

## Amber origin

<http://www.ambermuseum.ru/museum/building>

The first scientist who set out to prove that amber is fossilized resin of trees was the Roman writer Plinius the Senior. He noticed the resin smell and the smoky flame that were coming out when the amber was burning. He also noticed that one could find solidified insects and parts of plants in the transparent amber.



Later the German scientists tried to dispute this conclusion. Thus, for example, a well-known naturalist George Agricola (16th century) proved that amber was formed in the interior of the Earth from liquid bituminous matter that fossilized when flowing out onto the Earth's surface. In the early 18th century some scientists claimed that amber originated when oil combined with mineral acids.

Amber was well known in Ancient Russia. It was called alatyр or latyr-stone and it was ascribed miraculous powers. M.V. Lomonosov in his work «The first basics of the mining science» (1742) and «On the origin of metals as a result of earthquake» (1757) gave new arguments in favor of organic amber origin.

It is generally recognized today that the Baltic amber (whose international mineralogical name is succinite) is the fossilized resin of trees, mainly coniferous ones, that grew on the vast territory of the southern part of the Northland and bordering areas of the modern Baltic sea. Approximately 45-50 ml years ago the climate grew considerably warmer and more humid that favored rich vegetation. Bay-trees and Eugenia trees as well as palm trees and lianas were widely spread along with deciduous lime-trees, maples, oaks and chestnuts. The climate change brought about abundant resin flowing. The resin was oxidized by the air, it was covered with thick dark brown crust and in this state it accumulated in the soil of «the amber forest». The rivers and brooks gradually washed out hardened clods of resin from the ground and carried them into the estuary of a big river that flew into an ancient sea on the area of the modern Kaliningrad peninsula. This is how the largest in the world Palmniken amber deposit formed. Approximately two million years ago a huge glacier shifted the Earth's layers including the amber-carrying deposits of the Eocene period to the bottom of the Carpathian mountains, that resulted in the formation of the secondary (quaternary) amber deposits. At present amber is found on the whole of the vast area that used to be covered by the glacier.

## Physical and chemical qualities of amber

Amber differs in shape, colour and the degree of transparency. The shape of an amber piece was determined by where the oleoresin was flowing from. It was going on either inside or on the surface of the trunk of a damaged tree. In case of the abundant discharge the resin was flowing down as drops, icicles, inleakages. In the collection of the Kaliningrad Amber Museum the largest drop is a little larger than 5 cm in diameter. But there are also larger pieces elsewhere – of the size of a goose-egg. The length of icicles is 10-12 cm. Small lensing and falcated stones probably appeared in the «resin pockets» that were formed in the bags between the annual rings of trees. Traces of a tree texture can often be seen on the fossilized amber pieces here. The location of resin between the trunk and the bark resulted in the formation of the subcortical forms. The pattern of the wood or the bark can be well seen on them. Pieces that appeared in large subcortical bags can weigh up to two kilograms. Even larger samples of amber appeared in the spots of large open wounds on the tree trunk. The resin kept flowing for a long time and accumulated in the ground. The largest of all the known samples of succinite is kept in Berlin and weighs 9 kg 750 g. The Russian giant from the collection of our Museum is much smaller -- 4 kg 280 g.

The intensity of the coloration, the degree of transparency or non-transparency of the gem depend to a great extent on the microscopic cavities that can be found in every stone, on their number, size and location. The following varieties of amber are distinguished: transparent in which one can find isolated cavities, semi-transparent in which there are large clusters of cavities that lead to haziness (cloudy, hybrid), and non-transparent (bone and foamy) where the amount of cavities can reach 900 000 per 1 cubic meter.

The nature endowed amber with incredible richness of colors. There are bright yellow, reddish pieces reminding of a tongue of flame, as well as «honey» pieces. There are also «cloudy» pieces – they are sort of hazed with fleecy clouds. One can also find amazingly beautiful amber pieces of blue and green shades.

