THE INTERNATIONAL AMBER RESEARCHER SYMPOSIUM
AMBER. DEPOSITS-COLLECTIONS-THE MARKET

Gdańsk, Poland
22-23.03.2013

Seminar academic director:
Prof. dr hab. Barbara Kosnowska-Ceranowicz
The Museum of the Earth, Polish Academy of Sciences, Warsaw

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SCIENTIFIC PARTNERS:

- Polish Academy of Sciences Museum of the Earth, Warsaw
- Castle Museum, Malbork
- Museum of Amber Inclusions University of Gdańsk
- Amber Museum Branch of the Gdańsk History Museum
- The International Amber Association
- Gdańsk University of Technology – Faculty of Chemistry
- University of Gdańsk

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Foreword

The Board of the AMBERIF Fair appreciates that research is necessary for the jewellery industry, with amber as its main focus, to develop. This awareness has brought yet again a published volume as its concrete effect and this year it is a piece fitting for the Gdańsk event’s 20th anniversary.

The AMBER. RESEARCH—COLLECTIONS—THE MARKET Symposium, the proceedings of which we now give you, enriches the knowledge about amber presented by the symposium contributors at very diverse lengths. These are both short abstracts and papers longer than can be presented during the symposium itself. 32 speakers and 22 contributors behind the poster submissions are not all. The co-authors almost double this number. Today, in view of the enormous methodological possibilities and equipment available only in some laboratories – for more complex subjects – it is important to gather a good research team. These are people of science, collectors or just simply amber lovers.

Professor Dany Azar’s paper introduces us to the state of the art in the RESEARCH on fossil resins in the world. And then there is a large dose of knowledge about the Eocene deposits of amber (=succinite) around the Baltic Sea, in Ukraine and in Saxony–Anhalt. Plus deposits which are of the same age but of different type in Fushun, the much older deposits of Cretaceous fossil resin in Myanmar (Burma) and for the first time also from Lebanon’s Upper Jurassic sediments.

From the perspective of the temporary shortage of raw amber on the market, we consider with interest the predominantly literature-based research on succinite redeposited in the Quaternary Age and the 19th century methods of its production. For the first time gypsum minicrystals have been described on the surface of amber collected on the beach which, just as barnacles and bryozoans, tell us about amber’s dwelling in the Baltic.

A British palaeoentomologist has finally pointed out that it’s really worthwhile to study copal, a source of research material that went underestimated in the past. A German researcher is still trying to convince us about the mediocre merits of ”green amber” obtained through the modification of not only copal but also other subfossil or even fossil resins.

The most difficult issues of the physico–chemical properties of fossil resins – from the point of view of identification (so necessary and always required at trade exhibitions) but also their use in cosmetics, are presented by a large and experienced contingent of chemists. We have also waited long for the discovery of the diagnostic bands of IR spectra which will allow us to tell natural amber from its modifications.

The papers on arthropods in amber are about true flies this time. A large team of authors presents Doug Lundberg’s (USA) discovery in Dominican amber: the traces of a bird, with more than just single feathers.

In COLLECTIONS, a contributor from Lithuania, a team from Russia and Polish archaeologists discuss amber routes, amber crafting in various epochs and cultures, based on collections available in museums. This is also where research material is sought by the conservators who are so vital in rescuing amber from the fatally destructive processes which it undergoes.

As always, interesting reports about amber in art, both in terms of the documentation of collections and in terms of design, can be read in contributions from recognised experts, educators and art historians.

Important MARKET issues for Baltic amber (succinite) include deposits, raw amber and trade exhibitions at which amber products reach the customers. It has become apparent that Poland’s northern Lublin region is the most prospective and recommended for raw amber production. Geologist Krzysztof Czuryłowicz gives us most realistic indications of an existing shallow deposit in Góra Lubartowska. For 13 years now, amber has had its prestigious place in Warsaw at the GOLD SILVER TIME trade show but it was in Gdańsk in 1994 that the first amber trade fair took place. The secrets of AMBERIF, organised this year for the 20th time by the MTG SA Gdańsk International Fair Co. will be revealed to you by its Project Director Ewa Rachoń.
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State of the art in the research on fossil resin in the World

OPENING LECTURE

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Amber (or fossil resin), a wonderful warm and shimmering material, with the colour of sun and gold, has seduced humans since ever and this fact is documented since at least the Neolithic. It has been prized over ages for its beauty and gemological qualities. The amber got its names in different languages and civilizations after its physical and chemical properties. A lot of mythologies provide explanations on its formation and most of them give it an origin related with divinities; but amber, in reality is a fossil vegetal resin. If today this reality is no more a secret to anyone, determining the exact botanical origin of amber is still a great challenge to the scientific committee.

