

## REVIEW OF THE LITERATURE ON AMBER

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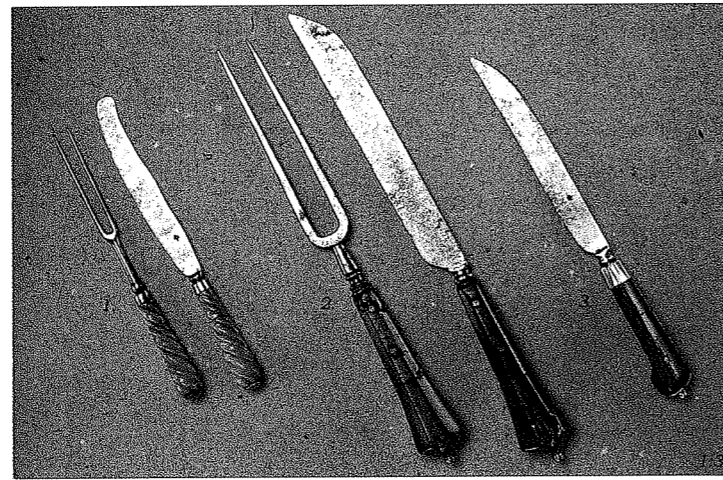


Fig. 5. Iron cutlery with  
amber handles. 17<sup>th</sup> century.  
From the cabinet of curiosities  
at a Danish stately home.

1. Fruit cutlery 2. Table cutlery set 3. Knife



Fig. 6. Box with tumulus. About 1920.  
Silver and amber. Hallmark: KBS (Kay Bojesen)  
and a buoy on the waves. Copenhagen.

Danish silver hollow ware of this period was often decorated with amber, and leading Danish designers such as Th. Bindsbøll, Kai Bojesen and Holger Kyster liked to use this combination of materials. Amber could be used in an elegant and restrained manner, stylistically suited to the shape of the work, or the silversmith might choose to play around, as when Kai Bojesen used four pieces of amber to form a stone barrow on the lid of a box.

Many Danish artists and designers worked closely together as well as with colleagues from abroad. In general, they all worked with the same long, curving shapes which developed into patterns that often were organic in nature.

In terms of the goldsmith's art in Denmark, around

1900 jewellers developed a preference for using amber as ornamental stones in the silverware typical of the era. In tune with the spirit of the times, designers stressed national characteristics, and regarded amber as well-suited to this purpose. It may therefore be said that the combination of silver and amber in Danish jewelry has a long tradition behind it.

All the copious literature on amber, including the oldest myths and legends born in ancient times, reflects an ages-long process of its investigation, leading from mystery to knowledge.

Amber is one of the rare creations of nature. As far back as hoary antiquity it used to amaze the people's mind and to stimulate their imagination by its mysterious specific properties. Though as hard as stone, amber can be easily polished and it would gleam in the rays of the sun with its marvellous inner radiance. The things that caused the greatest wonder were various insects and fragments of vegetation found in amber, completely the same as met with in everyday environment. This might have been the reason why amber was cloaked in a shroud of mystery and mysticism from time immemorial.

Throughout ages investigators made efforts to unveil that halo of mystery. The first attempts are witnessed by ancient myths and legends. Later on, amber drew the attention of prominent ancient authors and poets. Thales of Miletus was the first to describe electric properties of amber, comparing them to magnet's tractive force, and the famous Aristotle was the first who explicitly highlighted a resinous origin of amber. The Greek traveller Pytheus of Massilia after the greatest travel in ancient times from the Mediterranean Sea to the Scandinavian coast was the first to see and describe the washed-ashore amber, which was found in the sea grass by the natives and sold to their neighbours *Teutons*. The latter used to deliver it

to Gallia, the final destination being Massilia. It was Plinius Maior, a Roman historian, who gathered and systematized the most exhaustive information on amber, its origin, deposits and trade routes. When generalizing the elucidations presented by a great number of authors and the travellers' fantastic stories, he was the first to expressly state that amber had originated from the resin of pine trees.

Since the survived written texts by ancient and early medieval authors have not been consistently systematized up to the present time, it is expedient to survey them in a more consistent way.

### Amber in Ancient and Early Medieval Written Sources

'The Assyrian ruler Ashur-nasir-apal sent his people to the Land of Amber, where the seas wash amber ashore like copper...' (Assyrian inscription on an obelisk (the British Museum). Early 883, AD).

The earliest information on amber can be found in various legends and tales, which are usually referred to myths. The myths, which emerged from folklore, reflect the efforts of the people in primitive and tribal epochs to solve the mystery of the origin of amber. In the epoch, when people worshipped the phenomena of nature, amber was also imbued with some supernatural properties. Its articles were mainly used for worship purposes.

With the transition from tribal to a slave-owning system, amber articles as the symbol of nature worship

(mainly the Sun's cult) passed to the worship attributes of the rulers. Ancient Egyptians used amber as an amulet or the symbol of deity. It is witnessed by archaeological finds from Chatenia (21<sup>st</sup> dynasty) and other localities.

In the Aegean world amber was also regarded to be the symbol of the Sun. Its name *Helektron* was derived from the name of the Sun-god *Helector* reaching Homer's times, though its more ancient etymology was traced to the Greek word *Elek*, meaning resin. In ancient Greece this name (possibly borrowed from Phoenicians) acquired the name of the mythologicalized Sun-deity *Electron*.

The oldest monument of ancient literature that reached our epoch and where mention of amber articles is made – HOMER'S (8<sup>th</sup>-7<sup>th</sup> cent. BC) poem *Odyssey*. [1]

In Book 4 amber is mentioned as the symbol of luxury in slave-owners' palaces:

70. 'Son of Nestor, you who delight my heart, only look at the gleaming of the bronze all through these echoing mansions, and the gleaming of gold and amber, of silver and of ivory...' (Transl. R. Lattimore).

In Book 15 amber is mentioned as an object of trade. Here one discovers that it was Phoenician merchants who used to bring amber articles to ancient Greek towns:

415. 'There came Phoenician men, famous sea farers, gnawers at other men's goods, with countless pretty things stored in their black ship'. (Transl. R. Lattimore).

460. '... with a golden necklace, and it was strung with pieces of amber. Now in the hall the serving women with the lady my mother were turning it in their hands and eying it and offering...' (Transl. R. Lattimore).