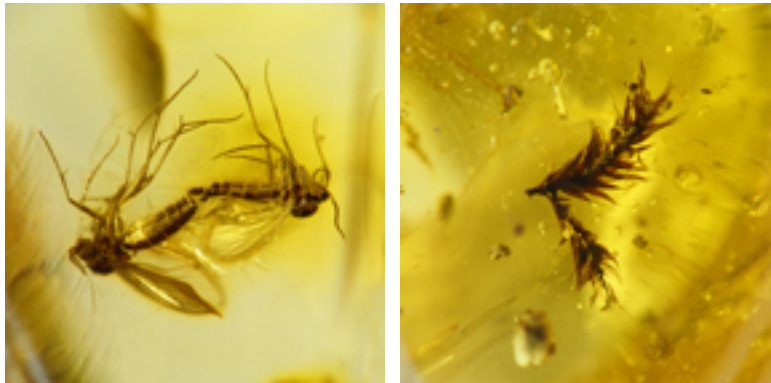
Amber is heterogeneous in its composition. Its basic ingredients are carbon (approximately 78%), oxygen (11%), hydrogen (10%). The following formula of amber as a mineral is usually given – C 10 H 16 O.

The Baltic gem is a relatively soft stone: it can be scratched with a knife. The amber hardness according to the Mohs' scale ranges from 2 to 3. To compare: the hardness of gypsum is 2, quartz is marked 7, diamond has the degree of hardness of 10. The amber is brittle, it can be easily broken if hit or if it falls down, but at the same time it is pliant. And this is a very valuable quality thanks to which the stone can be easily treated. Amber can be sawed, cut, drilled, ground and polished. When heated it first grows soft and then melts at the temperature of 315-350C. This quality is used when heating and pressing amber. Amber is able to oxidize under the influence of the oxygen in the air.

### **Inclusions in the amber**

Amber possesses an astonishing quality: for dozens of millions years it can retain unchanged small animals, especially insects and Arachnida, as well as vegetative remains that have been called inclusions. They are rarely found. The scientists have calculated that not more than 10% of the transparent amber contains inclusions. Amber pieces with inclusions have always been of great value. It was Aristotle who

first mentioned them in his works. In Ancient Rome they learned to skillfully forge them, and researchers were only able to identify forgery in the 19th century. Amber with inclusions was sometimes kept in the monarchs' treasury. The Polish king August II the Strong (1670-1733) owned a huge collection of amber with various animal inclusions. The largest pre-war collection was kept in Koenigsberg and contained approximately 100 items.



Our Museum houses more than 3000 samples of amber pieces with inclusions. They have been studied by the specialists of the Institute of Paleontology of the Russian Academy of Sciences V.V. Zherikhin, I.D. Sukacheva, A.G. Ponomarenko, V.G. Kovalev, K.Yu. Yeskov and a specialist of the Zoological Institute of the RAS A.R. Manukyan.

Inclusions can only be found in the external excretion of the oleo-resin – in the icicles and leakages. An insect's getting and retaining in the amber piece was also conditioned by the size and viscosity of the excreted oleo-resin. Flies, mosquitoes, ants, beetles, spiders that stuck to its surface were coated with a second and a third leakage. Larger insects, let alone amphibious, escaped from the resin captivity leaving behind some parts of their bodies, usually extremities. The collection of the Koenigsberg University used to house a little lizard. Several similar items with different states of preservation have been discovered recently.

Approximately 90% of the animal inclusions in the collection of our Museum are insects. Among them more than a half are dipterous: mosquitoes, flies. Quite often one can find caddis flies. They look like moths, they have numerous antennae, large complex eyes and long legs. Our collection also includes representatives of the water fauna, for example a water-tiger. Beetles that can be found in the Baltic amber are very close to the modern fauna of the subtropical forest. The Museum keeps quite a rare sample of the garden-spider. Besides insects, wool and hair of mammals as well as birds' feathers can be found in the amber.

Only 0.4% among the inclusions are plants. In most cases they are parts of wood tissue and rind. Occasionally withered flowers, remains of leaves, needles, twigs and fruits can be found.

The inclusions of flora and fauna in the Baltic amber are of great scientific interest due to their diversity and a perfect state of preservation. They help the researchers to explain numerous puzzles of the evolution of the animal world and the vegetable kingdom and to better comprehend the history of our planet.

### **Amber in the antiquity and in the middle ages**

Amber became a household item of the people living on the Baltic sea coast in the Late Stone Age – in 4000 BC. People learned to treat it with flint and ivory tools – to grind it, to saw it up, to drill it, and they made different adornments and amulets in the form of figures of men and animals.

As early as in the antiquity amber was a most important item of exchange that was popular far beyond the bounds of the Baltic sea region. Thanks to the archaeological diggings and the data from the records the scientists managed to identify the trade routes along which amber was traded from the Baltic to the countries of ancient civilizations.

The information about the «gold of the North» can be found in the antique records. Thus, in the Homer's «Odyssey» (8th century BC) amber was mentioned in several songs as a precious material for making ladies' adornments and for decorating tsars' palaces.