Amber is renowned as being a splendid material for the fascinating conservation of biological inclusions in their minute 3–dimensional details. It is a gold mine for the palaeontologists as it contains a variety of biological inclusions in pristine conditions. Till the last five years the study of biological inclusions in amber was only made by traditional optical microscopy; but today with the drastic advance in science, a great step toward the future have been made, especially with the use of new tools of exploration and imaging, even in opaque material. These tools are represented by the X–ray synchrotron tomography or even with the new generation of micro CT–Scanners that begin to be more and more precise and available. The new technology does not allow only the study of external morphology of the inclusions, but also their infinitesimal internal anatomy, and all this in a safe non destructive way. The most impressive is that the information resulting from the use of this technology can be reproduced and distributed in all natural history museums and thus constitute a virtual typotheque. Within some years, perhaps even scientists will not have the obligation to move for examining type material, as they will have a “virtual type” in their own institution or laboratory. Moreover not only the inclusion can be visualized in 3–dimensional fashion, but even printed in3D at the scale of our choice.

Amber occurs all over the world, and every year several outcrops are discovered here and there. During the last 20 years, known outcrops of amber have increased significantly in number, due to the international growing of scientific awareness and interest in such material. There is no doubt that “Jurassic Park” in 1993, the famous American science fiction adventure thriller film directed by Steven Spielberg, and based on the novel of the same name by Michael Crichton, played a noticeable role in making amber more popular. Before this date interest in amber was mainly restricted to Caribbean and especially Baltic countries (of great tradition in amber), though amber occurrence was recognized from several localities worldwide.

Due to this growing interest and to the globalization, several serious multidisciplinary and collaborative scientific teams are formed in diverse countries, and many PhDs are done or ongoing. What is really marvelous also is the fact that with the present technologies of communication, most of these scientists from all origins are collaborating internationally; and bibliography is quickly exchanged as pdf electronic format. Consequently a relatively massive number of good quality publications are produced annually either in chemistry of amber or in its biological inclusion. Moreover, fossil material is more and more attractive to neonatologists, which are integrating the palaeontologists teams, ameliorating as such the quality of research, and in consequence our knowledge of the historical evolution of the studied groups.

I believe that scientific researches on amber(s) and its (their) inclusions will be flourishing and very prosperous in the near future; as the development of technologies and the growing interest on this (these) fossil resin(s) is very promising.
DEPOSITS, EXCAVATION, RESEARCH

DEPOSITS AND FINDS: BALTIC AMBER (SUCCINITE) AND OTHER FOSSIL RESINS

Gypsum crystals on surface of Baltic amber from beach findings

POSTER

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Many crystals – colourless and transparent, with a length up to 1 mm – were discovered in the hollows on the surface of three Baltic amber nuggets found in beach sediments, now kept at the Polish Academy of Sciences Museum of the Earth in Warsaw. The crystals are of automorphous (acicular, rod–shaped, columnar, sometimes short–columnar) habit, with perfectly shaped flat faces and properly terminated. Only a few of them are chipped or broken off. Next to individual crystals, there are also spectacular radial aggregates of several up to several dozen specimens.

Research methods and findings

The initial observations were performed with a Scanning Electron Microscope (SEM) and an EDS Spectrometer at the Bialystok University of Technology (rough vacuum, pressure of 40 Pa). Detailed tests on the crystals were run at the Research Laboratory of the Institute of Ceramics and Building Materials in Warsaw.

The elemental composition of the crystalline forms was studied using a Field Emission Gun Scanning Electron Microscope (FEG–SEM) – the spot–specific Energy Dispersive Spectroscopy (EDS) tests were performed without spraying the pieces of amber with a conductive material, in rough vacuum range in the presence of water vapour. These were standardless elemental analyses performed through Variable Pressure Quantification (ViPQ) – the EDS spectra were recorded twice in each spot, at different water vapour pressures (30 Pa and 60 Pa). The elemental composition was determined by extrapolating the signal intensity from each element to the pressure of 0 Pa (perfect vacuum).

Selected crystals were subjected to a destructive test using X–ray Diffraction (XRD), with the material placed in a Lindemann glass capillary tube. The qualitative analysis of phase composition was performed in a Debye–Scherrer–Hull optical system, using a diffractometer with a Cu anode.

The crystals’ dominant elements are carbon (6.2–11.8 %wt), oxygen (49.7–54.6 %wt), sulphur (16.9–19.7 %wt) and calcium (19.2–22.9 %wt). The presence of Na, Fe, Si and Al was also discovered, in concentrations up to 1 %wt.