In Book 18 amber articles are mentioned as an expensive present for one's beloved:

295. 'Eurymacho's men came back with an elaborate necklace of gold, strung with bits of amber, and bright as sunshine.' (Transl. R. Lattimore)

There is also a narration from later epochs after Homer's hymn to Apollo, where amber beads were promised to the goddess Eileithyia. [2]

'... Iridis followed the goddesses' advice and promised Eileithyia to give her an elaborate, nine inches long, string of gold beads decorated with amber in order to make Eileithyia hurry to Delos'.

Another Greek poet HESIODUS (8<sup>th</sup> cent. BC) in his poem *Theogonia* describes Heracles' shield decorated with a piece of shiny amber symbolizing the might of the Sun-deity.

In ancient scholarly writings, the natural properties of amber were first described by Thales of Miletus (640-546 BC), a prominent philosopher, physicist and

mathematician of the early 6<sup>th</sup> century AD, called by the Greeks as one of the seven sages of the world. He described a specific peculiarity of polished amber – after rubbing it, to attract small and light things. Thales was the first to compare amber's traction with magnetic properties. The word 'electricity' was later derived from this source. [3]

AESCHYLUS (525-456 AD), a Greek tragic poet, was the first to write down an ancient myth about the origin of amber. Besides the elements of ancient religion, the mentioned myth also reflects the rudiments of the theory about the natural origin of amber. Its content is as follows:

'Once Phaëton, the son of Helios, got permission to drive the Sun's chariot. He was boldly driving the fiery chariot along the blue dome of heaven. But the young man got dizzy in unfathomable expanses, and his weak hands failed to bridle the Sun's winged horses. The fiery chariot got so close to the earth that the latter nearly caught fire.

When the heat reached Olympus, the angry Zeus sent a lightning and Helios' courageous son fell dead into the River Rohdamus. Phaëton's sisters Heliades lamented for their brother so much that the compassionate gods changed them into black poplar trees ... and their unrestrained tears turned into amber, which fell into the river and was washed ashore by the waves. This is the origin of amber.'

Later on, the myth about Phaëton – the 'shining', the son of Phoebus (the Sun's) and Clymene, reached us in the form of a graceful poetic episode in the book *Metamorphoses* by the Roman poet Publius OVIDIUS Naso (43 BC-18 AD).

Another ancient legend witnessing a fantasy-based origin of amber was written down by the famous Greek tragedian SOPHOCLES (497-406 BC) in his book *Antigone*:

1049. 'Drops of amber – the tears of mysterious Indian birds,

Lamenting over the death of the hero Meleager...'

When surveying the old authors' opinions on the origin of amber, PLINIUS wondered in his days at Sophocles' description:

'How could have Indian birds lamented over the hero killed on the land of Greece... [4]

The secret of the process of amber extraction must have been also carefully kept by the merchants who transported it from North Europe for barter trade. Even the prominent Greek historian HERODOTUS (484-425 BC), who widely travelled in Asia Minor, Babylon, Egypt, Italy and Scythia (present-day Ukraine), mentioning amber in his nine-volume treatise *The History of Greek-Persian Wars* (Lib. 3, p. 115), wrote only a few sentences:

'... amber gets to Mediterranean countries together with tin from North European countries. I have never met and seen a man who had seen or heard of the amber (*Elektron*) and tin (*Kassiteros*) extraction places...'

A more exact place of amber extraction was pinpointed by Aristotle's disciple THEOPHRASTUS (372-287 BC) in his treatise on mineralogy. Unfortunately ..., only a few short fragments have reached our times. Plinius presents the following quotation from them:

'Theophrastus informs that amber is obtained from Liguria'.

In Theophrastus' times, Liguria was a very rich Greek province with its centre Massilia, which was famous as a large trade centre. It was from this city that the well-known traveller PYTHEAS (4<sup>th</sup> cent. BC) started on his travel to the 'Tin' and 'Amber' lands in 350-320 BC.

One of the greatest geographical discoveries is associated with Pytheas' legendary expedition, when a man of ancient civilization forced his way as far as distant Thule (present-day Norwegian shores). The disappearance of his report on the journey is one of the greatest losses suffered by geographical sources. Its survived fragments specified veritable amber discovery places, its extraction and trade routes. [5]

'Pytheas of Massilia reports that Guiones, one of Germanic tribes, live in an estuary called Metuonis stretching for 60000 stades. From there, it takes one a day to reach the island of Abalus by sailboat. In the spring the waves wash amber ashore together with all kinds of grass. The grass is used as fuel instead of wood, and amber is sold to their neighbours Teutons ... the Teutons deliver it to the North-Gallic shores and from there it gets to Massilia...'

The goal of Pytheas' expedition to the Land of Amber – to collect reliable information on the amber discovery places, hoping to facilitate the transportation of these valuable goods to Massilia in greater quantities. Greek scholars did not believe in the truthfulness of Pytheas' report and did not appreciate the importance of his scholarly discoveries. Only later, it was geographical discoveries that confirmed and rehabilitated the scholarly significance of his expedition.

Another place from which amber was transported in ancient times was mentioned by the Greek author XENOPHON (about 430-355 BC) in his book *Helenica*. Plinius informs: [6]

40. '... Xenophon says that in Italia amber is called not only *succinum* but also *thium* and by Scythians – *sacrium*, because it was also transported from there...'

The application of amber in medical practice goes back to ancient Greece. HIPPOCRATES (460-377

BC), the father of Greek medicine, provided in his treatises information on the healing peculiarities of amber and the methods of its application. This information was later made use of not only by the Romans but also by early medieval scholars. (In A. Aunfabers' monograph on amber (1551) he quotes Hippocrates' information on amber in medical practice).

Natural properties of amber were described by EURIPIDES (480-406 BC), a leading figure of the Greek drama, a disciple of sophists. Speaking about various features of amber, he highlighted its inner transparent gleam. The outstanding philosopher PLATO (427-347 BC) analysed similar properties of amber and magnet in his work *Timaeus*.

Valuable ideas on the origin of amber were set forth by ARISTOTLE (384-322 BC), the greatest Greek scholar and encyclopaedist, in his treatise *Meteorologica* (L. G., p. 10). He was the first to mention a resinous origin of amber:

'... amber just as well as all other bodies called 'tears' originated from hardening resin like myrrh incenses. The insects in amber prove its formation by way of hardening...'

