temperature is 6° C. In May cold spells and heavy snowfalls are usual. On average, cold spells in sping end up not earlier than in the middle of May, but sometimes they occur even in June (- 4.5° C).

Summer is moderately humid and warm, with comparatively low atmospheric pressure. In July and August the influence of the Azore anticyclone (average monthly isobars are 968–971 mbar) becomes perceptible in the area. Westerly winds predominate in this season. Since the variations in baric conditions are smoothed out, local anticyclons periodically bring to the area the hot and fine weather accompanied by atmospheric and soil droughts.

Baric conditions in autumn are similar to those in winter. Total precipitation increases significantly from September to November. In this season the winds from west and south-west predominate. First ground frosts can be observed in early September.

In general, the moderate continental climate provides favourable conditions for the predomination of forest-type vegetation in the territory of the Ilmensky Reserve. However, mountainous relief, rugged terrain, a complicated combination of absolute and relative altitudes, frequent change of aspects and gradients of mountain slopes, the presence of large lake basins – all the abovementioned factors predetermine the high intra-landscape differentiation of microclimate, which, in its turn, together with the borderline position of the nominating territory (the border of steppe and forest-steppe zones), is a factor determining the high biodiversity of the Ilmenogorsky Mountain complex.

Soils

The pedogenesis in the region of the Ilmen Mountains develops under complex and heterogeneous conditions: predominance of massive landforms, complicated orography, diverse petrographic composition of soil-forming rocks, plant diversity and specific climatic factors act together determining significant diversity of soil mantle. There are many soil types and subtypes found within comparatively moderate-size area of the reserve. The soils of the reserve can be combined into two large categories: zonal and azonal soils. Zonal soils include chernozem, dark-grey and gray forest soils, brown mountain-forest soils, podzolic and pseudopodzolic soils (Bogatyrev, 1940). Dark-grey and grey soils covering the bottom of the mountains and thier slopes prevail over other types of zonal soils. According to the results of later studies (Abatourov, 1962; Firsova and others, 1976) brown mountain-forest soils are also common in the reserve. Dark-gray soils are usually located on the deposits of miaskits, sienits and serpentinites while gray soils are often found around granitte gneiss deposits. The development of these two subtypes of forest-steppe soils takes place in periodically dry or moderately humid forest sites. Brownified and brown forest soils have been developed in drier environment in the upper parts of gentle hillslopes.

Fig. 28. South taiga pine and birch wood
Photo by M. Kladovschikova
Fig. 29. Mixed forest
Photo by V. Surodin

Fig. 28

Fig. 29

The podzolation is localized. The spots of different subtypes of podzolic soils, first of all cryptopodzols and sod-podzolic soils are found throughout the reserve's area. They are usually located in mesorelief depressions. Bilberry pine forests grow on pseudopodzolic mountain-forest soils.

Low-degraded chernozems have thick soil profile and are rich in humus, they form a large area in the south-western portion of the reserve.

As for the azonal type of soils, the fragmentary or coarse-skeleton accumulative mountain-forest soils are the most common subtypes. They are especially typical of the mountain landscape zone of the reserve where they are found in the uppermost and the driest parts of mesorelief exposed to vigorous (intensive) weathering and denudation. These soils have thin profile (not more than 5-10 cm) and are distinguished by the prevalence of the coarse fraction over the fine fraction. They reflect the initial stages of pedogenesis under the hilltop conditions. The coarse skeleton chernozem-type soils are located on the serpentinite outcrops and there where the steppificated vegetation is well-developed.

Grassland soil type is represented by three subtypes: grassland chernozem, wet meadow and meadow boggy soils. They are located in different parts of the reserve, but mainly – on the Central Ilmensky Ridge, espessially on its eastern slope, which they encircle like an almost continuous belt covered with abundant meadow vegetation. Alkaline soils are rare and can be found only where the underground waters are rich in saline minerals or over the deposites of miaskites, which include Na-containing nepheline. Meadow bog soils are well-developed on the bottom of hollows and in closed depressions and also along the periphery of bogs.

The peat-bog and peat soil subtypes, which are different in thickness of turf layer, are also located in closed depressions. Bog formation and peat accumulation are most intensive in lake hollows and in the lowlands surrounding the lakes.

Flora

Based on the results of geobotanical zoning, the Ilmensky Reserve is situated within the Vishnevogorsko-Ilmenogorsky geobotanical district of the fore-forest-steppe pine-birch forest subzone of the Southern Taiga forest province. The subzone lies between the dark coniferous forests of dividing ridges in the west and the forest steppe of the Trans Urals peneplain in the east (Kulikova, 2005). The variegated vegetation of the reserve has been developed under the stress of complicated climatic and geological processes. The borderline position of the area (between steppe and forest-steppe zones), its rugged topography and high diversity of geological material are the main factors determining high floristic and phytocoenotic diversity of the nominated property.

Vascular Flora of the reserve includes about 953 species from 106 families and 406 genera. 56 per cents of the species belong to the 10 main families. The ratio between these families is similar to that one for the floristic composition of the Central European floristic region. The composition of the first triade of the taxonomic spectrum (*Asteraceae-Poaceae-Rosaceae*) gives grounds to identify the reserve's Flora as belonging to the *Rosaceae* type (conventional European) (Gorchakovsky and others, 2005). In the genera spectrum *Carex, Alchemilla, Potentilla, Artemisia* are prevail. It should be mentioned that the area of the Ilmensky Mountains is currently considered to be the center of local formation of *Alchemillae*. The abundance of *Potentilla, Artemisia* and *Salix* species is predetermined by relatively northerly location of the area.

Concerning the ecological composition and habitat location, the forest mesophytes predominate thus reflecting the general predominance of forest vegetation in the Flora of the reserve. Water, wetland, swamp, meadow-swamp hygromesophytes and hydrophytes are also represented in the territory due to the planty of lakes and boggy areas. Noticeable amount of forest-steppe, meadow-steppe and steppe mesoxerophytes, xerophytes and

Fig. 30. ***Pulsatilla flavescens***
Fig. 31. Alpine aster
Photo by L. Sniťko

puc. 30

Fig. 31

Fig. 32. Vernal sandwort (*Minuartia verna*)
Photo by L. Snit'ko
Fig. 33. *Scorzonera glabra Rupr.*
Photo by V. Merker
Fig. 34. Taliev thyme (*Thymus talijevii*)
Photo by L. Snit'ko

Fig. 32

Fig. 33

xeromesophytes evidences the proximity of the territory to the steppe region. Erosiophyles and rock species are scarce while synanthropic species are quite numerous.

The Flora of the Urals Region is primarily formed by non-Uralian species under the influence of the neighbouring, earlier developed, regions. The stage of relatively independent development of the Urals Flora began in the late Tertiary – early Quaternary periods, when the formation of the Ural Mountains complete. However, the Flora is rather peculiar because of the presence of endemic species (Gorchakovsky, Shurova, 1982). 25 endemic and subendemic species of the Southern Urals and Ural Mountains have been found so far in the reserve's area. In terms of ecological features they can be divided into 4 groups as follows:

The largest grope is comprised by the mountain-steppe and rock endemic species inhabiting rocky soils in the bottom and middle parts of mountain slopes and limestone outcrops on river banks. Among them are *Astragalus clerceanus* ((Iljin. et Krasch.), *Dianthus acicularis* (Fisch.ex Ledeb.), *Elytrigia reflrxiaristata* (Nevski), *Elymus uralensis* ((Nevski) Tzvel.), *E. viridiglumis* ((Nevski) Czer.), *Minuartia helmii* (Fisch), *Minuartia krascheninnikovii* (Schischk), *Oxytropis approximata* (Less.), *O.s spicata* (Pall) O.et.B.Fedtsch.), *Shivereckia hyperborea* (L.) Berkutenko), *Serratula gmelini* (Tausch.), *Silene baschkirorum* (Janisch.), *Thymus Talijevii* (Klok. et Shost.), *T. bashkirensis* (Klok. et Shost.) and some other species.

Fig. 34

Highland endemics (*Anemone biarmiensis* Juz., *Scorzonera glabra* Rupr.) grow in the upper mountains.

The group of endemics inhabiting meadows and light forests just below the alpine tundra belt includes, among other species, *Alchemilla iremelica* and *Alchemilla rhiphaea* Juz.

A small group of endemics of broadleaf forests includes *Anemone sylvestris* L. and *Cicerbita uralensis* (Rouy) Beauverd.

Many of the Urals endemic species were previously more widespread, but now are restricted to a few sites with particular edaphic conditions. In other words, the Urals Flora exhibits strong relict endemism.

The evolution of the vegetation of the Ural Mountains Region, driven by climate changes and landscape transformations, is mirrored by the distribution of relict plant species that first occupied vast areas but mostly died out later due to the impact of enviromantal changes and survived only in isolated areas, separated from the main habitat. The Flora of the reserve includes more than 40 relict species of different geological periods.

Pleistocene periglacial relicts originated from the mountains of Asia are represented by *Alopecurus glaucus* Less.

Bistorta vivipara (L.) S. F. Gray and *Pedicularis verticillata* L. are Pleistocene relict species came from the Arctic region.

The group of Pleistocene relict plants primarely inhabited light birch forests and mountain meadows of Asia includes *Cerastium pauciflorum* Stev.ex.Ser., *Geranium pseudosibiricum* J. Mayer., *Gentiana barbata* Froel, *Lathyrus gmelini* Fritsc., *Saussurea controversa* DC., *S. parviflora* (Poir) DC. and *Thalictrum foetidum* L.

The following relict petrophyte plants and mountain-steppe relicts of Asian mountainous origin came to the Urals in late Pleistocene – early Holocene: *Allyssum obovatum* (C. A. Mey.) Turcz., *Clausia aprica* (Steph) Korn.-Tr., *Orostachys spinosa* (L) C.A.Mey, *Patrinia sibirica* (L.) Juss., *Potentilla sericea* L., *Sedum hybridum* L.

Nemoral relicts, which in the first half of the Middle Holocene invaded northward, eastward and into mountainous areas, are represented by *Actaea spicata* L., *Digitalis grandiflora* Mill., *Tilia cordata* Mill., *Viola mirabilis* L.

The largest group of relict plants is steppe relicts, which presence is an evidence for the northward advance of steppe vegetation in the period of the middle Holocene thermal maximum. The group includes *Anemone sylvestris* L., *Artemisia armenica* Lam., *A. frigida* Willd., *A.a sericea* Web., *Aster alpinus* L., *Centaurea sibirica* L., *Echinops rutenicus* Bieb., *Galium verum* L., *Gypsophila*

Fig. 35. ***Siberian patrinia***
Fig. 36. ***Lichen Cladoniaceae***
Photo by L. Snit'ko

Fig. 35

Fig. 36

Fig. 37. *Cypripedium calceolus*
Fig. 38. ***Cypripedium macranthos***
Photo by L. Snit'ko

Fig. 37

Fig. 38

altissima L., *Helictotrichon desertorum* (Less.) Nevski, *Onosma simpilicissima* L., *Oxytropis pilos*a (L.) DC., *Phleum phleoides* L., *Phomis tuberos*a L., *Seseli ledebourii* G. Don fil., *Stipa pennata* L., *S. dasyphylla* (Lindem.) Trautv., *S. Zalesskii* Wilensky, *Veronica spicata* L. and other species.

The basic list of the Red Data Book of the Chelyabinskaya Oblast' includes 40 vascular plant species, among them the following species were entered also in the Red Data Book of the Russian Federation (2008): *Stipa pennata* L., *S. dasyphylla* (Lindem.) Trautv., *S. zalesskii* Wilensky, *Cypripedium macranthon* Sw., *C. calceolus* L., *Liparis loeselii* (L.) Rich., *Neottianthe cucullata* (L.) Schlecht., *Orchis ustulata* L., *O.s militaris* L., *Minuartia krascheninnikovii* Schischk., *Astragalus clerceanus* Iljin et Kraschen.

Besides the above-named species, the Red Data Book also records *Cypripedium ventricosum* Sw. and *Caulinia flexilis* Willd.. The Supplementary List of the Red Data Book of the Chelyabinskaya Oblast' includes plant species deserving special attention to their wildlife status; it contains another 15 vascular species.

Vascular Flora of the reserve is rich in useful plants including meliferous plants (138 species), forage plants (122 species), medical herbs (83 species), food plants (75 species), dye plants (79 species), adornment (68) and industrial (41) plants.

The studied ***Frondiferous moss Flora*** of the eastern slope of the Ilmensky Mountains consists of 157 species from 86 genera and 36 families belonging to 4 classes as follows: *Sphagnopsida, Polytrichopsida, Tetraphidopsida* and *Bryopsida*. The first three classes are represented by *Sphagnaceae* (1 genus and 25 species), *Polytrichaceae* (3 and 6) and *Tetraphidaceae* (1 and 1). The largest of the four classes – *Bryopsida* – includes 125 species belonging to 81 genera and 33 families. The number of moss species found on the eastern slope of the Ilmensky Mountain is 35-43% of the total number of Frondiferous mosses described for the South Urals (from 363 (Ignatov, 1993) to 450 species (Diachenko,... 2008). For comparison, there are 126 moss species found in the Visimsky Reserve, 136 species - in the Bashkirsky Reserve, 187 – in the Shulgan-Tash and 200 species found in the Basegi (Sovremennoye sostoyanije ..., 2004).

The most interesting findings made in the territory of the reserve are *Pseudocalliergon trifarium*, which is found here for the fisrt time in the Urals (Diachenko, 2001; Ivchenko, 2005), *Dicranum viride*, entered into the European Red Data Book (1995), *Aloina brevirostris, Bryum elegans, Cynodontium asperifolium, Encalypta procera, E. ciliata, Homomallium incurvatum, Tortella fragilis* and some other species that are rare in the South Urals.

According to the results of 1998-2008 scientific researches, ***the planktonic algal Flora*** of the Ilmensky Reserve and its neighbouring areas contains 626 species and subspecies belonging to 9 taxonomic groups of freshwater photosynthetic organisms: *Cyanophyta* (*Cyanoprocaryotes*) – 97 species

and subspecies; *Dinophyta* – 22; *Cryptophyta* – 4; *Chrysophyta* – 23; *Xanthophyta* – 15; *Bacillariophyta* – 196; *Euglenophyta* – 48; *Raphidophyta* -1; *Chlorophyta* – 220 species and subspecific ranks.

The algal Flora of lakes located in the Ilmensky Reserve and in the adjacent areas is mainly comprised by *Chlorophyta* (34%) and *Bacillariophyta* (31%) that is very typical of the temperate zone. Deep and clear lake waters are marked by the slight predominance of *Bacillariophyta* or by nearly equal share between *Bacillariophyta* and *Chlorophyta*. Slight predominance

Fig. 39. Pine
Photo by S. Malkov

Fig. 39

of *Chlorophyta* indicates the presence of succession-forming processes because such predominance is caused by appearance of numerous *Desmidiae* species stating the process of bogging typical for shallow lake bays.

A significant reachness of *Cyanophyta* species (16%) is observed in the nominated area; the increasing species reachness of this group of algae is typical of all surface land waters and reflects the global processes of disturbance of biogens.

About 70 per cents of the total number of species are comprised of true planctonic species while the rest are accidental planctonic species – benthonic algae and periphyton. Wide-spread species prevail. In terms of bio-environmental conditions the reserve's algae represent different groups. Thus, in terms of water salinity, indifferent spaces prevail, halophiles are of frequent occurence; desmid acidophiles (*Closterium, Staurastrum*) are common and somewhere numerous. Generally speaking, the algal Flora of the reserve's lakes is a typical algal Flora of freshwater mesotrophic lakes of the mid-latitudinal forest belt.