Amber was highly valued in the Ancient Roman empire. It was used not only for making adornments but also household items: miniature plastics, vessels for wine, incense bottles etc. During the rule of the emperor Nero (mid 1st century AD) amber was even used for decorating amphitheater where the gladiators' fights took place: it was plaited into the barrier nets, scattered onto the ring and sedan, it was used to incrust arms.

In Ancient Russia in the 10th – 13th centuries they were also aware of amber and valued adornments made of it. This is confirmed by the excavations carried out in the old Russian cities: Veliky Novgorod, Pskov, Ryazan, Smolensk where amber goods and amber treatment shops were found. Amber was called alatyry in Russia.

In the early 13th century the Teutonic Order conquered the Eastern Baltic that was rich in amber. The Order declared the amber deposits its property and established a monopoly for its extraction and trade. The Baltic citizens could have been tortured and executed through hanging and breaking on the wheel for hiding even a small piece of amber from the authorities.

### **Kaliningrad amber factory**

Kaliningrad Amber Factory was established on July 21, 1947. It is operating on the basis of the largest in the world amber deposit located on the Baltic seacoast near the village of Yantarny.

The amber is extracted in the open-cast mine at the depth from 12 to 50 meters. At present 400-500 tons of amber are extracted. All the extracted amber is divided into three classes: for making articles, to be pressed, and to produce lacquer.

The amber for making articles is of the greatest value, it is used as raw material for the jewelry industry. However, this kind of amber accounts for only one tenth of the extracted amber. The other small pieces can not be immediately used for making articles, they are pressed (30%) and chemically treated (60%). Pressed amber is used for producing adornments and it is used as insulators in industry. The products of

chemical treatment – «the fused amber» and amber oil become ingredients of various sorts of high quality lacquers and enamels. Amber acid is used for making medicines, chemicals for producing leather substitutes, biogenic stimulants.

The largest part of the Factory's output are amber goods produced in mass batches. During its operation the Factory has produced dozens of millions of jewelry articles. In the first years the range of the output was quite uniform. It mainly comprised of beads, bracelets, pendants, cigarette-holders, clips, buttons. The adornments were quite often made in the form of leaves, berries, fruits, insects. The amber was tinted to make it look more natural.

Along with the mass production the artists of the Factory created in those years a whole range of thematic compositions, monumental vases, gorgeously decorated caskets and souvenirs. Among them is the vase «Abundance», the model of the nuclear-powered ice-breaker «Lenin» and the clock «Epoch» rich in numerous details.

In the 1960s under the influence of the Baltic traditions of amber treatment the craftsmen started to use natural forms of amber, to pay attention to its colour and texture, to make various compositions, to combine amber with other materials (wood, wool, plastic).

In the 1970s amber had reached the peak of its popularity in the USSR. The real «amber boom» was connected with the use of gold in combination with amber. In such articles they often use red-hot amber that is made by being treated in special autoclaves. Dull and dirty-yellowish pieces of amber turn into transparent and sparkling stones that perfectly go together with gold.

### **Amber mining**

The history of amber mines on the Baltic comprises several thousands years. Since ancient times the amber was gathered along the beaches and sandbanks, where it had been thrown by the sea. According to the figures of S.S. Savkevich, there had been about 60 thousands tons of the mineral collected on the Baltic coast for the recent three thousands years.

The free gathering of amber had continued till the XIII century, when the Teutonic Order promulgated the amber to be its own monopoly. The one, who dared to break this law was subjected to cruel punishment by the decision of special «amber court». Beginning from the XVI century in addition to the collecting amber on the beaches, the new method of obtaining amber – catching was widely spread. The hunters, equipped with the big nets on six-eight meter sticks, were coming into the water or going to sea by boats; and catching the seaweed with the amber, stuck in it.

A little bit later, the people started to obtain the amber directly from the bottom of the sea with the help of different instruments: gaffs, pincers and scrapers. It was usually done from the boat and in a calm weather.

The first mentions of the surface amber extraction are referred to the middle of XVI century. The people dug the pits at the shore, and, if there were the grains of amber in the ground, the bottom was delved further – till the subsoil waters. The amber pieces

were emerging on the surface. In the middle of XVII century there were the attempts to excavate amber from the shore's steep.

In 1781 near the present-day village of Sinyavino the first amber mine of about 30 meters deep, was founded. It was meant for industrial extraction of amber. However, few years later it was closed as unprofitable. In the first half of XIX century the amber extraction on open mines proved to be more efficient. The small open-pits (30 x 30 meters) were founded on some areas of the coast, which were rich in amber. Stratum of barren rock were removed and the emerged layer of «blue earth» was exploited.