*Mayron* – fragrant resin widely used in religious ceremonies, medicine in Aristotle's days. [7]

'The bodies from which all the moisture disappears (evaporates) are of an earthly (natural) origin like ceramics or amber; ... some of those bodies can be softened, e.g. amber...'

Due to the fact that Aristotle's methodological starting point for the studies of nature was physiology, exploring the laws of the emergence, evolution and decay of a natural body, he considered amber 'tears' to be nothing else but mere hardened tree resin.

PAUSANIAS (2<sup>nd</sup> cent. BC), a Greek author and traveller, who described a great number of famous Greek cultural monuments, indicated in his work *Graecial descriptio* [5. 10] that:

'A shrine in Olympia among a host of statues and frescos boasts one small sculpture made of amber picturing the Emperor Augustus'.

Pausanias proceeded to explain: '... amber is a very rare thing, therefore, it is greatly valued. It is completely different from the metal *elektron* – the gold and silver alloy.'

CALLISTRATUS (mid 2<sup>nd</sup> cent. BC), a contemporary of Pausanias, also showed his great enough concern for the peculiarities of amber. He called one of its species, which according to him 'had a tint of gold and looked particularly marvellous before noon, even strongly attracting fire to itself (causing splitting)', *Chryselectron* (*Chryselectrum* = gold yellowish). He went on saying that ... nevertheless, tin and amber were delivered to us from the North.' Later on, STRABO (63

BC-17 AD), a Roman geographer and historian, despite his criticism levelled at Phythas' works, acknowledged their truth that '... amber as one of the products is delivered with Britannus tin and other luxury things...' [IV. 5-2-5].

A more exact place of amber extraction was pinpointed by another Roman historian DIODORUS Siculus (2<sup>nd</sup> half of the 1<sup>st</sup> cent. BC - 1<sup>st</sup> quarter of the 1<sup>st</sup> cent. AD). He wrote in his *Historical Library*:

'Straight to the North of Scythia, beyond Gallia, is the Island of Basilia. The waves wash ashore so-called amber, which nowhere else can be found on earth ... Local inhabitants gather amber and deliver it to the continent opposite the island. From there amber is transported to our lands...'

The Roman researcher PLINIUS MAIOR (b. 23 - d. 79 during the eruption of Vesuvius) collected and systematized thorough information on amber, its origin and the places of its discovery.

A particularly great scientific importance belongs to Plinius' work *Naturalis historia* consisting of 37 books, which include various pieces of information and fantastic elucidations on the origin of amber collected by other ancient authors and travellers. The work was published by his cousin Plinius Caecilius Secundus.

Amber is mentioned in Book 4 of the work:

97. '... Glaesaria (the Island of Amber) was named by our soldiers, because it was the place where amber was discovered, but local barbarians called it Austeravia...'

More thorough information on amber, its natural peculiarities, commercial value, other authors' words, and the routes of trade in amber is provided by Plinius in Book 37:

11. 'Pythas informs that Gutones live in an estuary (*aestuarium*)...'

12. 'As a precious stone it (amber) is so expensive that people pay more for the smallest figure made of amber than for a healthy alive man, - debauchery that deserves great contempt...'

33. CHARES claims that after Phaëton's death a shrine was built in Antiochia, where amber was found...'

34. PHILEMON explains that amber is extracted in Scythia in two places: in one - white and of wax colour called *electrum*, in another - dark yellow, known as *subalternicum*.

'Demosthrates says that amber forms of the lynx' urine, namely: dark yellow and of fire colour - of the male and light yellow and white - of the female urine, therefore, it is called *lyncurium* and others call it *langurium*... Zenothemis called those beasts living at

the River Padus *langa* or *languria*. This is the origin of amber's name *langurium* (*simply lyncurium*)...

35. 'SOTACUS thinks that amber runs out only of Britannia's cliffs, which he calls Electrides... NICIAS admits that amber - the dew of sunbeams, lingering at the sunset on the shores of the ocean in the form of a rich sweat washed to Germania's shores by the stream of waves. The same is the origin of amber from Aegyptus called *sacal* and from India... In Syria amber is exploited for the production of small spindles called *harpax*, because it attracts leaflets, straw and scraps of material...'

37. '...THEOCHRESTUS admits that amber was washed ashore by storms in the Piranicus Cape, acknowledged also by XENOCRATUS...'

ASARUBAS is of the opinion that amber forms in Lake Cephisis beside the Atlantic Ocean at the time when sunbeams heat its surface...'

39. 'CTESIAS indicates that the River Hypobarus in India (the name means the river carrying everything what is good) flows from the North to the East part of the Ocean at the hill, standing out on the coast of the Ocean among the shores overgrown with trees (poplars); the amber dropping from their tops is called *psithachora*; it gets from water ashore, where girls come to gather it...'

By way of generalizing the quoted views of many authors, Plinius proves them to be unfounded and explains the natural origin of amber:

42. 'Amber is known to be extracted on the islands of the North Ocean and is called *glaesum* by Germani, therefore, the Romans also called one of the islands Gleasaria known as Austeravia by barbarians.'

It (amber) forms of the sap of a special species of pine, like *cummis* from cherry-trees or tar from fir-trees; it is secreted due to the abundance of moisture and it hardens from cold or with time, or due to the influence of sea water, when the risen waves carry it from the islands. It is washed ashore so easily that it seems to be floating in water but not sinking to the bottom. Our forefathers called it *tree-cummis*, therefore, they gave the name *sucinum* to it; the origin of amber from pine species is also witnessed by the smell of a rubbed pine and the fact that if kindled, it burns in the same way like a smouldering pine sapwood, like all conifers...'

Further on, the scholar states that:

44. '... still at present, on the other side of the River Padus, women and commoners wear amber beads mainly as adornments and partly as a remedy for the swollen glands and the throat or palate pains.'

45. 'From Carnuntum in Pannonia the amber coast is 600000 Roman steps (about 888 km). Up to the

present days is still alive that Roman rider who was sent there (to the Sambian peninsula) by Julianus, responsible for the games of the Emperor Neron's gladiators, to provide for it (amber). At that time, the messenger visited trade stations *commercia* and shores. He brought such a great amount of amber that it sufficed to decorate the podium's fences and nets, protecting from wild beasts, and the stretchers for the diseased. Even all festive decorations were sparkling with amber. One of the biggest pieces equalled 13 pounds (about 4,2 kg)...'