The morphology of the crystals and the results of the elemental composition tests (taking into account the % content of main group elements’ atoms, excluding carbon) indicate them to be gypsum crystals (CaSO₄·2H₂O). This has been confirmed by phase composition tests (Maliszewski et al. 2012).
Based on the relevant literature, the authors’ observations and the performed analysis, it was concluded that the mineral crystallised most likely from sea water. The habit of the crystals and their condition contradict the possibility of their having formed before being deposited in the beach sediments.

The analysed crystals come in various forms and sizes. One can see smaller crystals formed on larger ones, or even entire radial aggregates found on larger monocrystals. The considerable diversity of the crystalline forms suggests that there were several episodes of dissolution and crystallisation – the saturation or depletion of the solution (Jafarzadeh, Burnham 1992). The gypsum crystals are mainly located in hollows in the amber surface where water retention may have taken place.

The tests (SEM–EDS, XRD) have also indicated the presence of other minerals:

1. **anhydrous or hemihydrous calcium sulphate – anhydrite and/or bassanite.**
   The reduced oxygen content, found in the elemental composition of some crystals as compared to the other crystalline forms, may be related to the dehydration of gypsum due to, for example, intense heating. According to Jaworska (2012), the gypsum–anhydrite transition in near-surface conditions requires temperatures close to 50°C, which are possible in beach sediments. However, the phase composition analysis did not show the presence of calcium sulphates other than gypsum.

2. **halite** – discovered using the diffraction method; the mineral may take the form of microcrystals which cover hollows and microcracks in the surface of amber or the hollows and microcracks formed on the gypsum crystals.

3. **quartz** (its presence was confirmed by means of XRD) – these are probably the fine grains of the dust or clay fraction from beach accumulations or those floating in the sea, which got stuck in the uneven parts of the surface of the analysed nugget.

**Peculiarities found on the surface of Baltic amber pieces from beach findings**

Moreover, the surfaces of three of the amber pieces display:

I – the weathered surface layer of the pieces – polygonal surface structure

II – fine pieces of driftwood in the surface hollows

III – diatom fragments on the driftwood

**Framboidal pyrite**

On the driftwood found in one of the specimens, the SEM tests have shown the presence of characteristic framboidal pyrite structures, whose aggregates are commonly found, for example, in contemporary coastal sediments. Framboidal pyrite formation is attributed to bacterial or even nanobacterial activity (Folk 2005), however the latest research points to the possibility of synthesising such pyrite aggregates under lab conditions (Ohfuji, Richard 2005).

**References**


The mining of Baltic amber deposits in Poland - an overview

POSTER

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According to the end of 2011 figures, the geological resources of the amber deposits in Poland amount to 1118 tonnes (Szufilcki et al., Eds. 2012); these deposits are found in Holocene, Pleistocene and Palaeogene sediments.

According to the new Act of 9 June 2011 on the Geological and Mining Law, amber exploration and prospecting does not require a license because amber as an ornamental stone is not covered by mining property rights (a geological works design is the only thing that is required). A licence is required to mine a deposit.

Due to the stochastic (random), irregular forms in which the amber has accumulated and the specific nature of the production method it would be advisable to carry out prospecting, exploration and extraction at the same time (Niec et al. 2010). In light of this, the Geological and Mining Law has not fully addressed the need to adapt the law to the specific nature of amber mining which had been put forward by geologists (Jurys et al. 2008). As a result, we still face the problem of illegal, wildcat mining which leads to the destruction of forests and precludes the methodical, rational development of amber deposits.

Polish amber deposits are genetically related to Palaeogene and Quaternary sediments. Due to the extensive nature of the subject we have presented chiefly the areas with the largest documented contemporary resources of raw amber and significant areas known from historical records. The Polish Academy of Sciences Museum of the Earth has compiled a list of all the localities where amber had been historically found and mined in a catalogue with maps by voivodship (region). The catalogue contains a list of 744 items (Kosmowska–Ceranowicz 2002). One of the authors of the present paper (A.M.) has performed preliminary research of the literature in German and historical cartographic materials; this research indicates that the catalogue needs to be re-updated.

Baltic amber production from Holocene sediments

The amber deposits accumulated in the Holocene are found on the ground’s surface or at shallow depths, mainly on the coast of the Bay of Gdańsk. Amber accumulations also lie at the bottom of the Bay. Due to their commonness and the relatively easy access to them, the succinite deposits which had been re-deposited in the Holocene were discovered and developed first. Initially, this was mainly done by gathering amber nuggets which accumulated in the process of coastal sedimentation. Both historically and today, the Vistula Sandbar and the Vistula River Delta are the areas of amber production from Holocene sediments in Poland.