Ecological and geographical analysis of phytoplancton shows that the water algal flora of the lakes of the Ilmensky Reserve is basically formed by eurybionts and indifferent species of wide georgaphical range. In terms of species wealth, *Bacillariophyta* and *Chlorophyta* species prevail, that is a typical characteristic of lakes of the mid-latitudinal forest belt. *Cyanophyta* species are quite abundant. 5 groups of algae - *Chrysophyta, Cyanophyta* (*Cyanoprocaryotes*), *Bacillariophyta, Dinophyta* and *Chlorophyta* – contribute substantially to the habitus of phytoplanctonic communities of the reserve. Different types of algae determine the phytoplanctonic biomass dynamics, which are marked by 3-4 peaks per season. Sometimes the bloom of blue-green algae (less frequently – of green, dinophyte or yellow-green algae) is observed.

Vegetation

At present, forest vegetation covers about 81% of the reserve's area, meadow and steppe communities occupy 10 %, bogs – 1% and lakes –8%.

The forests are mainly dominated by the common pine (approx. 55%) and weeping birch (approx. 40 %), but the dominating species can also be the pubescent birch or European aspen, larch-tree, grey alder, black alder and lime. Almost all forests in the reserve have been disturbed by logging or forest fires. The prevailing forest types are pine forests with motley grass – grassed associations, broadherbal, moss, moss-cowberry and steppificated associations. Rough slopes with nonuniform soil layer and the upper parts of northern slopes exposed to cold winds are covered with pine-larch light forests with steppe understorey or with light larch forests. The understory of light pine and pine-birch forests is often formed by steppe shrubs and meadow-steppe grass species, some of which are relicts. There are also lichen pine forests, polytric pine forests, peat bog and bog moss pine forests

Fig. 40-41. Bogs
Photo by L.Veisman, S. Malkov

Fig. 40

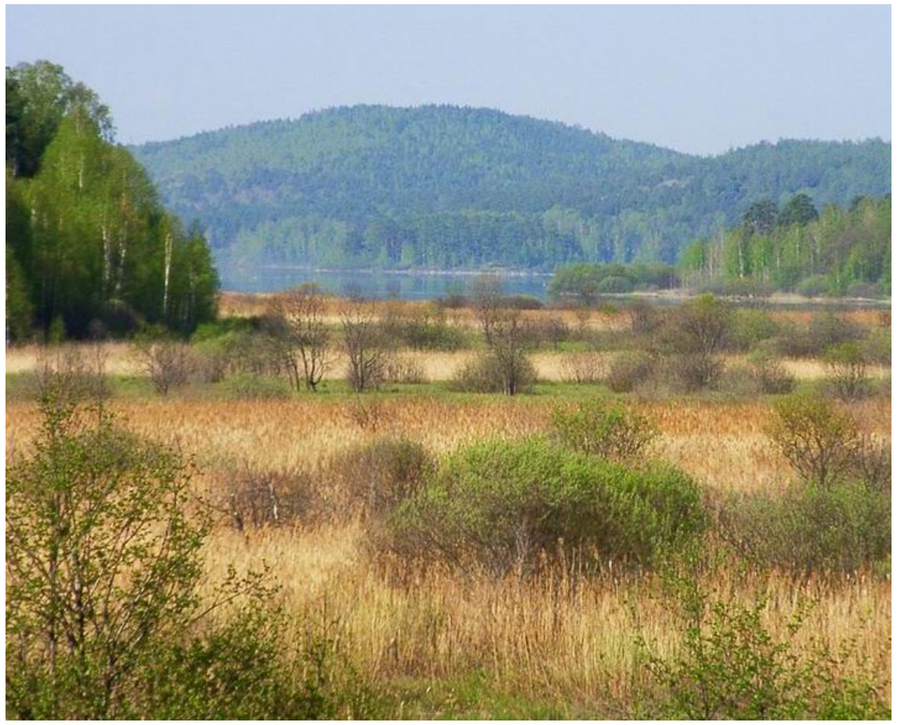


Fig. 41

in the nominated area, though they are much less common. Linden understorey occasionally occurs in wind-proofed plots of pine forests.

The weeping birch and European aspen form secondary forests with the understorey of motley grasses and gramineous plants in cutover areas. Birch forests growing on mountain slopes are significantly steppificated. They neighbor the mountain steppe sites and steppificated pineries and meadows. Piedmont areas are mainly occupied by forests of European aspen and birch trees with dense broadherbals.

On the banks of lakes and swamps and in the valleys of rivers and streams one can see forests formed by pubescent birch, weeping birch, grey alder, black alder or (occasionally) pine forests with an admixture of bird cherry and willow trees. These forests can be classified as grass-marsh and sedge-reed-peat moss forests.

Lime-tree forests with almost no grass cover can be found in hollows and on the banks of lakes located in piedmont areas.

Communities of gray and black alder with weakly developed herb layer occur in the valleys of rivers and streams, at the moor's edges and on the lake-shores. In some places, the alder, bird cherry and buckthorn form so-called uremas (riverain deciduous forest strip) with tall and dense thickets of dropwort, nettle, lady-fern and ostrich fern.

In the piedmonts there are a lot of meadows developed in the places of old cutover areas. These meadows are formed by commonly occurring meadow motley grasses including gramineous herbs (blue grass, cocksfoot grass, and bent grass), many *Fabaceae* species, buttercups, European globe flower, meadow geranium, lady's mantle, etc. The mountainous spring meadows located in hollows with groundwater outlets are also typical for the Ilmensky Mountains. In some cases, broadherbal meadows develop on the foots of mountain slopes. There is a plenty of hay meadows represented mainly by the dry motley grass meadows with a predominance of steppe and synanthropic species in the reserve.

Bogs are numerous and diverse, but small in size. Almost all of them have been developed from «aged» lakes or large lake bays. Part of them, now covered with reed and sedge thickets, are in substance yet floating mats. The bogs going through the later stages of evolution are featured by the presence of peat moss, by a certain composition of swamp shrub and grass species characteristic of the taiga bogs (bog-rosemary andromeda, Dutch myrtle, bog cranberry, marsh rosemary, *Scheuchzeria palustris, Drocera rotundifolia, Carex limosa, Salix myrtilloides,* rarer – *Rhynchospora, Drosera anglica, Rubus chamaemorus, Vaccinium*), and, sometimes, by the presence of tree species: birch and small-size «riam» pine trees. There are also small bogs of the forest-steppe type (with a predominance of various sedge species, reed and *Scolochloa*) in the nominated area.

Water and water-shore vegetation is rich and diverse in numerous and different-type lakes lying in rows along montain ridges and connected togeth-

er by channels and rivers. About 80 species of water macrophytes have been found here. Among the aero-aquatic plants, the *Cyperaceae* species, *Phragmites communis, Scirpus lacustris* are the most abindant species. *Nuphar luteum* and *Polugonum amphibium aquaticum* are the most common floating-leaf plants. As for the emophytes, they are represented by 13 *Potamogeton* species, *Myriophyllum sibiricum, Elodea canadensis, Stratiotes aloides,* charophytes and rare and endangered *Caulinia flexilis, Potamogeton rutilus, Numphaea candida, Nuphar pumila*. The macrophytes grow in shallow waters of bays and in the littoral zone of exposed shores.

Mountain steppe vegetation is an essential component of the Ilmensky Reserve's plant cover. This type of vegetation occupies arid mountain slopes having southerly aspects. Where the surface of the slopes is rough or covered with boulders the vegetation is represented by steppe shrubs (*Cerasus fruticosa, Spiraea crenata* and *S. hypericifolia*). Where the surface is rather smooth, there are grass communities composed of *Helictotrichon desertorum* and *schellianum, Stipa pinnata, Stipa capillata, Artemisia glauca* and *armeniaca, Artemisia frigida*. Such mountain steppe plant aggregations appeared in deforestated areas; they belong to the steppificated forest and meadow plant aggregations. However, there are relict primary steppe plant aggregations in the reserve, too. There is a line of low hills called «Demidovskije» westward of the Lake B. Miassovo. They are also called «serpentine hills» because they are composed of serpentinite. The substrate there is very dry and rubble, with an admixture of fine soil. The local vegetation is composed of various communities of *Koeleria cristata, Stipa capillata, Sparganium, Centaurea sibirica, Dianthus acicularis, Clausia aprica* and some other species. The steppe plant communities include many relict, rare and protected species.

Thus, the Ilmensky Reserve is important as the key specially protected area preserving the floral gene and cenosis pool. It is a sample of undisturbed and slightly disturbed plant communities of birch-pine forests of the Southern Urals, which have been significantly transformed in the neighbouring areas. The reserve protects habitats of endemic and relict plant species and of rare and endangered species listed in the Red Data Book of the Russian Federation and in the Red Data Books of the Chelyabinskaya Oblast', Kurganskaya Oblast', Sverdlovskaya Oblast' and of the Republic of Bashkortostan.

Fig. 42. Outskirts of the Ilmeny
Photo by S. Malkov

Fig. 42

Invertebrate animals

The complicated faunistic history of the South Urals in the Quaternary period and the location of the Ilmenskiye Mountains at the border between the mountainous (forest) and piedmont (forst-steppe) areas of the region predetermined the formation of communities of invertebrate animals marked by high diversity of species and the complexity of composition. Here, we can even say about the phenomenon of «richness of local invertebrate fauna of the Ilmensky Mountains».

Currently, there are 8 species of earthworms, 60 mollusc species (Khokhutkin and others, 2003), 228 species of *Arachnida* (Yesunin, Yefimik, 1996) and more than 3500 insect species (Lagunov, 2005) found in the Ilmensky Reserve. The Ilmesky Mountains provide habitat for more than the half of all Invertebrate species protected in the region.

Fig. 43. *Psithyrus*
Fig. 44. *Calopteryx virgo*
Photo by V. Snit'ko

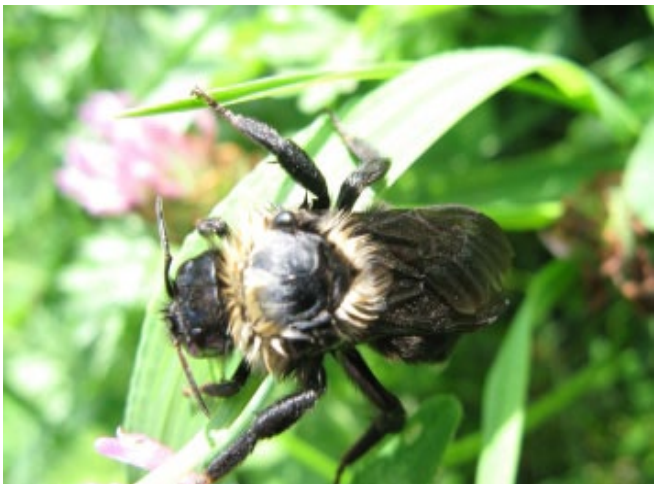


Fig. 43

Fig. 44

The fauna of ***aquatic invertebrates*** has a mixed (Euro-Asian) character. Plankton communities include both cold-water lake species from the north and warm-water pond species from the south. In recent years, the weight of southern warm-water species increases due to the climate changes. There are altogether 377 taxons of aquatic invertebrates including 19 species of *Protozoa*, 62 *Turbellaria* species, 153 *Rotifera* species, 25 ***Copepoda*** species and 36 species of *Cladocerae*, 15 - *Hirudinea*, 66 mollusc species (including a few terrestrial forms) and 20 species of other invertebrates (*Spongia, Coelenterata, Bryozoa*, oligochaetes, etc.) recorded within the reserve's area. Plenty of different-type water reservoirs, complicated relief of lakebeds and variety of hydrochemical characteristics are the factors predetermining the high biodiversity of water invertebrate communities.

The **ichthyofauna** of the reserve is representative of the most of mountain lakes of the eastern slope of the Southern Urals. Its species composition is more poor than the composition of water reservoirs of the European Russia. A total of 17 fish species (8 families), 10 of which are endemic species (*Rutilus rutilus, Perca fluviatilis, Gymnocephalus cernuus, Esox lucius, Tinca tinca, Leuciscus idus, Carassius auratus* and *C. carassius, Lota lota, Cobitis melanoleuca*) have been found in the lakes of the reserve, though almost all of them are of the roach-perch type except for the smallest and starved ones where the crucian carp is the only representative of the fish fauna. The acclimatization of new species was accidental (carp, zander, gudgeon, and ratan) or

Fig. 45. Moor frog (*Rana arvalis*) – representative of *Amphibia*
Photo by M. Kladovschikova

Fig. 45

planned (*Coregonus lavaretus, Pungitis platigaster* – as the result of fish stock replenishment in 1930-s, and the bream in 1970-s). Presently, the backbone of the local ichthyofauna is a mixture of endemic and successfully naturalized species (*Perca fluviatilis, Rutilus rutilus, Esox lucius, Gymnocephalus cernuus, Tinca tinca, Carassius auratus* and *C. carassius, Coregonus lavaretus, Abramis brama*). It looks like that some endemic species are pushed out by the aliens. For example, the ide and the burbot, earlier common in the lakes of the reserve, have become extremely rare.

Amphibians and reptiles

Currently, 5 *Amphibia* species are recorded in the territory of the Ilmensky Reserve, as follows: *Triturus vulgaris, Bufo bufo, Rana arvalis, Rana temporaria* and *Rana ridibunda*.

Triturus vulgaris is the most uncommon of them. *Bufo bufo* is more common (7% occurence among all amphibians). *Rana temporaria* mainly inhabits humid mixed forests (18% occurence). *Rana arvalis* is a large species, which is commonly found in the reserve (70% occurence). *Rana ridibunda* is an introduced species that has become common in the reserves's lakes within the last ten years.

6 reptail species occur in the reserve's area. *Coronella austriaca* is the rarest of them (sporadic occurence). *Vipera berus* and *Lacerta agilis* are rather uncommon (5% occurence each). The latter lives on stony slopes and on the skirts and meadows of mixed forests. *Anguis fragilis* has recently become little more common (approx. 10% occurence). *Lacerta vivipara* lives in various habitats. The species is widely distributed in the reserve and even abundant in certain localities (up to 45% occurence). *Natrix natrix* can be commonly seen on lake shores, in wet lowlands and on forest skirts (up to 36% occurence).

Avifauna

As of 2009, there are 179 bird species including 130 nesting and 49 migratory species in the Ilmensky Reserve.

The avifauna of the reserve is, in general, of a mixed type. Among the nesting birds, the common species predominate (63.6%), the representatives of the European type of fauna account for 24.6%, of the Siberian type - for 11.0% and of the Chinese type - for 0.8% of all bird species recorded in the reserve's area.

Terrestrial habitats of bird species are located mainly in pine, pine-birch and birch forests. The density of bird population there is various for different years (167-445; 328-509; 433-740 birds per square km). The commonly found *Fringilla coelebs, Anthus trivialis, Ficedula hypoleuca* and *Parus major* dominate over other bird species.