'Germani deliver amber to Pannonia. At first it was delivered by Venedi called Enedi by Greeks, because they lived in the neighbourhood of Pannonia and later spread all over the coast of the Hadrian Sea... In the Bay of Codanus up to the Cape Cimbria (Skagens) there are a lot of islands the largest of which is Scatinavia; its area is still unknown. The part of already known island is inhabited by Hilleviones, who call their island as another world. No smaller is Aeningia. According to other data, this country stretches up to the Vistula and is inhabited by Sarmati, Venedi, Sciri and Hirri. The sea bay is called Cylipenus.

The island of Latris is at its strait. Further beyond it, there is another bay called Lagnus and it stretches to the end of Cimbria. A narrow belt of earth stretches far into the sea and forms a peninsula called Tastris.'

One finds it easy to recognize the Baltic Eastern coasts in this laconic description by Plinius, where the Roman rider visited trade centres belonging to the inhabitants of Sambia. What makes one wonder is a huge amount of amber transported through all central Europe to Rome.

The mentioned fact evidently proves that the 'Amber Road' stretching from the Vistula via Carnuntum up to Aquileia was sufficiently provided with transport, and the barter trade in amber was well organized.

According to Plinius:

'... neither white, which if burnt for a while diffuses a pleasant smell, nor waxen yellow or dark (*fulvis major auctoritas*) amber was more valued by the Romans than transparent, slightly glossy (*praeterquam sinimio ardore flagrent*), which made possible to see looking through it not fire but only its reflection...'

'... The most favourite amber was of a transparent Falernian wine colour. It was the most expensive... Amber used to be made brighter (more transparent) immersing it in goat's heated fat with *Anchusa* (*Anchusa tietria* root).'

CORNELIUS TACITUS (55-120), a Roman his-

torian, when describing various nations and their geographical situation in his work *Germania* [8], mentioned Lithuanians' ancestors - Aestii, calling them *Aestiorum gentes*.

45. '... On its right coast, the Suebicum (Baltic) Sea washes Aestiorum tribes, which have the same traditions and wear the same clothes as Suebi, but their language shows a closer affinity with Britanni. They worship gods' mother and carry statuettes of wild boars, which serve as the sign of their faith and the arms defending them from everything and protecting even from enemies in turmoil. They seldom use swords, more often-clubs. They grow crops and other necessary plants more diligently than the lazy Germani. They also make a good search of the sea and are the only ones who gather amber called *glesum* in shoals and on its shores. As barbarians they did not investigate the properties and origin of amber and were ignorant of them. Amber had been lying among other things washed ashore by the sea for long centuries until our luxury gave a name to it. They do not use amber themselves: gather its pieces, sell unprocessed and take a reward wondering. It is easy, however, to perceive that amber is tree resin, because some beetles and insects stuck in hardening liquid remained there and in frequent cases show through it. I suppose that dense woods and forests, where incenses and balsam flow, can be found not only in secluded Eastern localities but also on Western islands and lands, where the liquid tree resin, squeezed out by the rays of the hot sun, flows (drops) to the nearest sea, and heavy storms cast it to the opposite coast. If you try to test the peculiarities of amber by sticking fire to it, amber will flare up like a pine, spreading rich, fragrant flame, but it will melt in an instant turning into tar and resin...'

Some time later, the great PTOLEMAEUS presents a sufficiently clear picture of the south-east coasts of the Baltic Sea in his maps.

VALERIUS MARTIALIS (42-102), a known Roman poet of epigrams, wrote epigrams about amber inclusions [Martialis, in epigrammata. L. 2, p. 65; L. 5, p. 31; L. 6, p. 15]. The descriptions of inclusions with a little bee and ant are particularly picturesque. Later on, these epigrams charmed Renaissance scholars, and M. Lomonosov was the first to translate them into Russian.

The description of an inclusion with a little frog provokes a particularly great interest. The epigram witnesses the production of their imitations (Artificial inclusions with little 'frogs' and 'lizards' reached us from N. Gendel's book on the carvings of amber inclusions (18<sup>th</sup> cent.)).

GALENUS (about 129-199), a popular Roman doctor and scholar, described in his book the application

of amber in medical practice. He used not only the curative recipes of amber found in the works of earlier ancient authors but also described folk medicine practice and the application of amber for the treatment of various ailments including by suggestion (Following Galenus' recipe, the Prussian Duke Albrecht sent a piece of amber to the sick Luther as a remedy for a stone disease).

At the beginning of our era, it was amber that strengthened economic and commercial links with the provinces of the Roman Empire. Under the rule of the Emperor HELIOGABALUS (218-222) those links greatly weakened, and later, with the fall of the Roman state, they were completely broken off. The Baltic tribes searched for ways and new means to re-establish trading relations with South and Middle Europe and the Near East through the mediation of Borysthenidae and Germanic tribes.

With a view of re-establishing a trade with Italy, Aestii's messengers went on a journey which, according to the content of THEODORICUS' letter was a success and the messengers were sincerely welcomed.

M. A. CASSIODORUS (Magnus Aurelijus Cassiodorus, 6th cent.), a Roman senator, THEODORICUS' secretary, among other various official letters presents the text of King THEODORICUS' letter to Aestii in his Book 5. [9]

'... Therefore, we cordially welcome you and say that we have gratefully accepted the pieces of amber sent through your messengers. We understand from the reports of your messengers that amber as a very light substance is cast ashore by a subsiding ocean wave. But the messengers told us that you were ignorant of the origin of amber: to tell the truth, you are the first to get it, because your land simply donates it to you'.

As Cornelius (Tacitus) informs:

'... amber forms of the resin (*ex-suco*) of the trees growing on more distant islands of the ocean, therefore, it is called *succinum*. Due to the heat of the sun, amber slowly hardens and when sets, it becomes a soft transparent substance of fire colour, sometimes with a shade of saffron. Polished by the waves constantly washing the sand, it is cast to your shores'.