Amber has been continuously produced from the coastal part of the River Vistula Delta since Neolithic times (Zalewska 1971). The oldest traces of Baltic amber production from Holocene sediments inland date back to 2500—2200 BCE and have been documented by archaeologists in the Vistula Lowland (Żuławy) region (Mazurowski 2005). The amber accumulated in the Holocene sediments on the Vistula Sandbar has been excavated since at least the 16th century (Kosmowska–Ceranowicz and Pietrzak 1985).

The intensive, industrial–scale amber production in this area took place in the 19th and 20th centuries. The output of the mines built “on the shores of Gdańsk” was high in the early 19th century; according to the great naturalist of the time A. Humboldt (1861), it was higher than in the mines of Sambia. In the second half of the 19th century, three mines were built in the area of Gdańsk’s Wisloujście Fortress; their exact location
was recorded on the Gdańsk plate of the Prussian Province Geological Map (Geologische Karte der Provinz Preußen) on a scale of 1:100,000 (Berendt 1871). At the time amber was also extracted in the towns of Brzeźno and Stegna (now districts of Gdańsk) (Klebs 1883).

![Geological map of the Gdańsk area, showing the location of amber deposits.](image)

Fig. 1. Magnified detail of a geological map on a scale of 1:100,000; plate: 1871 Gdańsk by G. Berendt with three amber mines marked in the area of Wisłoujście (Weichelmünde). Collection of the Polish Academy of Sciences Gdańsk Library.

In 1868 intensive mining of the Holocene deposits took place in the vicinity of Stegna by the Stantien & Becker company. Amber was extracted from a pine forest, about 1 km from the seashore, from a depth of 5 m. The walls of the pit, which was ca. 4 m wide, were reinforced with a timber lining. After cutting into the water table, the water would be removed with large wooden shovels and the succinite was scooped up from the water with wash nets, made of special mesh fixed to a long pole (Zaddrach 1869).

In the early 20th century, the construction of the port of Gdynia led to the coincidental discovery of large amounts of amber. During the construction and silting works performed in 1924–1934, vast quantities of amber nuggets, which could weigh as much as several kilograms apiece, were excavated (Kosmowska–Ceranowicz 2004).

There was a return to the systematic mining of the Holocene deposits in the vicinity of Gdańsk in the 1970s (Listkowski and Łazowski 1975). In May 1972, 14 amber production licences were issued in Gdańsk (source: www.gdansk.pl); the same year saw the first official use of the hydraulic method for extracting amber at the Wisłoujście Deposit in Gdańsk’s Stogi district (it had probably been used for the illegal mining of amber already in the 1960s). Today, hydro–mechanical technology is the most efficient way to prospect for and to mine amber deposits (Juryś et al. 2008). It works by means of “dynamic, wandering craters” made within a metal hoop with a strong stream of water directed vertically down. The stream of water is supplied to the head of the machine with a flexible hose and inserted into the sediment manually with handling rods. The water washes the output out and brings it to the surface, where it is fished out with nets with a 0.5 cm mesh. The maximum production depth is between 10 and 20 metres (Nieć, Ed. 2010).
As a result of geological surveys carried out in the early 1970s, the Wysłoujście, Górki Zachodnie, Sobieszewo–Komary Pole1 (Field1) and Sobieszewo–Komary Pole2 (Field2) deposits were documented. Later, two C2 category placer amber deposits were documented: the Wiślinka Deposit in the Vistula Lowlands (Żuławy) region (resources of 3.3 Mg) in 1996 and the Przeróbka Deposit in Gdańsk in 2009 (resources of 17 Mg). These deposits remain undeveloped or partially developed.

The now exhausted Wysłoujście Deposit was the largest of the Holocene amber deposits documented to date. Amber resources amounting to 178 tonnes were identified across an area of 70 ha (Jurys et al. 2008). Given the earlier 19th century amber mining in this location (there are records of amber production at Wysłoujście already in the writings of 18th century naturalists) and the illegal exploitation in the 20th century, the resources of the Wysłoujście Deposit must have been much larger.

The area in the Vistula Delta has now been deemed highly / moderately prospective, while exploratory and prospecting work is under way in Gdańsk on land which belongs to the county (powiat) of the City of Gdańsk (Jurys et al. 2008; Nieć, Ed. 2010).