Emberiza rustica, Phylloscopus sibilatrix, Prunella modularis, Regulus regulus, Ficedula parva nest in the pine forests very rarely, while *Tetrao urogallus* frequently occurs (especially in winter) in such biotops. Pine forests and mixed pine-birch forests differ little in the composition of bird species, but birds are more abundant in the latters due to more complicated storied structure. Also in the mixed forest, the cavity-nesting species are represented more broadly: *Dryocopus martius, Dendrocopos major, Sitta, Phoenicurus* and *Parus ater*. The most common ground-nesting species are *Phylloscopus collybitus* and *Phylloscopus trochilus*. Light and sparse birch forests attract for nesting the following birds: *Oriolus, Hippolais icterina, Chloris chloris, Parus caeruleus*, and *Emberiza citrinella*. But the most common species there is *Anthus trivialis* (up to 20% of the bird population). These forests are the only nesting grounds of *Dendrocopos minor* and *Dendrocopos leucotos*.

Sylvia borin, Acrocephalus dumetorum, Luscinia luscinia and *Sylvia atricapilla* are the dominating species in the riverian shrub thickets.

The most common species in the meadows are *Saxicola rubetra* and *Locustella fluviatilis*. Nests of *Lanius collurio* and *Carpodacus erythrinus* can be found on forest skirts and in meadow shrubs.

Upland fowl is represented by *Tetrao urogallus, Lyrurus tetrix* and *Tetrastes bonasia*. Since there are not many habitats for *Lyrurus tetrix* in the reserve, this species became rare in the last few decades. The populations of *Tetrao urogallus* and *Tetrastes bonasia* are rather small in size: 2 and 6 birds/ sq. km, respectively.

Fig. 46. Tawny owl
Photo by V. Snit'ko

Fig. 46

There are 20 predatory bird species recorded in the territory of the reserve. Among them, *Buteo* and *Milvus migrans* are the most common; representatives of these two species use the same nest for tens of years. The estimated numbers of *Buteo* and *Milvus migrans* in the reserve are 30 and 20 nesting pairs, respectively, that is only a little more than the numbers of *Accipiter nisus* and *Accipiter gentilis* (both species are residents of the reserve). There are only few nesting pairs of *Falco subbuteo* found in the reserve. A pair of *Falco peregrinus*, after 50 years of absence, got back for nesting to the Sokolinaya Mountain.

Circus pygargus and *Circus aeruginosus* occur comparatively rarely. *Strix uralensis* is the most common species among the *Strigiformes*. *Asio flammeus, Asio otus* and *Strix nebulosa* rarely nest in the reserve. Migrating *Surnia ulula*, *Aegolius funereus* and *Glaucidium passerinum* can be seen in the reserve's area in winter period.

In spite of the abundance of lakes, the number of waterfowl species amounts to only 12 in total: *Gavia arctica, Anas platurhynchus, Anas strepera, Anas penelope, Anas acuta, Anas querquedula, Anas crecca, Aythya fuligula, Bucephala clangula, Mergus merganser, Mergus albellus, Podiceps auritus*. Among the above-mentioned species, *Anas platurhynchus, Aythya fuligula* and *Anas querquedula* are the most common while *Anas penelope, Mergus merganser, Mergus albellus, Bucephala clangula* and *Anas acuta* occur more rarely. *Anser anser* and *Cygnus olor* appear in the reserve only for their en-route stops. *Gavia arctica* breeds on deep-water lakes like Lake B. Miassovo and Lake B. Ishkul.

The water-associated *Haematopinae* are not abundant in the reserve. *Actitis hypoleucos* breeds on lake shores, and *Gallinago* and *Tringa ochropus* can be commonly found on bogs and swampy areas, which are also a habitat for *Grus grus* and *Ardea cinerea*. The local population of common crane is rather stable; the number of the birds fluctuates from 4 to 6 pairs, depending on the year.

Concerning the rare and endangered bird species, *Gavia arctica* is entered (under the Category II) into the Russian Federation Red Data Book. About 7-8 pairs of these birds nest on the lakes of the reserve. The only pair of *Haliaeetus albicilla* (Category III of the RF Red Data Book; also entered into the 1996 IUCN Red List) nest in the high pine forest on the bank of the Lake B. Miassovo for the last 15 years. *Falco peregrinus* (Category II of the RF Red Data Book), as it was mentioned above, is back to its nesting ground on the Sokolinaya Mountain. The population of *Bubo bubo* (Category II of the RF Red Data Book) is sharply decreased, compared to the 1940's, and there are only 2 pairs left in the reserve now. *Aquila chrysaetos* and *Aquila heliaca* previously inhabited the reserve's area but presently can be seen only during their migrations.

Mammals

The specific composition of mammal species in the nominated area is predetermined by the geographic location of the reserve - at the border between the forest-mountainous Urals region and the forest-steppe Trans-Urals. Theriofauna of the reserve includes 50 resident species (10 - *Insectivora*, 9 – *Chiroptera*, 2 - *Lagomorpha*, 16 – *Rodentia*, 10 – *Carnivora*, 3 - *Artiodactyla*. *Ursus arctos, Canis lupus* and *Sus scrofa* visit the reserve from time to time but do not stay there permanently.

Insectivora, 10 species: *Erinaceus europaeus, Talpa europaea, Neomys fodiens* and 7 Sorex species: *Sorex minutus, S. coecutiens, S. araneus, S. isodon, S. daphaenodon, S. tundrensis, S. minutissimus*. *Erinaceus europaeus* and *Talpa europaea* are common and widely distributed species. Among the *Sorex* species, *S. araneus* is the most abundant and can be found almost in every biotop of the reserve. It is followed, according to the population size, by *S. coecutiens*, which, however, in certain years is outnumbered by *S. minutus*. The populations of other three species - *S. daphaenodon, S. tundrensis, S. minutissimus* - are always small in size.

In 1953, *Desmana* moschata was acclimatized in the reserve's area. During the next few decades it inhabited the area around the Lake B. Tatkul but ever since, the species hasn't been observed and it can probably be regarded as deleted from the reserve's territory.

The order *Rodentia* is represented by 4 families: ***Sciuridae*** (*Sciurus vulgaris, Tamias, Citellus major*), ***Zapodidae*** (*Sicista betulina*), ***Castoridae*** (*Castor fiber*), ***Muridae*** (13 species).

Before the 1970's one could find *Pteromys volans* all over the reserve's area except the northernmost parts of it, but currently the species doesn't occur in the reserve anymore.

The local populations of *Sciurus vulgaris* and *Tamias* are small in size; isolated animals of *Citellus major* can be observed in the cenral portion of the reserve, where its boundary lies close to agricultural lands.

Castor fiber is reacclimatized in the reserve. In 1948, 22 beavers were brought from the Voronezhsky Reserve. The maximum number of beavers - 330 animals (88 settlements) - was recorded in 1968. Since 1969, the beaver population is steadily decreasing. Thus, for example, in 1980 there were 108 animals (30 settlements), in 1990 – only 64 animals (18 settlements). In the late 1990's their numbers fluctuated between 60-80.

Clethrionomys glareolus and *Apodemus sylvaticus* are the most abundant of small-size *Zapodidae* species. The best biotops for these species are valleys of mountain streams and rivers and dips among the slopes overgrown with shrubs and strewn with deadwood. Meadow mouses (*Microtus arvalis, Microtus agrestis, Microtus oeconomus, Microtus gregalis*) inhabit riparian ecotones. *Arvicola terrestris* was quite abundant before the 1960's, but now its

population is very small. Another water-associated rodent species is *Ondatra zibethicus*, which was introduced to the reserve's territory in the 1950's. This species has become widely distributed in the reserve's water basins. Settlements of *Cricetus cricetus* are located near the southern boundary of the reserve.

The ***Chiroptera*** are represented by 9 species from 6 genera belonging to the family VESPERTILIONIDAE GRAY, 1821. Six species, namely *Plecotus auritus, Eptesicus nilssoni, Myotis brandtii, Myotis mystacinus, Myotis daubentonii, Myotis dasycneme*, belong to the group of boreal species, residents of the Urals. Three other species - *Pipistrellus nathusii, Vespertilio murinus* and *Nyctalis noctula* are mesophylous, migratory species. The regional Red Data Book records 5 species: *Myotis brandtii, Myotis mystacinus, Myotis daubentonii* (Category IV: poorly studied, vulnerable species), *Plecotus auritus* (Category II: rare species, which population decreases throughout the distribution area), *Pipistrellus nathusii* (Category III: rare, vulnerable species).

In accordance with the IUCN Red Data Book, one species (*Myotis dasycneme* (Boie, 1825)) is classified as Vulnerable (VU) while 8 others are under the category «Least Concern» (LC).

The *Chiroptera* visit the reserve's area seasonally (in the period of activity from April to September) for breeding. Isolated animals of *Eptesicus nilssoni* were also observed wintering in the reserve.

Lagomorpha. *Lepus timidus* and *Lepus europaeus* commonly occur in the reserve.

The ***Carnivora*** are represented by 10 species: *Martes martes, Mustela eversmanni, Mustela sibirica, Mustela erminea, Mustela nivalis, Mustela vison, Meles meles, Vulpes vulpes, Nyctereutes procyonoides, Felis lynx*.

Martes martes is a common species, which can be seen all over the reserve's area. *Mustela eversmanni* is more frequent in the southern portion of the reserve and along its eastern boundary. *Mustela erminea* and *Mustela nivalis* are not numerous.

The territory of the reserve lies withing the area of distribution of *Mustela lutreola* – an endangered species entered into the IUCN Red Data Book and into the IUCN Red List (status: EN). Before the middle of the 20th century, *Mustela lutreola* was a common species for the Southern Urals and was frequently observed in the reserve's area. Now it doesn't occur in the reserve anymore. The last confirmed observation of this animal is dated 1985. In the 1960's, the first steps were made torwards the acclimatization of *Mustela vison*. The first observations of the animals themselves and of the traces of their presence were made in 1975 near some certain lakes of the reserve. Since the late 1980's, this species has settled in almost every lake of the reserve. Thus, just within about 10 years, *Mustela vison* firmly established itself throughout the reserve and became a «full member» ot the reserve's fauna.

Animal and plant species included in the IUCN Red Data Book and in the Red Data Book of the Russian Federation

Red Data Book of the Russian Federation

Fungi

1. *Hericium coralloides* (Scop.: Fr.) Pers.
2. *Cortinarius violaceus* (L.: Fr.) S. F. Gray
3. *Clavariadelphus pistillaris* (Fr.) Donk
4. *Sparassis crispa* (Wulfen: Fr.) Fr

Plants

1. *Stipa zalesskii* Wilensky
2. *S. dasyphilla* (Lindem.) Trautv.
3. *S. pennata* L.
4. *Cypripedium macranthon* Sw.
5. *Cypripedium calceolus* L.
6. *Cypripedium ventricosum* Sw.
7. *Liparis loeselii* (L.) Rich.
8. *Neottianthe cuculata* (L.) Schlechter
9. *Spiranthes amoaena* (Bieb.) Spreng.
10. *Orchis ustulata* L.
11 *Orchis militaris* L.
12. *Minuartia krascheninnikovii* Schischk.
13. *Astragalus clerceanus Iljin* et Krasch.
14. *Caulinia flexilis* Willd.
15. *Chara strigosa* A. Br.

Animals

1. *Gavia arctica arctica* L.
2. *Aquila chrysaetos* (L.)
3. *Falco peregrinus* Tunstall
4. *Bubo bubo* (L.)
5. *Haliaeetus albicila* (L.)
6. *Calosoma sycophanta* L.
7. *Parnassius apollo* L.
8. *Neolycaena rhymnus* Ev.
9. *Bombus mastrucatus* Ger.
10. *Bombus paradoxus* Dal.

IUCN Red Data Book

Animals

1. *Myotis brandtii* (Eversmann, 1845)
Status: Widely distributed, common species. IUCN: «LR: lc»
2. *Myotis mystacinus* (Kuhl, 1817)
Status: Widely distributed, common species. IUCN: «LR: lc»
3. *Myotis daubentonii* (Kuhl, 1817)
Status: Widely distributed, common species. IUCN: «LR: lc»
4. *Myotis dasycneme* (Boie, 1825)
Status: Widely distributed species, common in certain areas, breeding colonies in houses are vulnerable. IUCN: «VU: A2c».
5. *Plecotus auritus* (Linnaeus, 1758)
Status: Widely distributed, common species. IUCN: «LR: lc».
6. *Pipistrellus nathusii* (Keyserling, Blasius, 1839)
Status: Widely distributed, common species. IUCN: «LR: lc»
7. *Eptesicus nilssoni* (Keyserling, Blasius, 1839)
Status: Widely distributed species, common in certain areas. IUCN: «LR: lc».
8. *Vespertilio murinus* Linnaeus, 1758
Status: Widely distributed species, common in certain areas. IUCN: «LR: lc».

Relief development

The Ilmensky Mountains are the central part of the East-Ural Zone, which is considered by many scientists to be a microcontinent that collided with Tagylo-Magnitogorsky festoon islands in the Paleozoic era. This concept seems to be reasonable for certain terrains of the zone.

Based on geological features of the Ilmensky-Vishnevyje Mountains, this area can be interpreted as a post-collisional regional shear structure, which was formed in the Permian – early Jurrasic periods. In this period, due to the widespread development of brittle-ductile a deformation, a huge rock mass was transformed into various blastomylonites, including granitic, apo-syenitic and apogneissic ones. Blastomylonites host relic nucleus of primary rocks dated back to the Archean – Mesozoic era. These transformed rocks are divided into the gneissic **Selyankinsky block**, gneissic-amphibolic **Ilmen-sky block** and **Saitovsky block** mainly consisting of quartz and shale.

The Selyankinsky block is composed of garnet-biotite and sillimanite-gar-net-biotite gneisses and associated amphibolites. The block is located in the axial region of the zone and has the shape of narrow tectonic wedges. The rocks are hyper-migmatized. Metamorphism is featured by CCW (coun-terclockwise) trend. The relic garnet-pyrop-almandine associations and high-titanium biotite from sillimanite-garnet-biotitic gneisses meet the characteristics of low-temperature granulite facies and high-temperature amphibolite facies. These rocks can be dated using two clusters associated with thermal events: 1 – Early Proterozoic, the time when the basement of the platform was formed; 2 – Late Carbonic – Permian periods, the time of collision.

The rocks of the Ilmensky block are featured by heterogenic composition and belong to a wide age range from the Cambrian to early Proterozoic. There is a reason to believe that the fragments of rocks of the Ilmensky block con-tain both the rocks of ancient Precambrian basement and polymetamorphic Paleozoic volcanites.

The Saitovsky block consists of meta-terrigenous rocks, which can be defined as a quartz-shale complex of a thinned mantle of a continental margin.

Magmatic rocks lie among blastomyolites of the shear zone in the form of large rock massifs (miaskitic Ilmenogorsky and Vishnevogorsky massifs; gabbro-ultrabasitic Nyashevsky, Buldymsky massifs and the Cape Osinovy) or numerous small-size boudinaged bodies. The whole complex is composed of three rock associations: mafite-ultramafite, alkali-ultramafite, miaskite-carbonatite. These associations could form a compound central intrusion, which formation was finished in the Ordovician – Silurian periods. The re-markable fact is that the mafite-ultramafite and alkali-ultramafite associa-

tions contain Vendian-Riphean zircons characterizing the age of the protolite. The formation of such an exotic rock association was predetermind by the effect of mantle plume - a result of intensive rifting in the late Ordovician.

The inclusion of a continental margin containing a body (bodies) of alkali rocks in the Ural system probably took place in the course of the Devonian – early Carbonic collision, and its moving up to the upper crust – during the late Permian – early Mesozoic post-collisional girtwise stratching of orogenic belt. Brittle-ductile deformations in the regional shear zone were accompanied by metamorphic and metasomatic transformations performed at an average temperature of 400-500 °C and a high fluid pressure of up to 10-13 kbar. In the Mesozoic period, plastic yielding in the shear zone was replaced by brittle deformations oriented across the tectonic foliation of rocks, while the filling of cracks with residual fluid gave birth to uniquely mineralized pegmatites.