This rare journey through Central Europe forwards and backwards seems to have been made between 523 and 525 along the old 'Amber Road'. With the fall of the Roman Empire, its provinces experienced great social, economic and ethnic changes. After the fall of the slave-owning economic system, followed by stormy wars and migration of nations, emerged small feudal states with a closed natural economy. The majority of

trade and crafts centres of the antique world nearly or completely discontinued their activities, and the links with distant trade routes reachable by Aestii (Baltic) tribes were broken off. Despite the fact that Aestii's messengers travelled to the Rome Emperor Theodoricus with a view of re-establishing trade relations, the goal was not reached.

Later, barter trade in amber continued through Borysthenidae tribes with the Byzantium Empire and Arabian countries along Eastern trade routes. Therefore, some written information on the utilization of amber in those lands can be found in more known scientific centres.

The most interesting data for science from the early Middle Ages on amber and other extracted resins is presented in the treatise on the properties of precious stones by the Uzbek encyclopaedist AL BIRUNIUS of Choresmus (973-1048). He wrote on the origin of amber:

'AL KINSIUS (9th cent. Arabian scholar) says that amber – resin is similar to that of sanders (tree) secreted by some trees growing on the bank of the River Scalabi. Everything what gets into water hardens. And what gets on the ground – does not'.

In this work amber is compared with other species of extracted resin, e.g. with African copal. In order to distinguish amber from copal, it is necessary to heat them. The author adduces some facts on byrsmith and today's tree resin, pointing out differences between various fossil resins. He draws attention to the natural forms of amber which perfectly witness that it was formed by flowing resin e.g. in the form of drops and icicles.

The Arabian scientists AL RASIUS (864-925) and IBN SINA (980-1037), making use of the information accumulated by ancient authors, presented some new medical recipes. For example AL RASIUS advised cleaning an eye (if a blade gets in) with a rubbed plate of amber. Another Arabian scholar JABIR HAYYAN (HABER) greatly valued curative properties of white (bone) amber, and later the Dominican monk and scholar ALBERTUS MAGNUS (1193-1200) described them.

In his well-known work *De metallicis et mineralis* [L. 5], on the basis of the information furnished by ancient and Arabian scholars, the author described various species of amber, the places of extraction, and more thoroughly elucidated its curative properties. The recipes presented by Albertus Magnus spread over all the drugstores of European monasteries or laboratories of alchemists.

The ancient and early medieval information on amber was often used by the investigators of later epochs

## Amber in the Evolution of the Baltic Culture

Amber was one of the most important natural resources in the evolution of the Baltic culture. Since the oldest times it was known and exploited in various spheres of people's activities. As an amulet or an adornment it adorned the people of primitive and tribal community. And later, with the expansion of intertribal barter trade, amber became its important object. The neighbouring Slavic and Celtic tribes took a liking to amber and widely exploited it. Archaeological investigations later acknowledged that amber following the routes of intertribal barter trade reached ancient states' trade centres of the Mediterranean Sea and Asia Minor. In the slave-owners' palaces, besides other jewelry [11], amber is mentioned as the symbol of wealth or value. The white amber seems to have had the greatest demand in the times of the Roman Empire [12], particularly with the growth of the 'Amber Road' stretching from the Baltic shores through Karnuntum to Aquileia. The Baltic archaeological monuments of the period include considerably more Roman coins and other imported articles witnessing a mutual character of trade.

Later, following the fall of the slave-owning Roman Empire and the ruin of the old trade centres, amber through the trade relations of Borysthenidae tribes reached Byzantium and other Arabian countries. [13] Therefore, larger Arabian science centres contain written facts on the Baltic amber and other species of extracted resin. [14] In the late Middle Ages, when the Order of Crusaders gradually occupied almost the whole of Baltic Eastern territory and appropriated the right to collect amber, trading in amber ceased and amber was mainly used in the sphere of religious worship: for making rosaries and other small church attributes. It was particularly abundantly used for incenses.

Only with the fall of the Order of Crusaders, the 15th century East Baltic countries more actively expanded their trade relations with West European countries. Baltic amber provoked attention again. In the land under the rule of Crusaders, the first Prussian Duke Albrecht, who with the intention of increasing his income gave permission to expand guilds and shops for processing amber and leased the rights to merchant to trade in amber, gained the monopoly in amber. [15]

With the development of natural sciences and the growth of the mining industry manufactories under the influence of Renaissance humanism and Reformation

ideas, interest in the investigations into amber grew again.

Besides books on general mineralogy, even seven monographs only on amber appeared in the second half of the 16th century. The first monograph was published in Königsberg (now Kaliningrad) in 1551. Its author doctor of medicine from Wrocław (Breslau) Andreas Aunfaber was the first to collect and accurately systematize all the information of the period on amber in nineteen chapters of the book. [16]

In respect of its scientific standard, Aunfaber's work ranks among the best monographs of the period, which due to its methodological form came close to today's classical scientific works. The beginning of the book is devoted to a detailed survey of the names used for amber from ancient times to the author's days. Besides ancient and Arabic names, he includes for the first time a dialectal name *Gentar* used by the local Suduvians. Aunfaber presented 50 names for amber and explained their meaning and origin.

In another chapter he described the entire amber discovery and extraction places known in that period. The author seems to have communicated with local Suduvians and described the processing of amber at great length.

He made the first attempts to classify the species of amber according to their morphological forms and the shades of their trade gradation. The most valuable in Aunfaber's days was white or 'bone' amber mainly used in medical practice.

On the basis of the mineralogical classification of fossil resin worked out by his contemporary Georgius Agricola (Georg Bauer), Aunfaber refuted the views of ancient authors on the vegetable origin of amber, considering them wrong. He attributed amber to bituminous tar or so-called 'mountain wax' (ozocerite, chartite, etc.) beside domerite, retinite and other resin of an organic origin. The basis for his mineralogical classification was not only a genetic link – combustibility and a tar origin. To be sure, there were other reasons as well. The mineralogists of those days wondered that coalfields contained retinites and 'ambers' of fossil tar, the genesis of which has not been fully explained up to now. Particularly rich deposits of the mentioned substances were discovered in brown coalfields. This was the reason which stimulated the investigators to include all the fossil tars into a joint resin group of a bituminous origin. Therefore, in Aunfaber's opinion, amber (Bornstein) is close to gagate (Agstein) another stone of a resin origin. It is of a lustreless glitter and is easily processed like amber (even today all the extracted resin is sometimes called amber irrespective of its geological age and the

conditions of formation). [18] The views of Agricola and Aunfaber on the origin of amber witness the achievements in the sphere of geology and mineralogy, which were followed by the majority of the 16<sup>th</sup>-17<sup>th</sup> century investigators.