Prospecting for amber accumulations was also carried out at the bottom of the Bay of Gdańsk, in the submarine part of the Vistula Delta. Methodological amber prospecting were carried out a number of times in the coastal area from the late 1970s. One of the methods was the hydro–mechanical method, used in 2005 by the Przedsiębiorstwo Robót Czerpalnych i Podwodnych sp. z o.o. [Dredging and Underwater Works Company] of Gdańsk. The exploratory headings were made using a cutter suction dredger, which sucked in the sediments from the seabed and sent the output through a floating pipeline to a screen–equipped pontoon workstation. After the amber was separated mechanically on the screens, the rest of the excavated material was dumped at the bottom of the sea in the excavation it had been taken from (Jurys et al. 2008).

The history of Baltic amber production from Pleistocene sediments

The Baltic amber deposits which are genetically related to the redeposition of the amber–bearing Palaeogene formations during the Pleistocene glacial periods are now of mainly historical significance. Today these deposits are almost completely exhausted, as they were intensively mined in the 18th and 19th centuries.
in the Kurpie region, the Tuchola Plain, the Kashubian Lake District, the Kashubian and Słowińskie Coast and other areas.

Presumably, the Kurpie region outwash plains (sandurs) of the were one of the oldest areas in Poland where amber was mined. German scholars were of the opinion that amber had been obtained in the vicinity of the River Narew since the times of Pliny the Elder (Klebs 1883).

In the early 1800s, the mining of the Kurpie amber deposits became industrialised to reach its peak during the first half of the century. The amber localities were enclosed within the lines which connected the following towns: Nidzica – Szczyno – Ruciane – Pisz, Pisz – Kólno – Nowogród; Nowogród – Ostrołęka – Krasnosielc; Krasnosielc – Chorzele – Janowo – Nidzica. Many shafts of up to 1 m under the surface were drilled to mine the amber. In 1835–1836, 1435 kg of amber was produced in the Ostrołęka forest administration region. The mining of the amber on private property was usually carried out by the landowners. In the case of government–owned land, the amber–producing plots were leased through auctions. The government mines in the Kurpie region closed down already in 1827–1839, but the last legal mine in Ostrołęka was leased out as late as in 1850. In 1880–1900 amber was still commonly mined on private land. Intensive amber production was continued in the vicinity of Rżaniec until the outbreak of World War I (Małka 2010).

The historical amber–mining areas in the Kurpie region attracted renewed interest in the 1970s. In 1977 and 1979, upon the initiative of the PP Jubiler State Enterprise of Sopot, the Północ Geological Factory of Warsaw teamed up with PP Jubiler to carry out geological survey and exploration on the Kurpie Plain. Three areas were explored: the valley of the River Rozoga, the River Omulew basin in Lelis Commune and the Czarnia–Surowe area in Myszyniec Commune. All told, 73 bore–holes were drilled at the time using the rotary percussion method, together with 1397 hydraulic bore–holes up to 10 m deep. No hydraulically productive amber accumulations were found and the explored areas were deemed negative (Gradys 1981). Today, the area does not play any role in the raw amber management.

Another amber–rich area mined in the 18th and 19th centuries was the upland of Gdańsk and its vicinity. Within the present Gdańsk city limits, Pleistocene deposits occurred in the Oliwa Forest, Trzy Nury, Brzętowo and today’s housing estates of: Klukowo, Firoga, Bysew and Kokoszki. Succinite was also produced in the following villages: Kleszczewko, Różyny, Łęgowa, Klodawa, Goszczyno, Bielkowo, Lublewo, Kowale, which are now within the limits of Gdańsk County (powiat), and also on Amber Hill (Bursztynowa Góra) in Bąkowo. The amber was mainly strip mined, with primitive subterranean mines also built (the latter could be as much as 20 m deep: so–called timbered multi–shaft mines). In Klukowo in 1869–1971 amber was produced from four mines near the villages of Drieck (Trzy Norty) and Viereck (now the Firoga housing estate in Gdańsk). The exact location of these mines was recorded on the Gdańsk plate of the Prussian Province Geological Map (Geologische Karte der Provinz Preußen) on a scale of 1:100,000 (Berendt 1871).

Pleistocene amber deposits were also mined in the 19th century in Bąkowo, on Amber Hill (Bursztynowa Góra) and in the nearby Lublewo. The Pleistocene amber accumulations constituted entire packets of Palaeogene amber–bearing sediments transported by the glacier in the form of glacial erratic slabs and amber grains and cobbles distributed through scattered transport.

In the early 1900s, geological research, being part of the mapping of the area, made it possible to determine the range and nature of the sediments. In the legend to the 1903 geological map of Prusocz Gdańsk (Wolff 1903a,b) we can find descriptions of Palaeogenic amber–bearing sediments, known as “Blue Earth.” The sediments were dated at the Lower Oligocene, very accurately for the time. These sediments were documented in photographs taken during geological surveys performed in places including Amber Hill (Bursztynowa Góra) in the vicinity of Bąkowo.