History of human activity in the nominated area

From the middle of the 18th century to the end of the 19th century, prospecting was done for gems (topaz, beryl), zircon and amazonite in small parcels of land (from a few meters to 20 meters long) in the Ilmensky Mountains. Besides, prospecting was done for the scientific purposes in some certain pegmatite lodes, too.

In 1911-1912 an expedition in search for Radium mined the Blyumovskaya mine. A total of 16 kilograms of aeschynite were produced.

In 1932 the Ilmensky Reserve extracted 1,5 tonnes of nepheline.

In 1933 the Urals Geological Survey discovered the Selyankinskoye ilmenorutile deposit –at that point in time it was the only commercial deposit of niobium in the Ural Mountains. The deposit was mined in 1934 – 1946; a total output in 1934 – 1941 amounted to **300,7 tonnes** of concentrated ore.

In 1933 the Ilmensky Reserve produced 60 tonnes of ilmenite for the Lakokraska enterprise.

In 1937 the Reserve extracted and sold to the Glavkauchuk 0,5 tonne of amazonite, 2 tonnes of nepheline, 12 tonnes of ilmenite and 200 kilograms of zirkon.

In 1938–1945 prospecting for ilmenite was done in various points of the Reserve's area. 225 tonnes of this mineral were produced as a result of exploration of the deposit found.

In 1943 the Reserve mined for feldspar for the needs of the Zlatoustovsky Metallurgical Plant (200 tonnes), mining was continued by the Turgoyakskoye Mine Group.

In 1946 the Reserve extracted 150 cubic meters of miaskite for the Staroutkinsky Plant, while the Turgoyakskoye Mine Group produced 200 tonnes of feldspar.

In the 19th century the intense utilization of forest resources of the region began.

In the southern portion of the area of a future reserve industrial forestry and forest management activities were in accordance with the relevant instructions and directives of the day, i.e. the forests were exploited on an orderly basis, while forests in the northern portion, which at that time belonged to Bashkirs, were unrestrictedly logged for cattle breeding. This difference in land use is reflected in the state of conservation of forest resources of the Reserve – currently the best forest fund is located in the central and southern portions of the Reserve's area.

Since 1942-1943 the following agencies harvested in the area of the Reserve: Zaporozhstroi, Chelyabmetallurgstroi, Chebarkulsky Garrison Barrack Services. In the middle 1930's, the Reserve's biggest swampy area – the Severo-Ilmensky peat moor marked by extensive (up to 6 meters in depth) peat accumulation was drained for agricultiral purposes. In 1947-1948 the peat deposit was developed by manual and machine excavation.

After the World War II they stopped any industrial development of the Reserve's area.

History of nature conservation

In 1912 upon a request of Academician V.I. Vernadsky the Ilmenskye Mountains were declared to be closed for private mining.

In 1919, in a board meeting of the Technical Society of the Supreme Council of National Economy (SCNE) of the Russian Soviet Federative Socialist Republic (RSFSR), the Head of the SCNE's Department of Mining N.M. Fedorovsky reported on scientific value of the Ilmensky Mountains and on the necessity to declare the Ilmens a national park just as the USA Yellowstone National Park in order to totally prohibit mining activities in the area and to preserve this natural mineralogical museum, which is absolutely unique in its richness and diversity.

On May 14, 1920, V.I. Lenin signed a decree of the Soviet of People's Comissars of RSFSR on the establishment of a mineralogical reserve in the southern portion of the Ilmenskiye Mountains.

«Considering an exceptional scientific value of the Ilmensky Mountains located in the South Urals near the River Miass and in order to preserve their natural mineral resources the Soviet of People's Comissars decrees: to authorize the People's Comissariat for Education to declare, in concert with the Department of Mining of the Supreme Council of National Economy, the selected portions of the Ilmenskiye Mountains in the South Urals near the River Miass a State Mineralogical Reserve i.e National Patrimony that is meant solely to handle scientific and scientific-technical problems of the country.

The use of the Reserve for practical purposes can be permitted only by the Soviet of People's Comissars».

On January 7, 1924, the All-Russia Central Executive Committee and the Soviet of People's Comissars of RSFSR issued a decree on the recognition and conservation of monuments of art, antiquity and nature. In this decree a reserve was defined as a land area under the total protection forever, withdrawn from any commercial use. On May 6, the same year, the Small Soviet of People's Comissars adopted a decision to integrate the Ilmensky Mineralogical Reserve into the network of scientific-research institutions of the People's Comissariat for Education. Academician A.E. Fersman was appointed as the Scientific Director of the Ilmensky Reserve.

3 Justification for inscription

Photo by V. Gubko

3a Criteria under which inscription is proposed (and justification for inscription under these criteria)

The natural complex of the Ilmensky Reserve is proposed for inscription on to the UNESCO World Heritage List under the following criteria:

Criterion (viii). *The nominated property shall be an outstanding example representing major stages of earth's history, including the record of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features;*

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 earth depths».
Academician A. E. Fersman (1928)

«The Ilmensky mountains have a global mineralogical 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 by the nature»
Gustav Rose (1829)

In mineralogical sense, the Ilmenogorsky complex is, without doubt, a globally unique geological object. It was its mineral variety that gave occasion for the creation of the world's first mineralogical reserve in the Ilmensky Mountains in 1920.

At present, there are 277 mineral species (including varieties - more than 360) found in the territory of the Reserve. Just for comparison, there are 1109 mineral species recorded within the entire territory of the Urals, 120 of them were for the first time in the Urals described in the Ilmensky Mountains. 18 new mineral species were discovered here, as follows: 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), kalium-sadanagait (1999), polyakovite (2000), makarachkinit (2005), ferriwinchite (2005).

Fig. 47. Miaskite blocks
Photo by V. Gubko

Fig. 47

The minerals of the basic systematic groups are widely represented in the Ilmenogorsky complex. They include feldspars, amphiboles, pyroxenes, mica and minerals of rare, rare-earth and radioactive elements. In particular, it has been found out as a result of special researches that the amphibole group, which contains, according to the world taxonomy, about 110 species, is represented by 38 species in the Ilmenogorsky complex (almost one third of all amphiboles known today).

The contribution of the Ilmenogorsky complex to the development of geomineralogical sciences

1. The Ilmensky minerals made a significant contribution to the studies of radioactivity when the samarium-containing samarskit was discovered in the Ilmensky Mountains in 1847. At the beginning of the 20th century, in the framework of the Radium expedition of the Russian Academy of Sciences, the specimens of radioactive minerals were collected in the Ilmensky Mountains for the scientific researches by Skladovskaya-Curie.

2. One of the most important scientific contributions of the Ilmensky Mountains is the l**aw of mineralogical (crystallographic) induction**, formulated by A.E. Fersman in the first half of the 20th century. While studying pegmatites, Fersman observed the processes described by this law in different pegmatite deposits. But the idea took its final shape during the investigation of the specimens from the Ilmensky Mountains. This is one of the fundamental laws of mineralogy, which allows to identify age relations between minerals in mineral aggregates and bodies and thus to synchronise the processes of mineral formation and to find their sequence.

3. Pegmatites are the major scientific attraction of the Ilmensky Mountains due to their plenty and diversity in this area. As a part of the studies of pegmatites, several models of their formation have been developed. Of course, not only the Ilmensky pegmatites were used in the studies; specimens from other pegmatite deposits were examined, too. But the Ilmensky minerals either played the key role in the development of a model or was an “original” (a lode or an object), which represented this or that model in the best way. According to the Fersman’s model, pegmatites were formed in cavities as a result of solution-melts decrystallization. In the 1930’s, A.N. Zavaritsky worked out a model according to which pegmatites were formed from fine-grained rocks by recrystallization accompanied by “grain” enlargement. In the 1960’s, N.M. Uspensky gave a preference to the metasomatic nature of pegmatites. In the 1970’s – 1980’s, the fourth model of the pegmatization mechanism - similar to that for the Alpinetype lodes, but in the high-temperature and high-pressure conditions with the participation of melts, fluids, gases and solutions - was developed as a result of scientific researches carried out by the research team of the Ilmensky Reserve. At the same time, a model was suggested for the development of fenite formation. That gave a deeper understanding of the alkaline processes taking place in the Imenogorsky complex.

4. Materials concerning the Ilmens were used by Zavaritsky and D.S. Korzhinsky in the development of some tenets of a theory of metamorphism.

5. In the 1970's-1980's, the scientific researches carried out by V.A. Popov resulted in the development of series of corresponding forms of mineral crystals. That was a significant contribution to the crystallographic studies. Besides, Popov compiled a crystallographic identifier basing, among other samples, on "the reachest crystallographic material of the Ilmensky pegmatites…".

6. In the current decade, the research team of the Ilmensky Reserve workes on the classification of individual groups of minerals (amphiboles, mica, pyroxenes, etc.) The findings of this investigation have provided a basis for the thorough nomenclatural analysis of minerals data stored up during the almost two-century history of geological and mineralogical studies of the Ilmenogorsky complex. As a result, the inventory of minerals of the Ilmenogorsky complex (2000) and inventories of amphiboles of the Ilmenogorsky complex (2000) and of the Urals (2004) were prepared and published. Since the above-mentioned work was a comparative analysis involving the data on the entire Urals, an opportunity emerged to compile the inventory of minerals of the Ural Mountains in 2006-2007. This work has a global significance, since it was the first time that a mineral inventory was compiled for the greatest global-scale taxon such as the fold system of the Urals.

The above facts justify the significance of the Ilmenogorsky complex as a global-scale model geological and mineralogical complex, which scientific potential seems to be far beyond the limits of the above- mentioned works.

Fig. 48. Blyumovskaya mine
Photo by A. Butorin
Fig. 49. Ettle of mine
Photo by L. Veisman

Fig. 48

Fig. 49

Table 1. ***List of Museums containing geological specimens extracted from the Ilmensky Mountains***

№	Country	Museum	Number of specimens	Remarks
1	Estonia	University of Tartu National History Museum	About 200	According to an article by E.P. Scherbakova «The Conservation of Mineral Diversity of the Ilmensky Mountains Basing on the Resources of the Science Museum of the Ilmensky State Reserve" (Abstracts of an International Symposium «Mineralogical Museums in the 21st Century", June 26-30, 2000, Saint-Petersburg) pp.136-137
2	Germany	Technische Universtat Bergkakademic Freiberg	Over 50	-/-
3	Ukraine	Kharkov State University Museum	246	According to the correspondence with the Museum's keeper, the collection includes specimens dated 1829 – 2002. List of specimens is available
4	Australia	Australian Museum	Not available	According to E.P. Scherbakova.
5	United Kingdom	The Natural History Museu, London	324 образ-ца	Web site of the Museum. List of specimens is available
6	USA	Smithsonian Institution/ National Museum of Natural History (Washington)	12	Web site of the Museum. List of specimens is available
7	Brazil	Museude Ciencia e Tcnica da Excola de Minas da Universidade Federal de Ouro Preto	Not available	Grateful letter from the Museum concerning the donation of the Ilmens specimens to E.V. Belogub
8	Bulgaria	Museum of Earth and Men (Sofia)	Not available	According to N.N. Levtsova and E.V. Medvedeva
9	Poland	Museum of the University of Silesia (Katovice, Sosnovice)	Not available	According to P. Khvorov

Fig. 50. Blyumovskaya mine
Fig. 51. Blue amazonite
Photo by V. Surodin

Fig. 50

Fig. 51

3b Proposed Statement of Outstanding Universal Value

The nominated property can be recognized as being of outstanding universal value for the following reasons:

1. Due to a great diversity of mineral species (more than 370 varieties) the nominated property is one of the key mineralogical sites of the world. Taking into account a relatively small area of the site (approx. 304 sq.km), the Ilmensky Reserve has no equal in terms of the concentration of minerals.

2. The fact that a total of 18 new mineral species were discovered in the nominated territory enhances the geological value of the property.

3. Great contribution of the Ilmensky Reserve to the development of mineralogical sciences can be compared with scientific contribution of such well-known natural phenomena already inscribed on the WH List as Grand Canyon and Hawaiian Volcanoes (USA), Aeolian Islands (Italy), etc.

Since mineralogical sites, in contrast to other geological sites (mountains, fossil sites, hydrogeological sites, etc.), remain under-represented on the UNESCO World Heritage List, the Ilmesky Reserve would become the first specialized mineralogical site of World Heritage.

3c Comparative analysis (including state of conservation of similar properties)

1. Global biogeographic framework

As of July 01, 2009, the UNESCO World Heritage List recorded 176 natural properties inadequately representing different regions of the world. For example, among all biogeographical realms defined by M.Udvardy (1982) the Eastern Palaearctic is the least represented realm with only 0.47 World Heritage sites per 1 mln. square kilometer (according to J. Thorsell, 2003). Just for reference, the dencity ratio for the neighbouring Western Palaearctic is 1.6 that is 3 times higher than for the E. Palaearctic, and the Indomalaya Realm has the maximum density rating of 2.26, as of 2003 (the situation hasn't changed much since then).

Thus, taking into account that the nominated property is located in the Eastern Palaearctic, i.e. in the most under-represented region of the UNESCO World Heritage List, the inscription of the Ilmensky Mountains looks very reasonable for the balancing of global distribution of natural World Heritage sites.

Fig. 52

Fig. 52. "Garnet hill" mine on coat of B. Miassovo Lake

Photo by A. Butorin

2. Regional context

Apart from biogeographical zonning, the following should be considered with regard to geographic location of the nominated property. The Ilmensky Mountains are situated almost in the very center of a huge area with a radius of about 1,5-2 thousand km, which includes 3 large regions of Eurasia – European Russia, Western Siberia (including the Ural Mountains dividing the two) and, in the south, Kazakhstan. In comparison to other regions of Eurasia, this area has the lowest density of natural World Heritage sites (other large Eurasian «white spots» under-represented in the WH List are Eastern Siberia and the Russian Far East, Mongolia and North-Eastern China, Mountains of Western Asia and Saudi Arabia).

This «white spot» is the biggest one on the map of global distribution of natural WH properties and is comparable in area to the Western Europe, Brazil or Australia. At present, there are only four existing natural World Heritage sites located within its boundaries: "The Saryarka — Steppe and Lakes of Northern Kazakhstan " (about 800 km southeast of the "The Ilmensky Mountains"), Virgin Komi Forests (Russia, North and Subpolar Urals; 800-1,2 thousand km north of the Ilmens), "The Western Caucasus" (Russia, Caucasus Mountains; about 1,8 thousand km southwest of the Ilmens) and "The Golden Mountains of Altai" (Russia, Altai; about 2 thousand km east of the Ilmens). The area also contains 3 prospective World Heritage sites, namely, "The Great Vasyugan Mire" (Russia, West Siberian Plain; about 1 thousand km east of "The Ilmensky Mountains"; included into the official Tentative List), "The Volga Delta" (Russia, Northern Caspian; 1,3 thousand km southwest of the Ilmens; entered into the nonofficial Tentative List) and "The Valdai Great Watershed" (North-Western Russia, 1,6 thousand km northwest of the Ilmens; entered into the nonofficial Tentative List). Besides that, there are a few natural reserves planned for the World Heritage nomination located in the far south and southeast of Kazakhstan, in the Tien Shan Mountains and in the neighbouring uplands, i.e. about 2 thousand km far from "The Ilmensky Mountains". It is, for instance, "The Western Tien Shan" transboundary site (Kazakhstan-Kirgizia-Uzbekistan).