By the beginning of XX century the deep amber mining had become unprofitable; and in 1912 the big open-pit was founded in the district of the village Palmniken (now – the village of Yantarnij) away from the sea. This amber pit had been exploited for about 60 years, and was exhausted at the beginning of 70s.

Before the Second World War at this deposit there had been about 400 tons of amber-adobe extracted annually. The amber was treated at Königsberg Amber Manufacture and other companies of Eastern Prussia. At the end of 30s, 2,5 thousands workers and craftsmen were working at the amber manufactures, and the same quantity of people was employed in winter season for additional works, mainly women. In 1945 during the attack of Soviet Army the big battles were taking place in about seven kilometres from Palmniken, that is why the amber manufacture almost was not damaged, though the amber pit was flooded and put out of operation. People, who moved to this territory after the war, remembered, that at the beginning nobody paid attention to the amber, considering it to be something like colophony, and even used it for kindling the fire in the stove. After the retreat of Germans at the store-houses of Palmniken there were several dozens tones of excellent amber left. These amber stores were used in the small workshops, which were organised in the village. The demobilised soldiers and some German citizens, who remained in the village, were working there. In 1947 the Amber Factory was founded.

### **The industrial amber mining**

The most productive stratum, which has rich deposits of amber, is «blue earth». It has received such a name due to the considerable content of glauconite mineral, which imparts the bluish grey tint to it. The stratum of «blue earth» with the thickness from 2 to 12 meters, lays on the depth of 40 – 60 meters from the surface.

Nowadays the amber extraction is carried on in the open-cast mine, being a composite, highly-mechanized production. Originally the over-burden layers were exploited by excavator, and were transported in the slag-heap by rails. The principle of hydro-mechanization was introduced into practice after two huge landslides in 1957 and 1958, when the bottom of the mine was buried by almost half a million tons of the earth, the equipment and the whole transport system was out of order. To get to the amber stratum it's necessary to remove the upper layers of barren rock. The thickness of the over-burden rocks at Primorsky deposit, which is currently in operation, is 56 meters. Hydro-monitors are washing them away by the streams of water, and the liquid pulp (the mixture of rock and water), which was formed, is thrown down to the sea by the pipeline. Before 1995 the «blue earth», containing amber, had been extracted by the chain-bucket excavator, and then transported to the

concentrating mill by belt conveyer. Nowadays, in order to preserve the amber in a good state, the method of hydro-mechanization has been used; and the amber has been transported by pipeline.

The «blue earth», which was washed away by the water, is going to the Factory through the grate with the meshes 5 cm in diameter; where the workers are picking out the biggest pieces of the mineral. Then the most part of the barren rock, having gone through the sieve with the 2mm meshes, is going to the waste. The material, which has remained, is passed through the system of arc sieves, where it goes through its initial washing and dehydrating. Then in the separator this mass is exfoliated in the special solution of the density lower than amber; the heavy fractions are accumulating at the bottom, and the small amber with the pieces of wood are emerging at the surface. And after it the amber is washed again and dried in the heaters. The amber, separated from admixtures, is delivered to the sifter – the system of moving in opposite directions sieves, with the meshes of different diameters, which are located one above the other. By means of vibration the amber is sifted and divided into three fractions, depending on the size.

## The building of the Amber Museum



### Architecture

Kaliningrad Amber Museum is located in the city center on the shore of the lake Verkhneye in the fortification tower of Dohna, which was named after a Prussian Field Marshal-General Friedrich Karl Dohna. Friedrich Karl Dohna took part in the liberation war against Napoleon's France, being allotted to Russian-German legion. Since 1812 he served in Russia.

The tower is the historical and the architectural memorial of the mid of the 19th century, being the part of an entire defensive fortification, which also includes Rosgarten Gates. The history of complex is connected with the Napoleon wars, town-planning development of Koenigsberg, and the events of the Second World War.

On the 5th of April 1843 the plan of Koenigsberg defensive fortification was approved. It was decided to protect Verkhneye lake by two round towers. The towers were put at the double-range of weapons, which enabled to shoot through the lake's surface by a gun cross-fire. The tower of Vranghel was disposed on the western lakeside, Dohna's tower – on the eastern one.

Prussia was one of the first European countries, which used the ideas of Montalembert (1713-1799) in action, considering the multi-leveled gunfire to be the important and powerful factor of defence.