Geological research was performed again in the 1970s at Lublewo, Kokoszki and Klukowo; however, no amber nuggets were found in the drilled sediments (Sylwestrzak 1975).
Today, the only promising amber locality in Pleistocene sediments is the vicinity of Mozdżanowo on the Słowiński Coast. The amber deposit was discovered there as early as in the second half of the 18th century. In 1782–1784 many mines established by the merchant Liepmann operated in the vicinity of Starkowo and Mozdżanowo. These were usually shallow headings, no more than 4 m under the ground (Małka 2010). Further operation stopped when the water table had been reached.

Later, in 1950–1956, deep bore–holes were drilled in Mozdżanowo in order to explore the deposit, with amber deposit prospecting carried out in 1957. In 1974–1975, thirteen bore–holes of an average depth of 20 m were drilled, together with two deeper bore–holes: M I to a depth of 173.5 m (the bore–hole reached the roof of Mesozoic formations) and M II to a depth of 70.3 m. Both bore–holes reached the Palaeogene layers located in situ. The presence of amber was documented in 11 bore–holes. The research showed the presence of glacial erratic slab in Quaternary sediments at a depth of 2.5–6.0 m under the ground – an accidental inclusion of Upper Eocene sediments. The erratic slab’s sediments include silt, clay, sometimes xyloid coal with brown coal and quartz sand with amber splinters. The Palaeogene formations in the secondary deposit reach a thickness of 12.4–33.8 m. The amber occurs here in the form of unevenly distributed pockets. The age of the Palaeogene erratic slab sediments is estimated at the Upper Eocene, while the occurrence of amber is related to a Polczyno Member of the Lower Mosina Formation (Błaszak 1987; Kramarska et al. 2010).

The recoverable geological reserves of amber in the Mozdżanowo area have been estimated at 10 Mg (Szufilcki et al., Eds. 2012). With no investors available, the deposit remains undeveloped.

**The prospects for Baltic amber production from Palaeogene sediments**

The Palaeogene Baltic amber deposits in Poland have never been mined and still remain undeveloped. The Palaeogene amber association is found in two areas: in the northern Lublin region and in the vicinity of Władysławowo.

The occurrence of amber–bearing formations in the northern Lublin region is related to the Siemień Formation dated at the Upper Bartonian (Woźny 1966) and Priabonian (Kasiński and Tłokanowicz 2007). The layer of Palaeogene sediments in the discussed area is made up of Quaternary clastic formations. Most commonly these are: yellow–brown and grey fine– or medium–grained quartz sand and polymictic sand, sometimes silty, very fine–grained silty sand and morainic loess–like clay.

In 2004, the Góra Lubartowska category D deposit was documented. Its resources have been estimated at 1088 Mg with an average accumulation of 376.8 g/m³. The amber association in this area occurs at a shallow depth (at a 12 m datum on average), with the average 10 m thickness of the deposit layer (Kasiński and Tłokanowicz 1999). With no investors available, the deposit remains undeveloped.

The vicinity of Władysławowo is the second area where amber is found in Palaeogene sediments. The Kashubian Coast amber–bearing deposits were identified in the area of the Swarzewo Hillock (Kępa Swarzewska), the Puck Hillock (Kępa Pucka) and the River Plutnica valley, which separates the two, reaching as far as the town of Karwia and the Hel Peninsula.

The Kashubian Coast amber–bearing formation at Władysławowo is the western extension of the rich Sambian deposit. The amber–bearing series is genetically related to the sediments of the Chłapowo–Sambia delta, also known as the Palaeogene Gdańsk Delta (Kosmowska–Ceranowicz et al. 1990; Kramarska et al. 2008).

The occurrence of amber in Palaeogene deposits in the Swarzewo Hillock (Kępa Swarzewska) was found during the 1965–1972 geological research on salt deposits (Marzec and Woźny 1972). In order to establish a more exact assessment of the quality and quantity of the amber, three full–core geological and exploratory drill holes with a diameter of 132/112 mm – Chłapowo I, II and III – were drilled in 1981–1983. The analysis of the data from all the drill holes made it possible to establish the range and thickness of
amber–bearing deposits, while based on the three holes drilled in 1981–1983 the volume and concentration of amber in the sediment were estimated (Olkowicz–Paprocka 1983).