However, one can readily see that all the above-mentioned WH properties, both existing and potential, are situated far away from the Ilmensky Mountains. In addition, they represent landscapes, which are substantively different from the landscapes of the Ilmens: rocky glacial uplands (Virgin Komi Forests, Caucasus, Altai, Tien Shan), swampy taiga lowlands (Virgin Komi Forests, Great Vasyugan Mire), steppes, meadows and salt marshes (Saryarka), a delta landscape (Volga Delta) and hilly lake-and-forest lanscape (Valdai).

The Bashkir Urals – a potential WH site (the Russian Federation) lying in the South Urals, slightly south of the Ilmensky Rerserve - is the only exception from this rule. However, in spite of the similarity of their natural landscapes (in both cases it is a low-mountainous terrain covered with south-taiga vegetation), the Bashkir Urals has no any special mineralogical value. Besides, the Bashkir Urals was already proposed for the inscription on the UNESCO World Heritage List in the 1990's, but in 1998 the inscription was rejected with reccomendations to nominate the property as a cultural landscape.

Thus, a giant area that includes a significant part of the territory of Russia (European Russia/Urals/Western Siberia) and Kazakhstan and has the Ilmensky Reserve in its center is now represented in the UNESCO WH List only by three natural properties, none of which bears even faint resemblance to the Ilmensky Mountains.

3. Thematic studies

According to the IUCN's *Geological World Heritage*: A Global Framework (2005), the World Heritage List currently contains not less than 70 natural and mixed (natural & cultural) properties having, to a greater or lesser extent, geological (geomorphological, paleontological) value. Approximately 50 of them are inscribed on the List under Criterion viii, that means that the sites are true geological phenomena. Accorging to the above-mentioned source, the thematic studies were carried out as a part of which the 70 sites were distributed into groups according to 13 key earth science themes.

The studies revealed that the most numerous types of geological sites are mountain systems, fossil sites, fluvial, lacustrine and deltaic systems (each type includes at least 20 sites). The next, little less though quite sufficiently represented, are volcanoes, coastal systems, karst structures, glaciers, reefs and atoll reefs, and some other types. Two sites comprise the group of stratigraphic fenomena and another site represents the results of the attack of an ancient meteorite.

In terms of mineralogy, the UNESCO World Heritage List does not contain any property similar to the Ilmensky Reserve (though some properties listed in *Table 2* are of particular mineralogical interest). Moreover, mineralogy was not included in the 13 key earth science themes of the Thematic studies. By now, five years after the IUCN carried out the studies, the situation concerning the geological World Heritage sites has not changed substantially. Although several new valuable geological monuments have appeared on the List since then, none of them, according to the information we have now, is marked by special mineralogical value. There are no outstanding mineralogical sites among the potential World Heritage properties included in the Tentative List, too.

Thus, the Ilmesky Reserve being the first specialized mineralogical reserve in the world since 1920 can become the first mineralogical World Heritage site and a unique member among natural World Heritage properties.

4. Comparison to similar sites

CRITERION VIII

The nominated property shall be an outstanding example representing major stages of earth's history, including the record of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features.

The Ilmensky Mountains hold a most unique position even among geological phenomena - first of all because of the diversity of mineral species (279 species, 370 species + varieties), 18 of which are newly discovered minerals.

Today, there are approximately 4,5 thousand mineral species found throughout the world, including 1,5-2 thousand of mineral species found in the territory of the Russian Federation (about 450 of which are newly discovered species). In Russia, the Kola Peninsula (North-Western Russia), Ural Mountains (Middle and South Urals, in particular), Yakutia and Kamchatka rank amongst the richest in mineral diversity.

A) Comparison to similar World Heritage properties.

Slyudyanka (the Russian Federation) is a mountainous site near the southern bank of the Lake Baikal. About 250 mineral species have been found there within the area of about 1500 sq. km (i.e. the number of minerals is comparable to that one found in the Ilmensky Mountains, but the area of Slyudyanka is five times bigger than the area of the Ilmens). Rich deposits of phlogopite and high-grade lazurite are pride of this place. In spite of that fact that officially Slyudyanka lies within the boundaries of the Lake Baikal World Heritage site, the area does not yet have any protection status that would preserve it from commercial development. Many mines are abandoned but many are still operating. The site is intensively used. There are settlements, mining enterprises and infrastructure facilities located in the area. It is well-known that the Lake Baikal is inscribed on the WH List under all natural criteria including criterion xiii (geological value).

Sinharaja National Park (Sri Lanka). Presious topaz, tourmaline, sapphire and ruby are found in the territory of the Park. However, the site is inscribed on the WH List under criteria ix and x (virgin rainforests, endemics) but not under criterion xiii. That means that the main natural value of this site is not in the presence of gem deposits.

The Banff National Park (Canada) offers its old silver mines as a showplace. There are a lot of suchlike examples among the cultural World Heritage sites: silver mines of **Rammelsberg** (Germany), copper mines of **Cornwall and Western Devonshire** (Great Britain), **Falun** copper mine (Sweden). The above-mentioned sites, however, are far from being comparable to the Ilmensky Mountains with its great wealth of various minerals and precious stones. The above-listed old mines are interesting first of all for the remnants of former mining activities bearing the impress of the old-time technology and infrastructure.

B) Comparison to similar properties included in the UNESCO Tentative List

None of the natural sites proposed for the inscription on the World Heritage List is marked by the same outstanding diversity of natural minerals as the Ilmensky Mountains. There are no properties similar to the Ilmens on Tentative Lists submitted by such countries as Brazil, USA, Canada, China, India, Sri Lanka, Republic of South Africa, Madagascar and some other countries traditionally famouse for their rich deposits of semi-precious stones and precious metals.

Of course, some of prospective World Heritage sites are of high mineralogical value. For instance, a Brazilian park Serra da Canastra situated in the state of Minas Gerais – one of the richest in gold, precious stones and diamonds regions of the New World. However, the main treasure of the park is its unique ecosystems and a high level of endemism. The place is also famous for its diamond fields (which are being developed), but we do not talk about any significant local diversity of minerals. Another example is the well-known Klondike in the Canadian Yukon, with its historical mining landscape reminding us of the gold rush of the end of the 19th century. The site is nominated for inscription on the WH List as a cultural property. The bottomless Kimberley diamond mine is another prospective cultural WH site representing a colossal installation. There are several more old mining areas among the properties included in the UNESCO Tentative List.

C) Comparison to other mineralogical sites of the Earth

Russia:

Vishneviye Mountains is an alkali rock massif in the South Urals, slightly to the north of the Ilmensky Reserve. Its geological and mineralogical characteristics are quite similar to those of the Ilmensky Mountains; in particular, the areas have the same type of terrain (low mountainous). The total area of the site is about 300 sq. km. A total of 191 mineral species have been found there including 6 newly discovered species (i.e. the number of mineral species per unit area is one and half times less then in the Ilmensky Mountains; the lists of mineral species of the two areas overlap by 75%). This is an area of intensive development containing settlements and mining industry and infrastructure facilities. The area has no protection status or a management plan.

Urals' Semiprecious Stone Belt is a site consisting of five separate clusters located in the Middle Urals (Sverdlovsk Region). Previously the site was proposed for the inclusion (though finally wasn't inscribed) in the UNESCO Global Network of Geoparks. The clusters' names are as follows: Murzinsky, Neivinsky, Sarapulsky, Izumrudnye Kopi (Emerald Mines) plus a regional-level nature mineralogical zakaznik Rezhevskoy. According to the main characteristics, two of the five clusters, namely Murzinsky (about 100 sq. km; 90 mineral species) and Izumrudnye Kopi (300 sq. km; 174 (189 – according to updated information) mineral species) bear the most resemblance to the Il-

mensky Mountains. Those two clusters, however, are habitable and populated areas with well-developed agriculture, forest and mining industries and therefore, they cannot have any protection regime. The protection regime of the Rezhevskoy Zakaznik (established in 1995) is nonstrict and allows mining, though it is restricted and is not on the same scale as it has been for the past three centuries, and tourism activities (mineralogical tours). It should be mentioned that the most common minerals in the five clusters of the **Urals' Semiprecious Stone Belt** are semi-precious stones used in jewelry, while the Ilmensky Mountains contain, besides the semi-precious stones, various radioactive and rare metals that makes the scientific value of the Ilmensky Reserve significantly higher.

The Khibinsky alkali rock massif is situated in the central part of the Kola Peninsula. Its area is 1327 sq. km. A total of 470 mineral species have been found there including more than 60 newly discovered species (i.e. the number of mineral species per unit area is about 3 times less than in the Ilmens). This is an intensively developed area with settlements, industrial facilities and infrustructure. The area has neither a protection status nor a management plan. It is featured by dissected plateau-like relief with deep river valleys and lake beds.

The Lovozersky alkali rock massif is located in the central part of the Kola peninsula. The area of the site is 650 sq.km; 340 mineral species have been found among which 60 are newly discovered minerals (i.e. the number of mineral species per unit area is 2 times less than in the Ilmensky Mountains). This is an intensively developed area with settlements, industrial facilities and infrustructure. In 2005, following a decision of the Government of the Murmansk Region, a state complex zakaznik «Seydyavvr» with the total area of 180 sq. km was established within the boundaries of the site. The main purpose of this regional-level protection area is to preserve the original Lapps culture and to facilitate its development.

Sakharioksky massif is located in the central part of the Kola Peninsula to the east of the Lake Lovozero, its area is only about 4 sq.km. The estimated number of mineral species does not exceed 50. No protection statys.

The world:

Langesund fjord - an alkali rock massif in the southwestern Norway with the total area of 5 000 sq. km; more than 60 mineral species; newly discovered mineral species - not less than 20. An industrial zone (mineral deposits).

Magnet Cove (Arkansas, USA). It covers a total area of 20 sq. km. More than 40 mineral species found. An industrial zone (mineral deposits).

Blue Mountains, Ontario, Canada. This is an alkali rock massif with a total area of about 112 sq. km. The area is an industrial zone (mineral deposits). A few dozens of mineral species have been found there so far.

Haliburton-Bankroft, Ontario, Canada. An alkali rock massif in the form of a narrow strip of 130 km long. Several tens of mineral species. An industrial zone (mineral deposits).

Table2. ***Mineral wealth of selected mineralogical sites of the world***

Site's name and location	Number of mineral species found/ newly discovered in the site	Site's area, km²	Protection status/ availability of a management plan	State of conservation of natural complexes	REMARKS:
Ilmensky Mountains (Russian Federation,South Urals, Chelyabinsk Region)	279 (including varieties – over 370) / 18	303,8	State Reserve/ Management plan is available	High state of conservation	Proposed for the inscription on the UNESCO World Heritage List (criterion viii)
Slyudyanka (Russian Federation, south of Eastern Siberia, Irkutsk Region)	250 / ?	1500	No / not available	Developed area	On the WH List as a part of the Lake Baikal WH site (1996).
Vishneviye Mountains (Russian Federation, South Urals, Chelyabinsk Region)	191/6	300 кв. км	No / not available	Developed area	
Murzinsky cluster (Russian Federation, Middle Urals, Sverdlovsk Region)	About 90	100	No / not available	Developed area	One of five clusters of a prospective Geopark «Urals' Semiprecious Stone Belt »
Izumrudnye Kopi (Emerald Mines) (Russian Federation, Middle Urals, Sverdlovsk Region)	About 170	300	No / not available	Developed area	One of five clusters of a prospective Geopark «Urals' Semiprecious Stone Belt»

Site's name and location	Number of mineral species found/ newly discovered in the site	Site's area, km²	Protection status/ availability of a management plan	State of conservation of natural complexes	REMARKS:
Khibinsky Rock Massif (Russian Federation, Kola Peninsular, Murmansk Region)	470 /over 60	1327	No / not available	Developed area	
Lovozersky Rock Massif (Russian Federation, Kola Peninsular, Murmansk Region)	340 / over 60	650	1/3 of the area is a natural zakaznik / not available	Developed area	
Sakharioksky Rock Massif (Russian Federation, Kola Peninsular, Murmansk Region)	About 50	4	No / not available	Developed area	
Langesund fjord (Norway)	Over 60 / over 20	5 000	No / not available	Developed area	
Magnet Cove (USA)	40 / ?	20	No / not available	Developed area	
Blue Mountains (Canada)	Several tens/ ?	112	No / not available	Developed area	
Haliburton-Bankroft, (Canada)	Several tens/ ?	130-km long strip	No / not available	Developed area	

Talking about the scientific importance of the Ilmensky Reserve we can say that the great contribution of this comparatively small Russian protected area to the development of mineralogical sciences can be compared with the scientific importance of such well-known geological phenomena already inscribed on the WH List as Grand Canyon (contains stratigraphic sequences that mirror the 2-billion-year tectonic history of Earth, beginning with the Precambian), Aeolian Islands (the Stromboliand and Vulcanian types of eruption were described there for the first time in the world) and Hawaiian Volcanoes (the active Kilauea volcano gives valuable information on the nature of volcanoes).

A particular advantage of the Ilmensky Mountains as a potential WH site is its 90-year conservation history (and thus the availability of a management plan). The territory of the site is thoroughly studed and preserved almost undisturbed. Its protection regime provides the total non interference in natural processes: any industrial activities are prohibited and commercial development of deposits or mining of semiprecious stones is not allowed. What is the most important is that the site contains so-called «historical pits» - rock exposures where important findings were made (the Fersman's Wall, for instance). Due to the aforesaid features the Ilmensky Mountains compare favorably with not numerous similar sites and neighboring mountain areas.

IN SUMMARY:

The nominated property can be recognized as being of outstanding universal value for the following reasons:

1. Due to a great diversity of mineral species (more than 370 varieties) the nominated property is one of the key mineralogical sites of the world. Taking into account a relatively small area of the site (approx. 304 sq.km.), the Ilmensky Reserve has no equal in terms of the concentration of minerals.

2. The fact that a total of 18 new mineral species were discovered in the nominated territory enhances the geological value of the property.

3. Great contribution of the Ilmensky Reserve to the development of mineralogical sciences can be compared with scientific contribution of such well-known natural phenomena already inscribed on the WH List as Grand Canyon and Hawaiian Volcanoes (USA), Aeolian Islands (Italy), etc.

The Ilmensky Mountains is a prospective candidate for the World Heritage status in the context of global distribution of natural World Heritage sites. The nominated property is located in the Eastern Palaearctic – a giant biogeographical realm, which is the least represented on the UNESCO World Heritage List.

The Ilmensky Mountains are situated almost in the very center of a huge area with a radius of about 1,5-2 thousand km, which includes the European Russia, the Urals, Western Siberia and the vast area of the Russia's southern neighbor, Kazakhstan. This area is probably the biggest «white spot» on the map of global distribution of natural WH properties, it is comparable in area to only a few of other regions also featured by a very low density of natural World Heritage sites (Eastern Siberia and the Russian Far East, North-Eastern Canada, Central and Western Asia, Sahara).

Since mineralogical sites, in contrast to other geological sites (mountains, fossil sites, hydrogeological sites, etc.), remain under-represented on the World Heritage List, the Ilmesky Reserve would become the first specialized mineralogical site of World Heritage.

Other tangible advantages of the nominated area are a federal protection status (state reserve) and the availability of management plan, a high state of conservation and a long history of geological studies.