The second part of the book refers to the curative properties of amber: Aunfaber includes a lot of ancient medicine and Arabian doctors' recipes, where 'amber oil' and 'amber balsam' are used in medical practice beside folk medicine incenses and massage. In Aunfaber's days chemists were enough qualified to make amber acid and amber salt used in medicine up to our times.

Thus, A. Aunfaber's monograph not only generalized empirical data on the investigations into amber but also formed a serious scientific basis for its further studies. Original hints of the morphological properties of amber as drops (Tropfen) and other forms can be discovered in Caspar Poiceraus' [19] study, where he makes an attempt to analyse the process of amber formation. Here the author highlights a diversity of amber shades. In other books on mineralogy amber is attributed to bituminous tar. For example C. Encelius, following the views of ancient scholars, was of the opinion that amber was formed of conifers' (Pinus) resin, and gagate was bituminous tar or oil product. [20]

Active studies gave an incentive to researchers to accumulate mineralogical collections, which served as the basis for the formation of the collections with amber inclusions. Conrad Gesneri [21] was the first to accumulate and publish collections of inclusions, and his contemporary Dan Hermann described artificial inclusions. [22] At that period of time plant remains hardened in Baltic amber, described in J. Wigandi's book [23] published in 1590, also provoked a great enough interest in them. Some time later, A. Cesalpinaus (Andreas Caesalpinus *De metallicis*, lib. II-III. Rome, 1696) in his book on mineralogy quotes Tacitus' words about Baltic forests on a Northern coast, copiously producing resin, which gets into the sea at storms and is cast to the Sambian coasts. A great attention to the study of natural sciences is devoted in the works published in the 17<sup>th</sup> century. It was the time when more than thirty works and articles only on amber were written and published, where, besides a fashionable critique of ancient authors, the conclusions of Aunfaber's and other researchers' works of the 16<sup>th</sup> century were presented in various versions without a primary source. The work of Anselm Boetii

Boot, where he pinpointed a mineralogical place of amber in the systematization of extracted tar [24], distinguishes itself among works describing a mineralogical classification of amber. He thinks that the name 'amber' includes the majority of tars of different origin: some species of amber found among coal originated from oil, those called *ambra* emerged from the fat of sea creatures, but the basic part of those discovered on the Baltic shores are hardened vegetable resin.

The extraordinary professor of medicine Philip Jacob Hartmann presented a big two-part work [25] devoted to the most comprehensive description of amber. In his book (p. 291) he thoroughly examines the issues of amber: he provides the data known by ancient and medieval scholars, surveys the works of earlier authors and his contemporaries. Hartmann was the first to get a deeper insight into the morphological peculiarities of amber, recommending them to apply for an artistic processing of amber. Like the refutation of the natural origin of amber, Hartmann advanced a new hypothesis concerning the origin of amber based on practical observations, which continued the theory of a mineralogical origin of amber worked out by earlier investigators. Hartmann is of the opinion that amber might have formed of tars rich in oil and gas mixed with salts dropping in liquid form on fossil remains of the trees. With the evaporation of gas, this mass, as he assumed, would harden and turn into amber. The shades of amber are determined by the amount of salts in this mixture (white amber contains the greatest amount of salt).

With respect to science, Hartmann furnished greatly valuable data in his description of amber extraction illustrated by an impressive engraving. At the end of the second edition of the work, the author attached the catalogue of references, which has a great scientific bibliographical value.

The early 18<sup>th</sup> century witnessed the publication of several new articles. [27] They deal with the remains of charred wood and those of other vegetable origin found in amber discovery places and amber itself. [28] On the basis of these articles and other investigations, Caspar H. Rappolt, a Königsberg University professor, came to the conclusion [29] that amber might have formed at the time of coast forest fires, when the masses of resin flowing from resinous trees got to a damp forest soil. Besides, the author assumes that resin would also form of scorched tree trunks, which due to the sun used to be particularly fluid, creating a possibility for various insects and vegetable remains to get into it. Later, resin would harden and sea storms would cover it with sand

dunes or wash to the bottom. These conclusions deserved the attention of even the 19<sup>th</sup> century researchers.

The first large-size monograph on inclusions (in respect of its format and press quality, a folio book) was published in 1742 in Leipzig [30]. Its author N. Sendel, who lived in Elbing (Elblong) for a long time, completed a valuable collection in those days, featuring the specimen of inclusions and morphological amber. Unfortunately, it was lost in the fire of 1849. It is only the splendid engravings at the end of the book that cast some light on this collection.

The collection was systematized according to the content of inclusions into two major parts: inclusions with the remains of insects and inclusions with vegetable, mineral remains, and amber specimen with morphological features. Whereas inclusions with insects were classified into three appropriate subclasses: 1) winged (flying) insects, 2) earth insects and 3) water creatures, amber falsifications and unrecognised inclusions.

The second part of the book features inclusions with vegetable remains, various inclusions of mineral origin (water drops in amber), morphological specimen of amber with the ornaments of inner textures and drops of amber. The last table of illustrations includes the prints of four Roman amber statuettes.

The book contains much data on the earlier studies and descriptions of amber inclusions, which together with the prints of inclusions and other materials are greatly valuable in the history of investigations into amber. Besides, the book presents the descriptions of false inclusions (known as far back as ancient times) and their identification methods. Among later works on the investigations into amber inclusions rank C. Linné's works published in 1735, which deserve a great scientific significance. They presented a general flora and fauna classification system worked out by the great Swedish naturalist. It served as the basis for the systematization of inclusion collections. It is worthy of mention that C. Linné was well stored with facts [31] for the substantiation of the origin of amber. In his report made in 1757 at the Petersburg Academy of Sciences, M. V. Lomonosov argued convincingly that amber is the resin of certain trees. In his later published work [32] on the strata of earth he elucidated the formation of amber at greater length.

The 18<sup>th</sup> century scientific works on amber were crowned with F. S. Bock's monograph, which thoroughly demonstrated the data collected by investigators throughout long centuries and the carried out theoretical generalizations of scientific data [33]. The

prominent professor of Königsberg University F. S. Bock directed the work of the State Mineralogy Cabinet, which possessed a valuable collection of the morphological specimen of amber and inclusions. After the study of all special literature on amber, Bock collected valuable facts proving the processes of amber formation, its chemical composition, physical properties and a host of other facts concerning the history of amber.