In the years that followed, further Palaeogene– and Neogene–related research performed in the Baltic Sea and on the coast showed the amber–bearing sediments to continue towards the east in the Hel Peninsula, where these formations were found in 1992 in the Chalupy and Kuźnica cartographic drill holes (Kramarska et al. 2008).

There is currently no production from the Palaeogene amber deposit in Chłapowo and its future development potential will very likely be connected with new inventions in efficient raw amber production technologies for major depths and the exhaustion of the deposits located closer to the surface of the ground.

The hydro–mechanical well technology is an interesting option for the production from these deep Palaeogene deposits; it is commonly used for glass–making sand and phosphate sand produced from deep within the ground and from the bottom of seas and oceans (Nieć, Ed. 2010). Perhaps it is this very method that, in the future, after the near–surface and shallow amber deposits are exhausted, will make up for the shortage of raw amber on the market.

References
Geological nature and primary sources of amber-succinite deposits in Europe

Lecture

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The questions about amber origin concern humanity since ancient time. The earliest plausible information about the amber origin belongs to Pliny the Elder (23–79 AD) who proved its vegetable nature.

In the beginning of the 21st century, all important stages of this long process – from the resin efflux from producing species of gymnospermous trees, and its accumulation in the soil of the amber forest to form amber–succinite deposits in sediments of the marine basin – became a certain theory which has some amount of points that need clarification.

Eocene–Oligocene amber forest soil in the European platform has not been discovered yet. Systematic paragenesis of natural fossil resins, amber–succinite and brown coal, small amounts of resins presences, succinic acid in brown coal are generally accepted.

Based on the data of analysis of the Cenozoic coal basins in Europe, the geological position and the material composition of fossil resins, and paleogeography of the seas, which surrounding lignite basins of Germany, Poland, Byelorussia and Ukraine in the Eocene –Early Oligocene, H. Lebed’ and V. Matsui came to conclusion that the primary source of amber–succinite in European deposits could be eroded layers of bitum–containing brown coal of buchak suite, and its stratigraphic analogues of before Late Eocene age. In light of the proposed conception, the bituminous brown coal formation is regarded as a placer, or indigenous origin of fossil resins and amber–succinite.
New Jurassic amber outcrops from Lebanon

POSTER

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Reports of amber of occurrence predating the Lower Cretaceous are extremely rare. During the past two decades, records of discoveries of amber sites have increased considerably worldwide, consequently to the alertness by the scientific community of the importance and conservational pristine quality of the amber.

Lebanon is well known to contain abundant Lower Cretaceous amber outcrops (more than 400 localities). A number of these outcrops yielded the oldest amber containing intensive biological inclusions. We report herein the discovery of nineteen outcrops of amber from the Late Jurassic in Lebanon. Some of these outcrops gave large centimetric sized amber pieces. These new amber sites are all located in the Northern part of Mount Lebanon in volcano–lateritic Late Jurassic deposits (Kimmeridgian age, circa −150 Million Years). The amber is found in lens of lignite mixed with laterites and pyrite that occupy pits in a volcano–basaltic complex soil.

Fig. A. Jurassic amber outcrop in Ehden-Aintourine region
B. Jurassic amber from the outcrop

The characterization of these Late Jurassic ambers is performed by studying their chemical constitution via FTIR (Fourier Transform InfraRed) spectroscopy.

Though the new Jurassic amber yielded to date no more than some fungal inclusions, but the discovery of such material is very significant and promising especially in the reconstruction of the paleoenvironment. It also opens great prospects to reveal hopefully some Late Jurassic fossil arthropods.

Acknowledgements: This is a contribution to the team project “Biodiversity: Origin, Structure, Evolution and Geology” awarded by the Lebanese University; and to the program “Novembre 2” from the French National Institute for the Universe Sciences. YN would like to thank the AZM and SAADE Association for financing his PhD
Overview of Bitterfeld amber

POSTER

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History

The first discovery of amber from the Tertiary in the Bitterfeld area was made in the push moraine of Schmiedeberg. There, the enormous glacier compressed the layers imbricatively during the ice age. This way, the amber–bearing sediments came to the soil surface here and there. A letter from 1731 informed King Augustus II the Strong about the first findings of amber near Großwig (a village not far away from Bad Schmiedeberg). A turner from Schmiedeberg exploited amber from a pit discovered by himself in Patschwig between 1880 and 1890 and produced pipe bowls (fig. 1).

First findings of fossil resins near Bitterfeld were made at the beginning of the brown coal mining starting about 1850. A piece of resin with a mass of 1 kg was found in the mine of Golpa in 1906. It came from the underlaying bed of the lignite deposit. The resin was named “Scheibeit”. Later, comparisons of IR-spectra recognised that the resin was Glessit.