Thus, the granting of World Heritage status to Ilmensky Mountains would conform fully to the policy of the World Heritage Center and to the 1994 Global Strategy for a balanced and representative World Heritage List (the best representativeness of globally unique natural and cultural heritage with the involvement of all key geographical regions of the Earth).

The statement of integrity and/or authenticity is given in accordance with the Operational Guidelines for the Implementation of the World Heritage Convention (2005).

Paragraph 88:

(a) The nominated property includes the Ilmensky Mountains - one of the easternmost mountain ranges of the South Urals. The site is an integrated natural complex, which main components are united by a common origin, history and dynamics of natural development. The property includes all elements necessary to express its outstanding universal value.

(b) The Ilmensky Reserve is of adequate size (30 400 hectares) to provide the sustainability of natural complexes and to ensure the complete representation of the features and processes which convey the property's universal significance. The availability of a buffer zone (960 hectares) provides additional guarantees of integrity.

(c) Among various forms of human activity occured in the nominated territory before the establishment of the reserve (1920) mining was the main factor of disturbance for the reserve's ecosystems. Today, previously developed mines (330 mines with more than 600 pits) and their mineral treasures serve as show-rooms of a natural geological and mineralogical museum available for observation and research by experts and students.

In 1936, a strict protection regime was established throughout the reserve's area by the Regulations of the Ilmensky Reserve, according to which any human activity that would possibly change natural environment including mining and collection of minerals, tree harvesting, logging and/or tree damage, hunting, decoying or frightening of birds and animals, taking nests and holes, egg collection, fishing, grazing, haymaking and other damage to vegetation cover, berrying, fruit harvesting and mushrooming, visiting the reserves area armed with guns, traps, cannon nets and other catching equipment, fire building, littering, and travelling out of public-access roads is strictly prohibited.

Now the nominated area is being professionally guarded as a state reserve (the highest protection status in Russia) according to the laws and regulations issued by the Government of the Russian Federation. As of 2008, the staff of the Reserve included 112 people, among them 30 security officers responsible for border surveillance and observance of protection regime.

Paragraph 90:

Biophysical processes and natural landform features of the nominated property are relatively intact. The territory of the Ilmensky Reserve is a perfect natural laboratory fully "equipped" for floristic, environmental, geobotanical and soil research to reveal the principles of natural processes running without human interference.

Paragraph 93:

The nominated property contains all the key interrelated and interdependent elements in their natural relationships. The Ilmensky Mountains hold a most unique position among geological phenomena - first of all because of the diversity of mineral species (279 species, 370 species + varieties), 18 of which are newly discovered minerals.

4 State of conservation and factors affecting the property

Ilmensky Ridge
Photo by S. Malkov

4a Present state of conservation

Since there have been no any exploration/mining activities in the territory of the Reserve for last several decades, the natural complex of the Ilmensky Mountains has recovered.

For the purposes of forestry and scientific research, the territory of the Reserve is divided into two functional areas, namely, the quiet zone (6978 ha) meant solely for research activities and the test area (23039 ha), within which restricted economic activities such as haymaking, grazing, selective cutting, fire-preventing measures are permitted for the only purpose to provide the observance of the Reserve's protection regime. The Reserve's mines are objects of special regard; they are patrolled by security officers of the Reserve. As for the quiet zone, haymaking, educational tourism and any forestry activity related to tree felling or travelling are strictly prohibited there.

The test area includes 23 cordons and the Central Base of the Reserve (47 ha), haylands (50 ha), grazing lands (266 ha), service roads and cuttings (292 ha), 3 electric power lines (77 ha, 19 km), a public highway (22 ha, 10 km) and a TV relay tower of the Chelyabinsk Regional Broadcasting Center (0,8 ha).

4b Factors affecting the property

(i) development pressure (e.g. encroachment, adaptation, agriculture, mining)

The Ilmensky Reserve is located in one of the most industrially developed and densely populated regiones of the South Urals. In its south-western part it shares a border of 24 kilometers with the territory of Miass city (the population is 180 900), which has over 50 plants emitting air pollutants. Among the main polluters are OJSC UralAS, Miass Machine Factory, Turgoyakskoye Mine Group, OJSC Miasstal'k and motor traffic that together emit up to 20 tonnes of air pollutants every year.

There are 10 community gardens located in the Miass administrative area and in immediate proximity to the Reserve's buffer zone.

In the south-east the Reserve borders a regional-level specially-protected area Kisegach Health Resort (Chelyabinsk Region) that includes 52 recreational facilities - sanatorium and spa treatment facilities, therapeutic & medical and preventive treatment facilities, fitness centers and children recreation camps, rectreation centers of different forms of ownership - functioning under the supervision of the Regional State Unitary Enterprise Chelyabinskkurort, the Ministry of Public Health of the Chelyabinsk Region and of some other official agencies. The Trans-Siberian Railroad built in 1892 and a public highway cross the Miass city and the territory of the Reserve from west to east.

The northern portion of the Reserve experiences the continual impact of emissions of the Karabashsky Copper-Smelting Plant.

Besides, there is the Chebarkulsky Fish Processing Plant situated on the bank of the Lake Maloye Miassovo near the eastern boundary of the Reserve. The plant operates in the fields of fish farming and commercial fishery and regulates the outflow from the lake.

Due to the terrain features, there are no large agricultural holdings nearby the Reserve.

In 1940-1960, efforts were made to introduce to the area of the Reserve some hunting and commercial alien species including *Castor fiber, Desmana moschata, Mustela vison, Cervus nippon, Ondatra zibethicus*. Some of the above-mentioned species, namely, *Castor fiber, Mustela vison* and *Ondatra zibethicus* have now become denizens of the Reserve.

(ii) Environmental pressures (e.g., pollution, climate change, desertification)

The results of long-term observations indicated a warming tendency for winter season and a drying tendency for summer season for the last 40 years. No pronounced responce from the biota has been observed so far in relation to these changes.

(iii) Natural disasters and risk preparedness (earthquakes, floods, fires, etc.)

The territory of the Ilmensky Reserve does not lie within an earthquake zone or inundation area. Stormy winds causing the fall of trees occur very rarely here.

Forest fires are the main danger to the Reserve due to the predominance of softwood species (larch-tree, pine-tree). Presently, all forest fires occur as a result of careless handling of fire by local people. Firefighting is a responsibility of security officers of the Reserve, for which purpose they are properly equipped with modern and effective fire-detecting devices, alerters and fire-extinguishers. The fire prevention system also includes firebreaks, mineralized fire lines, bared strips, forest roads, watch towers and water intake facilities. Cooperation for firefighting has been established between the Reserve and EMERCOM and neighboring forestries. Besides, measures are implemented to raise the awareness of local people.

(iv) Visitor/tourism pressures

The territory of the Reserve is closed for all kinds of visitors exepting students of leading Russian universities (Moscow State University, Saint Petersburg State University, Yugor State University) coming to the Reserve for their summer field practice. For this purpose, several educational routs have been developed. Anually, a total of about 100 people – students, scholars, members of environmental camps – visit the territory of the Reserve.

Table 3.

	2006	2007	2008
Number of excursions in the territory of the Reserve (excursions/participants)	5/56	7/72	7/68

(v) Number of inhabitants within the property and the buffer zone

A total of 111 residents are registered in the Reserve with 96 people living there de facto including 61 member of the Reserve's staff (including retirees) and their family members.

(vi) Other

5

Protection and management of the property

Korablik Cape on the western coast of B. Miassovo Lake
Photo by A. Butorin

5a Ownership

The territory of the Ilmensky Reserve is a state-owned property (the Russian Federation). It is governed by the Ural Branch of the Russian Academy of Sciences on the basis of operational control rights.

The Russian Federation
Moscow, Krasnopresnenskaya Embankment
Government House
Prime-Minister

The Ilmesky Reserve is a scientific institution of the Chelyabinsk Research Center of the RAS Ural Branch.

5b Protective designation (incl. legislative act(s))

The legal status of State Nature Reserve is provided under:

- The Federal Law of the Russian Federation N33-FZ dated March 14, 1995 «On Specially Protected Areas» (Annex B1);

- Decree of Soviet People's Commissary of RSFSR «... on announcement of some parts of Ilmensky Mountains on South Ural near Miass as Mineralogical Reserve», dated 14.05.1920;

- Resolution of VCIK and SNK RSFSR «On establishing of full State Reserve within the Chelyabinsk Region», dated 1.12.1935.

5c Means of implementing protective measures

Fig. 53

Fig. 53. Nyashevo cordon on B. Miassovo Lake
Photo by A. Butorin

In accordance to the Nature Conservation Laws of the Russian Federation the Security Unit was established in the Ilmensky Reserve for guarding the Reserve's area and its natural values. A total of 33 security inspectors are responsible for border control and enforcement of protection regime.

During the forest fire season (April-October) the Reserve hires temporary empoyees (watchmen on watch towers and fire-fighters). During the day and night watchs the Reserve's inspectors are frequently assisted by members of VFB (Voluntary Fire-fighting Brigades; 85 people in 2008). Inspectors, field teams and VFB members regularly patrol the protected area.

5d Existing plans related to municipality and region in which the proposed property is located (e.g., regional or local plan, conservation plan, tourism development plan)

In the framework of the *2006-2010 Regional Target Program of Nature Conservation Measures for the Enhancement of Environmental Situation in the Chelyabinsk Region* the Ilmensky Reserve participates in the following projects:

- Elaboration of a scheme of the development and distribution of specially protected areas in the Chelyabinsk Region;
- Maintenance of the Red Data Book of the Chelyabinskaya Oblast';
- Development and maintenance of a cadastre of animal and plant species, including the publication of the *Materials for the State Cadastre of Animal and Plant Species of the Chelyabinskaya Oblast*';
- Integrated environmental investigation of SPAs;
- Monitoring and control of the state of conservation of regional-level SPAs.

5e Property management plan or other management system

The 2010-2014 Management Plan for the Ilmensky Reserve is approved by the Chairman of the Presidium of the RAS Ural Branch Mr. Charushin (Annex B5). The Plan has been developed in compliance with the Plan of RAS *Fundamental Research for the period until 2025*.

Table 4. FINANCING OF THE RESERVE IN 2008

1. FEDERAL BUDGET (SUM TOTAL)	(Thousand Rubles) **38968,4 (EUR 1113383)**
ADMINISTRATIVE AND OFFICE EXPENSES (TOTAL)	**7689,5**
DEFENSIVE ENVIRONMENTAL EXPENDITURES	**6925,5**
DIRECTED FUNDS FROM Russian Foundation for Basic Research (RFBR)	205,0
OTHER DIRECTED BUDGETARY FUNDS (including targeted financing from RAS, the RAS Ural Branch and other sources)	3710,0
2. BUDGET OF THE CONSTITUENT ENTITY OF THE FEDERATION (including appropriated environmental funds)	**3305,6 (EUR 94446)**
3. MUNICIPAL (LOCAL) BUDGET (including municipal environmental funds)	-
4. REGIONAL AND MUNICIPAL EXTRA-BUDGETARY FUNDS	-
5. FOREIGN GRANTS	
WWF	-
UNDP/GEF	-
Other foreign grants (please, specify)	-
6. DOMESTIC SPONSORS	**50,0 (1429 евро)**
Banking institution	-
Industrial enterprises	50,0
Transport companies	-
Trade companies	-
Advertising agencies	-
Other commercial entities	-
Non-profit organizations	-
Individuals	-
7. OPERATING REVENUES OF THE RESERVE	**1086,8 (EUR 31051)**
Timber and woodwork sale	-
Hay sale	-
Sale of meat and fish products left after scientific work or regulation measures	-
Collection of fares for transit through the territory of the reserve	-
Collection of entrance fees	-
Collection of photographing and video shooting fees	-
Guide services	-
Hotel and camping services	-
Entrance fees to the Reserve's museum and enclosures for animals	-
Other services including transport services	-
Fishing licensing	-
Licensing of game and sport hunting	-
Fees for other use of recreational resources	-
Fees for other permitted use of natural resources	-
Sale of souvenirs, badges and printing products	-
Lease of fixed assets	173,6

Income from contractual scientific research and technical-scientific projects	92,4
Sale of agricultural goods from part-time farming	-
Income from experimental farms and nurseries	-
Fees for housing and public utilities	-
Organization of environmental field training and environmental camps	-
Other operations (organization of practical training at the Research-and-Production Base of the Reserve, etc.)	820,8
TOTAL BUDGET:	**43410,8 (EUR 1240309)**

Table 5. ***Data concerning extra financing granted to the Reserve for scientific purposes:***

2008 extra financing for research activities				
collective			individual	
Number of contractual research projects and research grants	Sum (thousand RUB)	Number of the Reserve's employees participated	Number of the Reserve's employees obtained individual grants	Sum (thousand RUB)
6	3650,6	20	1	40

5g Sources of expertise and training in conservation and management techniques

In 2008, research activities in the Reserve were carried out by 21 research officers (against 24 officers in 2007) including the Director of the Reserve, the Academic Secretary of the Reserve, Deputy Director of Science and Deputy Director of Environmental Education. Among the 21 sixteen are Candidates of Science (Annex 5 and 6).

As of 31.12.08, the staff of scientific units of the Reserve included 2 heads of the units, 8 senior researchers, 6 researchers, 2 junior researchers. Engineering and technician staff of Biological and Geological Units, the Reserve's Museum and support units consisted of 26 people including laboratory assistants, engineers, guides, collection keepers and a programmer.

Now the sources of scientific personnel are full-time postgraduate studentship and candidacy for an academic degree. Despite the number of scientific staff was reduced by 3 gone into retirement in 2008, there were no significant changes made year-on-year with regard to the staff of the scientific units because some employees were transfered to extrabudgetary positions or have got a part-time joint appointment. Currently, there is 1 full-time postgraduate student of the Institute of Ecology of Plants and Animals of the RAS Ural Branch (field of specialization: Botany) among the Reserve's staff and 1 scientific officer is a candidate for a degree. In 2008, two research officers successfully passed through their thesis examination with their thesises in the fields of mineralogy and chrystallography and ecological sciences.

Table 6. ***Staff of Scientific Units***

Number of employees						
	Researchers, including the deputy Director of Science	Hired within the accounting period	Dismissed within the accounting period	Engineers	Laboratory assistants –researchers	Laboratory assistants and other support personnel
According to the Staff List of the Reserve	21	0	3	14	0	11
Actually working	21	0	0	14	0	11
Permanent employment	21	0	0	13	0	11
Secondary employment	0	0	0	1	0	0

Table 7. ***Researchers with an academic degree***

Academic degree							
	Scientific Units		Other Units				
	Candidate of Science	Doctor of Science	Candidate of Science	Doctor of Science	Thesis examination	Including	
						Candidate for a degree	Post-graduate studentship by correspondence
Permanent employment	16	0	1	0	2	1	1
Secondary employment	0	0	0	0	0	0	0

The protection of the territory of the Ilmensky State Reserve and observation of protection regime is provided by the Security Unit comprised by 33 staff inspectors and researchers (including 6 people with higher education in the field of forestry), as of 31.12.2008. Number of patrolling tours – 25, cordons – 23.

The Security Unit, with the assistance of scientific staff, is responsible for keeping records of animals and for making phenological observations in accordance to the standards of the Nature Records program. In autumn and winter, in compliance with the approved plan, technical training and duty weapon handling training (a total of 6 lessons) were conducted for the Reserve's inspectors with the participance of scientific and technical and engineering staff of the Security Unit.