In his monograph the author presented and generalized the whole of the data accumulated in his investigations and observations. The book concluded with a scientific catalogue of amber collections. The merit of the catalogue lies in its topical scientific significance. In comparison with the publication of D. H. Paschke's, his forerunner's collections of the Amber Cabinet [34], F. S. Bock's catalogue was the publication of the collections witnessing their great scientific virtue.

This book was the last thorough description of amber, which seemed to complete the cycle of the 17<sup>th</sup>-18<sup>th</sup> century monographs on amber.

In the early 19<sup>th</sup> century some articles on narrower problems of amber emerged in special scientific literature on the study of amber. The first cycle of articles devoted to the solutions of economic goals in the sphere of amber extraction and exploitation [35] was published by K. G. Hagen. These articles contained a lot of historical and statistical data from old chronicles and other 15<sup>th</sup>-18<sup>th</sup> century written sources about the gathering of amber, various methods of its extraction, the sorting and preparation of raw material for production. They also specify the cases and circumstances of the discovery of unique amber pieces. A large-sized study on amber and other fossil resin [36] was published in 1816 in Cologne. Its author, a famous authority on natural science – Professor of chemistry J. F. John, availing himself of the newest achievements of chemistry, explored a chemical composition of amber, its physical properties, the preserved organic remains and other issues related to the morphology of amber. His scientific conclusions laid a solid foundation for the present-day investigations on amber. Original investigations into chemical properties of amber were continued by J. P. Graffenauer [37], and later – by I. I. Berzelius [38], whose published results greatly complemented J. F. John's study. Quite a great contribution to scientific studies of amber was made by scientific societies established in two big centres for the studies of amber: in Danzig (Gdansk) famous for its amber processing masters since old times and Königsberg, where investigators accumulated collections of amber and other science-related things.

J. C. Aycke, the founder of the *Danzig Investigators' Society*, who made up mineralogical collections of this Society, explored amber for long years and generalized his studies in his book published in 1835. [39] In his work the author makes a lengthy description of the morphological processes of amber. He also thoroughly analyses the remains of fauna and flora preserved at the time of the secretion of amber resin. He was also the first to more comprehensively study the processes of amber decay and its causes. At the end of the book he presents a concise description of the sorting and processing of amber.

A further attention of the Danzig investigators was focussed on palaeontological and palaeobotanical explorations of the organic remains preserved in amber. G. K. Berendt, a long-standing member of the Society, began his studies of amber inclusions publishing a small book. [40] Later in partnership with a group of other investigators he published a big two-part work in two volumes, summarizing his studies of amber inclusions in the course of many years. [41] H. R. Goeppert and A. Menge presented a monographic description of vegetable amber inclusions after completing a detailed study on anatomic composition of wood. The comparison of their data with today's conifers led them to the conclusion that amber resin was secreted by several species of conifers. They offered a scientific characteristic of the conifer wood remains preserved in amber as well as the growing conditions of the trees in the forests that had produced amber resin. Wood remains among other various vegetable remains preserved in amber became the focus of investigators' attention. Upon a thorough examination of the wood preserved in amber, H. Conwentz, director of the Danzig Museum, wrote a monograph on Baltic forests rich in amber. In this monograph he analysed only the organically related to amber fragments of bark, wood and other substances, which could secrete resin themselves. In Conwentz's view, the remains of wood preserved in amber with the properties of resinous trees are the plants which secreted amber (*succinit*) resin as a substance for the formation of amber through centuries. The book is splendidly illustrated with colour illustrations placed in 18 tables. All the present-day descriptions of amber are based on the conclusions of this monograph. The Danzig-based scientists O. Helm and R. Dhams wrote a series of articles devoted mainly to the mineralogical study of amber and other fossil resins. They later appeared in a periodical publication (1878-1927) of

the Society. The researches on amber were greatly influenced by the *Society of Physicists and Economists* established by the Königsberg naturalists in 1789. It accumulated a large collection of mineralogical fossils and announced its researches in the periodical publication of the Society. Among the members of the Society ranked such prominent researchers of amber as G. Zaddach, G. Berendt, R. Klebs, A. Jentzsch and a great many of others, who on the basis of private collections and those owned by the Society founded a Mineralogy Museum in 1822 as the centre for scientific studies.

Ch. Darwin's theories and the appearance of his *On the Origin of Species by Means of Natural Selection* made a tremendous impact on the completion of collections of amber inclusions and their study. V. Siverdeker was the first to draw attention to amber inclusions as a means of casting light on Darwin's theory. It provoked an enthusiastic collecting and study of amber inclusions, joined by such outstanding scientists as G. Zaddach, G. L. Mayr, H. Loew, G. Kunow and their numerous followers. The periodical publication of the Society (*Schriften der Physikalisch-ökonomischen Gesellschaft zu Königsberg*) included quite a number of important articles and monographic studies among which ranked H. Loew's monographic study on dipterous birds [44], G. L. Mayr's on ants [45], T. Cockerell's on hymenoptera [46], G. Ulmer's on ephemera and the studies on other etymological groups of inclusions.

Scientific data on a geological composition of the strata rich in amber, the formation of its deposits and other conclusions concerning their discovery places were presented by G. Zaddach [48] and other geologists, among them A. Jentzsch [49], F. Kaunhowen (1914) and O. Linstow (1922).

Following World War I, the studies on amber were continued by the Königsberg Mineralogy Museum, which was issuing a non-periodical publication. [50]. Two monographs published by K. Andrée [51] and A. Rohde [52] were also of considerable interest.

In Lithuania amber attracted scientist's attention only after World War I. The first short book on amber was published in 1922. Its author Prof. P. Matulionis adduced some concise facts about amber and its importance for Lithuanians. The economist J. Kačkelis wrote a larger monograph on the extraction of amber and economic problems in 1933.

In the post-war years, the investigations initiated by Kačkelis were successfully continued by J. Dagys, who presented a dissertation (1948) on economic issues of amber (Unfortunately, this rather comprehensive manu-

script was not published). Later, on the basis of the works by J. Kačkelis and J. Dagys, the economist J. Bubnys wrote and published his dissertation (1957).