The tower was built in 1852-1853. The tower is round, with the diameter of 34 meters, the height of 12 meters; it has two floors and one underground with the basements. The basements were intended for provision storing; the ammunition and munition depots. There are 42 casemates in the tower, which are situated in two round tiers. Their suite location, without any interior partitions, was very convenient for the defensive maneuvers of garrison. When building the tower, the special fortification brick was used. It was going through the multi-firing hardening, on the principle of



steel hardening. The stucco wasn't used, since the brick was firmer and more durable in the local climate with its frequent rains, dampness, and mild winters. The brick imparted the beauty of design to the front of the tower.



The tower was equipped with the heating system of fireplace type (it didn't survive), ventilation, sewerage and drainage. There was storage well. The thickness of the walls, durability and the good quality of the constructions made the tower the strongest point, which was able to withstand the enemy and long-lasting sieges, as well as to conduct all-round defence.

By the middle of the 19th century many construction elements of fortification architecture of Königsberg became decorative, being only the symbols of medieval tradition. It concerns the merlon parapet wall. In the tower of Dohn the merlon parapet is repeated twice on different levels. This is one of the most significant decorative elements, which perfectly accentuates the contour of the whole construction.

«The brick neo-gothic» style, which was typical for the architecture of Königsberg in the middle of 19th century; became apparent in cross vaults of the tower's casemates and design of the outer wall.

The main entrance to the tower from the side of the lake Verkhneye was under cover of the shooting-wall with the numerous embrasures. The socle of this wall is faced with the big cobblestones, which are hewed to each other and mortared by cement solution.

The space between the outer wall of the courtyard and the wall of anti-penetration screen was always full of water. The water was probably rising to the level of rusticated stone, flowing in freely from the Verkhneye Lake. Nowadays the concrete dam was installed under the bridge. It prevents water flowing since the concrete in the rusticated stone is in bad condition; the drainage and damp course got out of order. The artificial moat, surrounding the tower was the obstacle in the way of enemy. The depth of this moat was approximately 2-3 meters.



### **History**

Before the beginning of the 20th century the tower of Dohna, as well as the whole bastion complex had been under control of military department. Before the Second World War the guard, which kept duty in the tower, consisted of 15 – 20 military men from the forces, based in immediate proximity.

Due to creating of the new, up-to-date defensive line – front fortification; and the extension of the borders of Koenigsberg – the municipality began to purchase the fortification objectives within the precincts of the city. As early as before the First World War the ramparts, moats, bastions were partly liquidated, and on these territories the civil buildings were built. The surviving constructions, which were designated as historical relics and monuments of architecture, became the museums. The restoration works were carried out there, the special temperature and humidity conditions were maintained inside. In the premises of the former bastions there were located handicraft workshops, private shops, cafes.

The Dohna's tower and the adjoining Rosgarten Gates were connected with tourism too, being the historical and architectural monuments. They were open for sightseeing; and made up beautiful recreation center in combination with the picturesque landscape of Verkhneye Lake and the forests on its side. There were numerous paths for walking, viewing grounds, cafes, a shop for souvenirs and a small photo-studio. Probably, the bow-shaped bridge was built at the same period.

With the beginning of the Second World War the Vrangels' tower and the tower of Dohna became military installations. The blocked up with brick embrasures were opened; the systems of security were put in order; the casemates' cannons were brought and installed. The former commandant of the Koenigsberg fortress Otto von Lacsh stressed in his book «Surrendering of Koenigsberg» that the old fortifications of the inner ring of the city, as well as the external fortresses; had been used as the main supporting installations at the defence of Koenigsberg. Before the autumn 1944, ammunition, arming, and liaison depots had been based in the both towers. The air photography of 1944 shows the powerful broken-lined trench, which was dug close to the Dohna's tower.

Different obstacles, standing before the trenches: hedges, chevaux-de-frise (turnpikes), wire entanglements, Bruno's coils, were meant to function as the extra barriers on the way of Soviet troops. During the first post-war years the tower of Dohna hadn't any permanent proprietors, being used by different organizations for the storage of containers and friable materials. The constructional elements of the tower began to ruin; the corrosion of bricklaying appeared as a result of the permanent dampness; destroyed damp course, ventilation, drainage. Before 1969 the storage facilities of «Voentorg № 540» had been located in the Dohna's tower. The works on the foundation of the Amber Museum, which started in 1972, prevented the intensive process of the tower's destroying.