5h Visitor facilities and statistics

There are 4 excursion tours across the territory of the Reserve set out in the Regulations:
1. Blyumovskaya mine (the tour is developed by Medvedeva E.V.)
2. Mines of the Reserve's Central Base (by Medvedeva E.V.)
3. Tours to study ecology and landscapes. Ecological trail (by Snyit'ko L.S.)
4. Historic trails of the Central Base area (by Butorina L.A.).

The above-mentioned tours are annually attended by a total of about 100 people – students, scholars, members of environmental camps.

According to the statistics for 2008, 7 excursions of this kind were organized, with 68 people participated.

The total number of excursions to the Reserve's museum - 596, visitors - 62022 including 826 foreign citizens from the Ukrain, Kazakhstan, Moldova, Belarus, Uzbekistan, Germany, USA, France, Israel, Italy and Great Britain.

The museum has a lecture theater where, upon a request, one can see documentaries about the Reserve. It is also a place for lessons for schoolchildren (with the use of electronic lectures) and workshops for teachers. During the excursions to the museum such IT-developments as audio and video guides are used.

Fig. 54

Fig. 54. Museum of Ilmensky Reserve
Photo by A. Butorin

The members of the Reserve's staff responsible for excursion services prepare methodology recommendations, information for guiding general and thematic tours, texts for various guide books and reference books. They are ready to provide any relevant information and methodological advice to schoolteachers, tour guides and students.

Admission to the museum and guide service is free; the museum is open for visitors Wednesday through Sunday. To make a request or order an excursion, please call (35135) 9-18-48.

How to reach the museum: by minibus № 39 (from Poselok Stroiteley) or № 21 (from Mashgorodok) or № 8 (from Poselok Dinamo).

Virtual tour to the Reserve is possible via an automatic informational system "Ilmensky Reserve – a natural geological and mineralogical museum" where a virtual trip to the Reserve's area is available as well as a description of the Reserve's mines, lists of minerals and rocks and the list of literature concerning the Ilmenogorsky complex. The system is available at www.ilmeny.ac.ru.

The Museum of Natural Sciences has 7 exhibition halls with a total area of 2000 sq. km. It is a regional center of environmental education attracting more than 50 thousand visitors (including foreign citizens) per year.

The Reserve's officers responsible for excursion services comprise the excursion & methodology team, which included 3 members in 2008. At the peak of visitors inflow, the Reserve's collection keepers and research officers can assist in guide services.

Table 8.

	2001	2002	2003	2004	2005	2006	2007	2008
Guides	3	3	3	3	3	2	2	3
Excursions (total)	694	728	729	700	750	660	520	596
Visitors	47350	56316	51779	55281	44425	55017	42000	62022
Foreign visitors	572	701	621	748	703	703	676	826

Table 9.

Visitors from large Russian cities	2002	2003	2004	2005	2006	2007	2008
Chelyabinsk	12861	9790	11270	8944	8900	8331	12293
Ekaterinburg	1389	994	1275	1215	1200	583	1528
Magnitogorsk	582	391	601	418	410	482	1425
Ufa	349	290	336	247	240	175	312
Perm'	148	104	165	182	198	69	285
Moscow	705	85	992	753	750	742	932
Saint-Petersburg	209	196	326	215	215	186	343

Table 10.

	2001	2002	2003	2004	2005	2006	2007	2008
Developed guide's manuals and information materials prepared	3	3	4	2	2	3	2	5
Consultations to schoolteachers and tour guides	5	6	8	7	10	13	9	14

5i Policies and programmes related to the presentation and promotion of the property

Established in 1920, the Ilmensky State Reserve has a long history and wide experience in the field of environmental education. As early as 1925, it was set out in the Draft Regulations of the Reserve that «a research station to be established in the Ilmensky State Reserve for scientific investigation of the Reserve's area as well as for the development of issues of practical importance and for the organization of extensive local propaganda of nature conservation ideas».

It is said in the 2008 Regulations of the Ilmensky State Reserve [24] that: «[the Reserve] provides information, creates automatic information systems, websites, databases, software solutions to support scientific, scientific-organizational and environmental education activities; popularizes scientific and environmental knowledge, spreads the information about the results of research projects accomplished by the Reserve; provides museum and exhibition services and arranges excursions».

1. Since 1990's the Reserve is a regional center for environmental education currently performing the following educational tasks within the main target groups of population:

1. Different age groups of child population

- visitation of the Reserve's museum and selected portions of the Reserve's area;
- research projects for schoolchildren, scientific consulting to students of secondary schools;
- organization of summer environmental camps;
- organization of environmantal festivals and other environmental events;
- support of school forestries and «green» patrols;
- distance education and consulting via the website of the Reserve;
- publication of popular-scientific literature.

2. University students
- summer practices for Russian university students;
- distance learning and self-education (electronic lectures, e-books and electronic publications);
- access to scientific databases;
- lectures and lessons in the Reserve's museum.

3. Work with specialists

4. Work with other visitors:
- arrangement of thematic excursions;
- popular-science publishing;
- environmental education through mass-media;
- volunteer brigades;
- «Friends of the Reserve».

The performance of the above-mentioned tasks requires significant methodological and information support including the development and subsequent implementation of methods to adapt scientific information to the needs and demands of different population groups and to deliver the adapted information to target audience by means of exhibitional, excursion, tutoral and publishing activities. Besides that, there is a need for new IT-developments for distance environmental education and self-education. Another must is an intergated research and information system with distributed databases containing scientific data on the Ilmensky natural complex and adjacent areas.

Every unit of the Reserve is involved in educational activities based on the following distribution scheme: members of the scientific units form the scientific and factual basis by means of the creation of thematic databases and catalogues, the development of concepts and principles of description and analysis of the state of conservation of the Ilmensky natural complex and natural complexes of adjacent territories. They also maintain distance education and consulting programmes and facilitate research projects for schoolchildren and university students during the academic year and in summer camps.

Environmental education events take place mainly in the Museum of Natural Science, which serves as a visit-center of the Reserve. The museum is located in the specially constructed building with a total area of over 2500 square km, including over 2000 sq. km occupied by 6 exhibition halls on 3 floors. The museum's collection includes over 20000 specimens. The main expositions were created more than 30 years ago and they now may serve as the basis for the introduction of new exposition technologies. Two groups of the museum's personnel, namely excursion & methodology team and information publishing team, are involved into educational activities.

The staff of the excursion & methodology team conducts excursions for the above-mentioned target groups of visitors in the museum halls and in the territory of the Reserve. They elaborate methodology materials, write scenarios for environmental events, documentaries and TV programs, show electronic lectures and films in the lecture theatre of the museum and assist to collection keepers and research staff in the creation of new museum expositions and in the organization of various exhibitions. In cooperation with schoolteachers and university professors they develop and implement various study programs (cources, lessons, practical trainings), which incorporate information and materials from and about the Reserve and, in particular, the museum. The museum hosts scientific conferences and workshops for students and experts (including schoolteachers).

The information publishing team is responsible for writing and publishing scientific and popular science publications related to the Reserve (books, booklets, travel guides, calendars, etc.); team members participate in designing new expositions for the museum and make information boards and other visual information aids. In cooperation with the research staff the team creates electronic lectures, scientific and integrated databases and provides the maintenance and update of information for the Reserve's website. It also supplies the joint e-library of the Reserve and the Institute of Mineralogy with electronic versions of books and articles to enable the development of distance education and self-education. This team is responsible for the establishment of good relations with mass-media and for the distribution of relevant information to the general public through various mass-media including the Internet. The team updates the news column on the website of the Reserve, issues press-releases and news releases on the Reserve's/museum's activities and events. Team members provide information content for TV programs, magazines, specialized websites (www.museums.ru (Museums of Russia), www.oopt.info (Russian SPAs)). Another function of this team is to make photo and video shooting and to make documentaries about the Reserve. The development, maintenance and integration of new information projects of the reserve into the Ilmens automatic information system is also a responsibility of this team.

For more than 50 years the Research-and-Production Base of the Reserve is the headquarters of summer field camps for students specializing in natural sciences and of ecological camps and summer research schools for schoolchildren.

In addition to nature protection function, the Security Unit of the Reserve is charged with the tasks of building public awarness of environmental law and of raising public awarness of the problem of forest fires in the Reserve and in the adjacent areas. The unit maintains contacts with school forestries and «green» patrols.

Being a protected area with a well-studied natural complex preserved as a natural museum, which natural treasures are represented in the expositions of the scientific museum of the Reserve and can also be examined by means of virtual tours, electronic lectures and the Ilmens information system; be-

ing an institution with combined functions of a state nature reserve and a RAS research institute; having wide experience in the field of environmental education, the Ilmensky Reserve is probably one of the most successful embodyments of the noospheric ideas of V.I. Vernadsky.

The collaboration with mass-media (including electronic media) is of special importance for the presentation and promotion of the nominated property as well as for educational and information activities of the Reserve. Since 2004, daily issued press-releases are available via e-mail or can be found in the «News» column on the website of the reserve. Information concerning the Reserve is welcomed and regularly published by more than 10 national, regional and local newspapers and displayed on about 50 informational web-portals throughout the country. 3 video films (total time - 2 hours) and over 20 TV-programs were shooted in the Reserve in recent years. Long-standing partners of the Reserve are newspapers *Glagol, Yuzhno-Uralskaya Panorama, Zapovedniye Ostrova*. Features about the Reserve have been published in such well-known national magazines as *Nauka v Rossii* (2003–2004), *Vokrug Sveta* (2005), *Lazur'* (2004), *Priroda* (2006). The Reserve won the award for the best popular science article based on the outcomes of RFBR grant.

In 2005, equipment for video shooting and film editing was purchased and tested in the frameworks of a project the "Ilmensky Reserve – a geological and mineralogical natural museum". Now the equipment can be used for making news blocks for TV-companies and/or for webcasting through the Reserve's website.

The *Information analysis team* of the Reserve consists of 6 persons including the team leader, 3 senior engineers and a programmer, as of 2008. This team is responsible for rapidly developing publishing, decoration and information analysis activities of the Reserve. The Information publishing center of the Reserve has a complete printing minihouse where over 100 books, booklets and posters for the museum exhibition halls and for information boards located in the Reserve's area have been printed so far.

The partnership program supports various environmental events (festivals, actions) including those in the framework of the March of Parks project. Not less that 2 public events with 50-100 participants are arranged annually.

Thus, educational activities of the Reserve fully answer all tasks and objectives set out in directive documents. The activities cover not only the Miass city but the entire Ural Region, that gives grounds to regard the Ilmensky Reserve as the largest regional center for environmental and natural science education.

Research Activities

The staff of the Reserve includes 21 research officer, of which 16 are candidates of science. Research activities of the Reserve are based on research programs approved by the Presidium of the RAS Ural Branch. The main research trends for 2008-2012 are, as follows:

- study of structural and substantial evolution of the Ilmeno-Vishnevogorsky natural complex;
- development of a scientific basis for biodiversity conservation and efficient use of ecosystems;
- development of theory and methods of scientific collecting and exhibition of minerals, rocks and biological specimens; development of a conjugated system of databases.

The bulk of work related to environmental monitoring of the property falls within the second research trend, in particular, within a basic research project «Dynamics of processes and phenomena of the natural complex of the Ilmensky Reserve» (the Nature Records program).

Experts from other RAS scientific institutions and Russian universities also participate in research projects of the Reserve.

The Ilmensky Reserve is one of the oldest scientific institutions in the Ural Region. Today the Reserve is a state nature conservation establishment and at the same time a research institute of the Ural Branch of the Russian Academy of Science.

One of its key objectives is the study of geological and mineralogical features of the Ilmeno-Vishnevogorsky natural complex. There are about 400 mines located in the territory of the Reserve; more than 70 rocks and 268 mineral species have been identified so far including 18 newly discovered species.

A number of previously unknown mineral species were found in the territory of the Reserve for the last 25 years. Dr. of Geological and Mineralogical Scieces, Boris V. Chesnokov discovered ushkovite and svyazhinite. Three new amphibolic minerals were found by Alfred G. Bazhenov. In 1990's, Vladislav O. Polyakov discovered two minerals, one of which (polyakovite) was later named after its discoverer. In 2005, the discovery of a new mineral species named makarochkinite has been confirmed.

Researchers of the Biological Unit carry out fundamental ecological and biological studies. For instance, the unit conducts a study on *Mustela lutreola*, which is recornized as an endangered species both in the Urals and in Europe. Research officers of the unit have participated in quite a number of joint expeditions with their foreign colleagues. They elaborated documentation for the establlishment of national parks Zyuratkul' and Taganay and contributed much to the compilation of the *Cadastre of Animal and Plant Species of the Chelyabinskaya Oblast*' and the Red Data Book of the Chelyabinskaya Oblast'.

The Reserve has a nature science museum, which performs the following missions: administration and facilitation of activity of a student scientific society and of research activities of students; organization of environmental school camps; organizational and other support to the Friends of the Reserve youth movement and to volunteer brigades.

For the last 8 years the research staff of the Reserve attended more than 40 scientific conferences; about 200 thesises and articles have appeared in various publications.

5j Staffing levels (professional, technical, maintenance)

Table 11. ***Staff numbers according to units, as of 31.12.2009***:

Unit	Staff
Administration	4
Personnel office	4
Accounting office	4
Security unit	35
Museum of Natural Science	17
Geological unit	14
Biological unit	21
Production-operating service	13
Total	112

6 Monitoring

View of Ilmensky Ridge from B. Miassovo Lake
Photo by M. Kladovschikova

Table 12.

Indicator	Periodicity	Location of records
Census of animals: - En-route winter count - Count of species and numbers within different bird groups (waterfowl, forest birds, predators, *Tetraonidae*) - Census of *Cricetidae* and *Muridae* - Census of *Cheiroptera* - Census of terrestrial *Invertebrata* in sample areas - En-route count of rare insect species - Census of zooplancton life in water reservoirs of the Reserve	annually	Ilmensky State Reserve, the Nature Records annual reports
Status of plant communities and populations of rare species in phytomonitoring areas in forest, steppe, meadow and marsh ecosystems.	annually	
Status of plant communities of water and water-shore ecotops	once in 1-3 years	
Status of synanthropic vegetation around the cordons and on the shores of water reservoirs	once in 5 years	
Status of pine crops in burnt areas	once in 1-10 years	
Lake phytoplancton: count of numbers and examination of structure	annually	
Chemical composition of surface and underground waters	annually	
Metheorological parameters	year-round	
Phenological observations	year-round	
Record of forest fires and violations of protection regime	annually	
Checkup of cordons and forest patrols	annually	
Inventory of mines	annually	

6b Administrative arrangements for monitoring property

The Ilmensky State Reserve is controlled by the Russian Academy of Science (integrated inspection and audit once in 5 years). Certain nature conservation activities are controlled by the Environmental Prosecutor's Office of the Chelyabinsk Region and by the Chelyabinsk regional office of the Federal Service for Oversight in the Sphere of Nature Use (Rosprirodnadzor). Address: 75, El'kina Str., Chelyabinsk, the Russian Federation. Tel/Fax: +7 (351) 237-81-74.

Monitoring of the nominated property is carried out by the staff of the Reserve. They implement an extensive annual program of intergated studies on the structure and dynamics of the Ilmensky natural complex as well as make comprehensive assessment of current state of conservation of the nominated site. The results of monitoring are reported in scientific publications and contained in the Nature Records kept since 1927.

6c Results of previous reporting exercises

Geological monitoring

The first description of the Ilmensky mines was made by I. Menge in 1825.