### Amber in the Light of Current Studies

A more explicit history of the formation of amber was described in the articles and monographs of the 19<sup>th</sup> century authors due to the progress in the fields of geology, palaeontology, geography, history, archaeology, chemistry and other branches of science. Our contemporaries, exploiting the latest achievements in the sphere of science and technology, specified a number of aspects concerning a complex biography of amber.

On the basis of the mentioned facts, amber is regarded to be the extracted tree resin without any crystallographic features, containing 2-7% of amber acid in its composition. Such is the Baltic amber called *succinites* since Plinius' times.

According to the data presented by the science of geology, amber formed some 45-50 million years ago of the coniferous tree resin. In scientific works such trees are often referred to as *Pinites succinitera*. In Palaegone period the forests with such trees must have grown in the south-western valleys of the old Fenoscandinavian continent.

With the great changes in the climatic conditions (possibly due to the sea transgression or the influence of the Gulf Stream), the climate grew warmer and the amount of moisture increased. In the result of a higher air temperature, coniferous trees abundantly secreting resin grew sickly and gave forest areas to subtropical leaf-bearing trees, which could grow in a warmer climate.

The secreted resin under the conditions of a warm climate, due to the evaporation of volatile terpenes would quickly harden and later get to a damp forest soil together with wood remains.

During frequent floods, forest soils together with resin and wood remains were washed away by water streams and carried to a semiclosed sea bay by rivers and then deposited, forming glauconitic sea sand sediments called the 'Blue Soil'. Over millions of years the resin affected by various physical and chemical environmental factors underwent changes turning into the Baltic amber. Later climatic changes more than once altered the map of land continent and the sea, and the washed away amber again travelled by sea, forming various deposits of sediments in a much wider geographical area. The basic places of the Baltic amber discovery, however, remained in the Sambian peninsula.

One can find valuable scientific facts about amber in the publications of foreign researchers such as J. H. Langenheim, C. W. Beck, G. O. Poimar, R. Zadziewski, R. Schuüteri, V. G. Kovaliov and others.

In Lithuania, comprehensive researches into the geological and mineralogical properties of the Baltic amber were carried out by Dr. V. Katinas, who generalized them in his monograph [53] and in his later published work. [54] On the basis of the copious factual data of the conducted researches, he formed new aspects of amber genesis, thoroughly featuring the stratigraphy of the deposits of the South Baltic amber as well as their lithological characteristics.

Besides, upon a detailed analysis of the fascial conditions under which the places of amber discovery were formed V. Katinas continues geological and morphological researches on amber and other extracted resin. At present, they are being continued by other researchers palaeontological researches on amber and other fossil resin inclusions. Among numerous scientific publications, the works of Dr. S. Podėnas, an entomologist of the Vilnius University Department of Zoology, distinguish themselves by their maturity. With the expansion of the industry of amber adornments and souvenirs, an interest in this unique nature creation has not decreased in Lithuania. The opening of the Amber Museum in Palanga in 1963 was followed by a methodical completion of amber collections. A great part of these collections include morphological, geological and unique specimen of amber for its further study and the elucidation of various issues in the sphere of natural sciences. Another part of the museum's collections consists of amber articles and the means of its processing, reflecting various historical periods. A particularly valuable in a scientific respect is the collection of archaeological amber finds, the accumulation of which goes back as far as the late 19<sup>th</sup> century.

On the basis of amber collections, the museum features a permanent exposition, which has become a popular centre for the information on amber.

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## BERNSTEINMUSEUM – GALERIE IN NIDA UND VILNIUS

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*KUNSTAKADEMIE VILNIUS (LITAUEN)*

Das private Bernsteinmuseum in Nida (Kurische Nehrung) wurde 1993 von Virginija und Kazimieras Mizgiriai gegründet. Das Museum befindet sich in einem alten Fischerhaus, einem Architekturdenkmal. (Author von Exposition - Designer Romas Martinkus).

Als Grundprinzip diente die Idee, Bernstein zu popularisieren, seine Entstehung und Morphologie zu zeigen und besonders wertvolle Exponate auszustellen. In diesem Museum gibt es vielseitiges wissenschaftliches und Informationsmaterial über die Entstehung und das Bildung von Bernstein, das mit zahlreichen Beispielen illustriert wurde. Es wird auch gezeigt, in welchen Ländern man Bernstein findet, Information über Bernsteinmorphologie, Beispiele von verschiedenen Bernsteinsorten. Von grosser Bedeutung ist die Sammlung von Einschlüssen, wo man den Bernstein mit versteinerten Fliegen, Bienen, Kakerlaken, Tausendfüssler, Spinnen, Mücken, Ameisen und Pflanzen sehen kann. In dem zweiten Expositionsraum werden verschiedene Farbabstufungen des Bernsteins präsentiert. Zur Zeit wird die obengenannte Sammlung von Einschlüssen draussen unter freiem Himmel ausgestellt, wo sich die Fortsetzung der Exposition befindet.

Die Besitzer von Bernsteinmuseum, Virginija und Kazimieras Mizgiriai hatten auch den Wunsch, Bernstein in der Hauptstadt zu zeigen, um den Besucher- und Liebhaberkreis zu erweitern. So wurde 1998 Bernstein Galerie-Museum in Vilnius eröffnet, die nicht nur Bernstein, Erzeugnisse und seine Geschichte ausstellt, sondern auch zwei Ausstellungsräume hat, wo man die Kunstwerke aus



*Bernsteinmuseum von Kazimieras und Virginia Mizgiriai in Nida (Kurische Nehrung)*

Bernstein der zeitgenössischen Künstlern präsentiert.

Das Gebäude von Bernsteinmuseum in Vilnius (Strasse Šv. Mykolo 8) wurde am Anfang des XVII Jahrhundert gebaut. Dieses Gebäude war damals zweistöckig, in jedem Stock gab es vier Räume. Im Erdgeschoss, wo jetzt die Ausstellungsräume sich befinden, gab es Flur, Wohnzimmer, Stube und Küche. Zur Zeit wurden zwei Zimmer im Erdgeschoss restauriert. Ende des XVIII - Anfang des XIX Jh. wurde dieses Gebäude durch ein grosses Brand fast zerstört und später umgebaut. Damals wurde der Innenhof eingerichtet, der bis jetzt unverändert erhalten geblieben ist. Das Gebäude gehörte dem gewissem Saugavičius,