In 1834-1838 the description of mines was a responsibility of «Coloured crews». In their reports the mines were for the first time numbered based on the development object.

In 1858, I.I. Redikortsev produced a map containing the consecutive numbering of mines (from 1 to 56) and indication of minerals.

In 1877, I.V. Mushketov published a petrographic map of the Ilmensky Mountains representing, inter alia, the distribution of mines.

In 1882, the work Ilmenskiye mineral'nyje kopi (The Ilmensky mineral mines) by M.P. Melnikov was published in Gorny zhurnal (The Mining magazine). The work included a map with plotted mines No 1 - 87. This numbering has applied to the present day.

The first instrumental snapping of mines outlining their contours was made by L.A. Kulik in 1910. Based on this information, D.S. Belyankin produced a petrographic map of the Ilmensky Mountains showing 111 mines.

The numbering continued as new mines were open: A.N. Zavaritsky (1939) described 149 mines; B.A. Berezina (1937) – 160 mines and T.I. Ustinova (1938) – 172 mines.

In 1939, T.I. Ustinova made an inventory and description of mines located in the northern portion of the reserve (mines from No 302 to No 392 and further).

Fig. 55

Fig. 55. Granite and pegmatite mine № 232. New mineral – Ushkovit, and the biggest crystal of beryl were found here in some 1980-th

Photo by A. Butorin

The complete inventory was made in summer 1973 by mineralogists V.A. Popov and T.P. Nishanbayev. The inventory covered mines 1-232 and 300-408. In 1974-1978, the results were updated since 27 new mines were open within this period in the central and northern portions of the reserve (mines 233-255; 298; 385-1; 409). At that point of time, the total number of mines was 367.

The most recent inventory was made by S.N. Nikandrov and J.S. Kobyashev in 1996-2006. Now the staff of the Geological Unit of the reserve is engaged in the GPS snapping of mines and annual inspection of mines for new samples to be analyzed. The findings of mineral studies are to be annually reported in the Nature Records.

Year 2008

1. Analysis was performed of author's data on the composition of pyroxenes recovered from three genetically different types of minerals found in the territory of the Ilmensky State Reserve: banded amphibolite (mine No 50); pyroxene-feldspar syenite (mine No 110); subporphyritic nepheline-hastingsite syenite («sandyite», watershed area of the Ilmensky Ridge, compartment 186).

2. Morphological and chemical properties of pyrochlore and columbite were established in the course of the studies of mineral associations of the Selyankinsky ilmenorutile deposit (mine No 158).

3. The integrated data on the composition, structure, zoning and minerogenesis conditions of hyalophane (mine No 199) and pyroxene were obtained in the course of studies of scapolite-containing rocks of the Ilmenogorsky complex.

Year 2007

1. A new high-natrium amphibole belonging to the nyboite – ferrinyboite series was for the first time discovered within the Ural fold system; two rare minerals, namely, georceixite (mine No 200 (Baritovaya)) and ferri-ferro-baroisite (mines 235 and 400) were for the first time found in the territory of the Ilmensky Reserve.

2. In the Ilmenogorsky complex, calcium garnets were found including grossular-almandines, almandine-grossulars, andradite-grossulars and grossular-andradites that together represent a full line of garnets based on the calcium content (Ca-comp=38–94, including Gross=19–66 and And=1–79 mol.%). Their formation was performed at a wide range of temperatures (170–740 °C) and pressure (1≥11 kbar) and was a result of metasomatic-metamorphic processes in the regional shear zone. Almandine-grossulars ($Py_{3–12}Gross_{43–66}And_{1–6}$) from garnet-pyroxen-amphibole-anortite blastoclasite-blastomylonites associated with serpentinites are comparable to garnets from high-pressure rocks of hyperpressure complexes of the Alps and some other regions.

3. Five types of mineral aggregates were classified according to their mineral composition in the Selyankinsky ilmenorutile deposit (mine 158). These are ilmenite-ilmenorutile, pyrochlor-ilmenite-ilmenorutile, hematite-ilmenite, pyrochlor-hematite-ilmenite, pyrochlor-columbite-hematite-ilmenite.

Year 2006

1. The complete report on minerals discovered in the Ural Mountains within the period of geological and mineralogical studies and industrial development of this region from the beginning of the 18th century to and including the year 2005. The report contains the complete list of mineral species (1084) and main varieties (405) found in the Urals, as of 01.01.2006.

2. The presence of hyalophane and jarosite in the territory of the Ilmensky reserve was confirmed. Hyalophan was found in the mine No 199 in an amphibole-plagioclase-pyroxene-garnet-scapolite rock. It was defined as a late mineral of scapolite-containing rocks of the Ilmenogorsky complex.

Jarosite was found in the mine No 158. It appeared in the zone of oxidation of pyrite-containing pyroxene syenite pegmatites.

Biological monitoring

Year 2008

1. The continuation of inventory of flora and fauna of the Ilmensky Reserve and areas of the South Urals adjacent to the Reserve's territory. The following results were obtained:

– A species of turbellarian worms, *Gieysztoria triquetra*, that was previously not found in Russia, was discovered in the territory of the Ilmensky Reserve. Before that, it was thought that the species occurred only in the Cenral and South Europe and Eastern Asia. Now it has been established that the geographic range of the species is extended considerably and that it is not disjunctive but continuous.

– As a result of the inventory of *Ichneumonidae, Hymenoptera*, 37 species previously not known in the Ilmensky Reserve were found; 23 of them have never been found before in the Chelyabinsk Region and 21 – in the Urals.

– Based on the results of inventory of records related to *Characeae*, the presence of 9 *Characeae* species in the reserve's area was proved; 2 of them have never been recorded before in the Chelyabinsk Region.

– The fact of nesting of *Strix nebulosa* – a species included in the Red Data Book of the Chelyabinsk Region - was recorded for the first time in the Reserve's history.

2. As a result of the studies on the structure and composition of moss layer, the classification of briosynusia was elaborated based on growth forms of frondiferous mosses.

3. Phytocoenotic distribution of rare *Orchidaceae* species inscribed on the Red Data Book of the Chelyabinsk Region was evaluated. The ecological optimum for 15 *Orchidaceae* species in plant cenopopulations reaching their maximum size was defined. These communities are marked by high species diversity.

Among 5 geobotanical zones of the Ilmensky Reserve, the highest diversity of *Orchidaceae* species (18 species) was observed in a bridging zone between the piedmont and mountain zones, that can be explained by the mitigating effect of lakes on local climate conditions.

4. Based on the results of long-time studies on phytodiversity of coastal and wetland communities involved in bog formation in lakes of the Ilmensky Reserve, it was found that in the course of succession of coastal vegetation, when moving to climax, the values of α_3, beta-diversity and gamma-diversity run down (due to the averaging of ecological factors), while discreteness and stability of the community increase.

5. Studies on the influence of ground fires on the formation of understory in sample areas for forest pyrologycal monitoring.

Based on findings of the detailed analysis of vegetation in 6 topoecological profiles with different fire load, the growth of $\alpha_{н}$ and $\alpha_{тк-м}$-diversity and of the range of their variation from ТЛУІ to ТЛУІІІ has been established. The plant aggregations with longer period of fire recovery are featured by higher α-diversity.

6. The first detailed investigations of spatial and temporal characteristics of invertebrates inhabiting herbaceous layer of different types of vegetation in the territory of the Ilmensky Reserve. Data were obtained on the structure, composition and dynamics of herb-inhabiting *Invertebrata* communities. Besides, the causes of diurnal fluctuations in numbers of herb-inhabiting *Invertebrata* were found: this phenomenon is based on vertical migrations of those species which can migrate from a layer to layer, as well as on activity rhythms of species – permanent residents of herbaceous layer and on the use by them of various refugiums in the period of inactivity. The ratio of spatial components of variability per temporal ones for herb-inhabiting *Invertebrata* was estimated. It was found that the biotope differences of *Invertebrata* population significantly exceed the temporal differences, and that the diurnal variability is comparable to the seasonal variability.

7. It was established that ground waters of the northern portion of the reserve, which are marked by high concentrations of hydrocarbonates and by a carbonate barrier, are featured by high buffering capacity against polluting agents. High concentrations of Eh-determining and pH-determining components increase the buffering capacity of the Reserve's water. The formation of various hydrochemical types of ground waters in the central and south portions of the reserve is caused by the cation exchange processes. New types of ground waters appear in conditions of slow water current and long time interaction with colloid-containing rocks featured by considerable proportion of fine fractions, in particular, clay particles.

7 Documentation

Bedding rock outcrops near the Baraus Lake
Photo by A. Butorin

LIST OF VISUAL ANNEXES
AND
FORM FOR PHOTO- AND AUDIOVISUAL MATERIALS

№	Format (slide / photo/ video)	Title	Date (month, year)	Photographer/ Production manager	Copyright holder (if differ from photographer / Production manager)	Contacts of Copyright holder (name, address, phone/ fax, e-mail)	Not exclusive transmission of rights

7b Texts relating to protective designation, copies of property management plans or documented management systems and extracts of other plans relevant to the property

Copy of orders, resolutions and management plans for property stand in Annex B.

B1. Extract from Environmental Protection Act, dated 14.03.1995, №33-FZ.
B.2. Decree of Soviet People's Commissary of RSFSR "... on announcement of some parts of Ilmensky Mountains on South Ural near Miass as Mineralogical Reserve", dated 14.05.1920.
B.3. Resolution of VCIK and SNK RSFSR "On establishing of full State Reserve within the Chelyabinsk Region", dated 1.12.1935.
B.4. Regulation of the RAS Ural Branch Ilmensky State Reserve named after V.I. Lenin, dated 25.11.2008.
B.5. Management Plan of of the RAS Ural Branch Ilmensky State Reserve named after V.I. Lenin.
B.6. Letter of Chelyabinsk Region Governor on viability of "The Ilmensky Mountains" inscription on the UNESCO WH List, dated 20.12.2007.

7c Form and date of most recent records or inventory of property

1. Annual report *Nature Records 2008* (Miass city, 2009)

2. 2008 Report on research, research-organizational and environmental activities of a scientific research and nature conservation institution of the Russian Academy of Science *the RAS Ural Branch Ilmensky State Reserve named after V.I. Lenin* (Miass city, 2009)

3. 2008 Information report by the Director of *the RAS Ural Branch Ilmensky State Reserve named after V.I. Lenin* to the Russian Ministry of Nature Conservation (Miass city, 2009)

4. 2008 International activities report of a state research institution *the RAS Ural Branch Ilmensky State Reserve named after V.I. Lenin* (Miass city, 2009)

5. 2008 Annual cadastre data concerning a specially protected area *the RAS Ural Branch Ilmensky State Reserve named after V.I. Lenin* (Miass city, 2009)

6. 2008 Comprehensive report on the state of environment of the Chelyabinskaya Oblast'. (Chelyabinsk, 2008).

7d Address where inventory, records and archives are held

The Russian Federation, Chelyabinskaya Oblast', 456317 Miass, Ilmensky State Reserve.

The Russian Federation, 620041 Ekaterinburg, GSP-169, Pervomaiskaya Street 91. Presidium of the RAS Ural Branch.

7e Bibliography

100 titles of more important Russian and foreign publications about Ilmensky Reserve are in Annex D.

& Contact information of responsible authorities

Photo by L. Veisman

8a Preparer

1. Valizer P.M.
Director of the Ilmensky State Reserve
The Russian Federation, 456317 Chelyabinskaya Oblast', Miass, Ilmensky State Reserve
Tel: +7 3513 591900
Fax: +7 3513
E-mail: valizer@ilmeny.ac.ru

2.Snit'ko V.P.
Deputy Director of Science
The Russian Federation, 456317 Chelyabinskaya Oblast', Miass, Ilmensky State Reserve
Tel: +7 3513 591848
Fax: +7 3513
E-mail: snitko@ilmeny.ac.ru

3.Gubko G.V.
Deputy Director of Environmental Education
The Russian Federation, 456317 Chelyabinskaya Oblast', Miass, Ilmensky State Reserve
Tel: +7 3513 591848
fax: +7 3513
E-mail: gvgubko@mail.ru

4. Treskin P.P.
Academic Secretary of the Ilmensky State Reserve
The Russian Federation, 456317 Chelyabinskaya Oblast', Miass, Ilmensky State Reserve
Tel: +7 3513 591551
Fax: +7 3513
E-mail: valizer@ilmeny.ac.ru

5. Nikandrov S.N.
Head of Geological Unit of the Ilmensky State Reserve
The Russian Federation, 456317 Chelyabinskaya Oblast', Miass, Ilmensky State Reserve
Tel: +7 3513 591551
Fax: +7 3513
E-mail: nik@ilmeny.ac.ru

6. Dubinin A.E.
Senior Security Officer (Senior Inspector) of the Ilmensky State Reserve
The Russian Federation, 456317 Chelyabinskaya Oblast', Miass, Ilmensky State Reserve
Tel: +7 3513 591551
Fax: +7 3513
E-mail: dubinin.aleks@mail.ru

7. Maxakovsky N.V.
Senior Scientist of the Russian Research Institute for Cultural and Natural Heritage, Moscow.
The Russian Federation, 129366 Moscow, Kosmonavtov Street, 2
Tel: +7 495 686 13 19
Fax: +7 495 686 13 24
E-mail: maxakovsky@mtu-net.ru

8. Butorin A.A.
The President of the Natural Heritage Protection Fund
The Russian Federation, 125212 Moscow, Vyborgskaya Street, 8-3
Tel: +7 499 150 92 93
Fax: +7 499 150 92 93
E-mail: info@nhpfund.ru

9. Kladovschikova M.E.
Executive Director of the Natural Heritage Protection Fund
The Russian Federation, 125212 Moscow, Vyborgskaya Street, 8-3
Tel: +7 499 150 92 93
Fax: +7 499 150 92 93
E-mail: kladovschikova@nhpfund.ru

10. Petrovskaya E.V.
Designer of the Natural Heritage Protection Fund
The Russian Federation, 125212 Moscow, Vyborgskaya Street, 8-3
Tel: +7 499 150 92 93
Fax: +7 499 150 92 93
E-mail: petrovskayaekaterina@yandex.ru

8b Official Local Institution/Agency

Presidium of the RAS Ural Branch. The Russian Federation, 620041 Ekaterinburg, GSP-169, Pervomaiskaya Street 91.

Presidium of an institution of the Russian Academy of Sciences the RAS Ural Branch Chelyabinsk Research Center. 620041, The Russian Federation, Chelyabinsk, Kommuny Str., 68.

Ministry for Radiological and Environmental Safety of the Chelyabinsk Region. 620041, The Russian Federation, Lenina Avenue, 57.

8c Other Local Institutions

1) Presidium of the RAS Ural Branch. The Russian Federation, 620041 Ekaterinburg, GSP-169, Pervomaiskaya Street, 91.

2) Presidium of an institution of the Russian Academy of Sciences the RAS Ural Branch Chelyabinsk Research Center. 620041, The Russian Federation, Chelyabinsk, Kommuny Str., 68.

3) Ministry for Radiological and Environmental Safety of the Chelyabinsk Region. 620041, The Russian Federation, Lenina Avenue, 57.

4) School Forestry. 456300, The Russian Federation, Chelyabinskaya Oblast', Miass city, Novoandreevka village.

8d Official Web address

http://igz.ilmeny.ac.ru

9. Signature on behalf of the state party

Head of the International
Cooperation Department,
Ministry of Natural Resources and
Environment of the Russian Federation