Amber was found in the brown coal pits Muldenstein and Goitsche (field I) already in the 1950s and 1960s. However, the exploration only began in the 1970s when the amber bearing sediments under the coal were exposed in the Goitsche Mine (field III). At the same time the amber supply from the Soviet Union decreased.
Mining

In a first Dry-mining period (1975–1990) the amber-bearing layers were extracted by an excavator (fig. 2). The silt was deposited in temporary stock–piles. They partly became relocated several times and served for several purposes. So the temporary stock–piles of silt were useful for continuous charging of the treatment facility, even if the exploitation machines were not available all–the–year. Furthermore the material broke up into smaller pieces in the meantime. Thus the preparation process became easier after six months storage of the raw material under atmospheric influence. The amber–bearing silt was carried to the treatment facility by a dumper (from 1983 with electric motor). The amber was separated with high water pressure (fig. 2). At the end of the shaker the amber came into a basin with MgCl₂–lye, where the amber swam up and could become fished out. Afterwards the material was sorted by hand into 4 fractions. The amber output was 408 t during this period.

The open–pit bottom was flooded after 1990 for reasons of environmental protection and the extraction was continued under water (Wet–mining 1992/93) with a floating dredger. Bucket wheels stirred up the silt (fig. 2). The silt–amber–mixture was exhausted and pumped through pipes to the treatment facility. However, this process did not get beyond the experimental stage. In 1993 the amber mining in the Goitsche Mine was definitely finished.

Private collectors still searched for amber for several years until the mine was suddenly completely filled with the floodwater of the river Mulde in 2002.

Fig. 2. Amber mining in the Goitsche mine of Bitterfeld (top left: Dry-mining 1975-1990, top right: amber separation with high water pressure, bottom: Wet-mining 1992/93, photos: R. Bär)
Application

Bitterfeld–amber was mainly used for manufacturing jewellery. The amber was sorted into four size classes and supplied to the factory VEB Ostseeschmuck in Ribnitz–Damgarten. There necklaces, pendants and other amber–jewellery were produced and exported abroad to get hard currency.

Bitterfeld–amber is integrated in the chain of office of Bitterfeld (fig. 3). The necklace was manufactured for the occasion of the 775th town anniversary. It is made of massive silver (925) with four typical insignia of Bitterfeld: the city coat of arms, the famous Bitterfeld–words „Seh’n wir uns nicht auf dieser Welt, so seh’n wir uns in Bitterfeld” (If we don’t see us in this world, we’ll see us in Bitterfeld), six synthetic spinels, produced in Bitterfeld and eight natural pieces of ambers. These amber pieces are dominating the chain of office and add a special vibrancy to it.

Great quantities of small–sized pieces resulted in the amber mining in Bitterfeld. These small pieces were not suited for jewellery. Therefore, 5 t of amber–lacquer were produced from 10 t amber during a short period from 1988 to 1989 in the factory VEB Delicia Delitzsch (fig. 3). The lacquer should become exported and was therefore presented on the Leipzig–fair in 1989. As a consequence of the political change in East Germany the production was stopped and not resumed due to the great expense.

Amber inclusions are a matter of importance for science. Until 1990 the inclusions were separated before manufacturing the amber for jewellery in the factory VEB Ostseeschmuck and were handed over to the Museum of Natural History in Berlin for further studies. Scientists from all over the world investigate the fossils of the Bitterfeld–amber since the last decades.

Geology

The amber–bearing Tertiary sequence of Bitterfeld is located on the Halle–Wittenberg–block. The amber–bearing sediments are classified as Lower Miocene/Upper Oligocene with an absolute age of 23.8 million years. The strata series consists of 2 to 5 m thick silty to sandy and silty to clayey layers with coaly additions and lots of light mica. The amber–series is situated at the basis of the Bitterfeld coal bed and can be subdivided into the following layers (from top to bottom):

- Bitterfeld amber–silt (Bitterfelder Bernsteinschluff)
- Bitterfeld amber–sands (Bitterfelder Bernsteinsande)
- Friedersdorf amber–silt (Friedersdorfer Bernsteinschluff)
- Bitterfeld under–companion (Bitterfelder Unterbegleiter, equivalent to coal bed Breitenfeld)

Fig. 3. Bitterfeld amber in the chain of office of Bitterfeld (left) and amber-lacquer (right)
The Upper and Lower Bitterfeld mica–sands with a thickness of 20 to 30 meters are lying under the above mentioned strata. The enclosed plant and animal fossils show the temporal expanding of the Tertiary Sea from northwest (North Sea basin).

**Bitterfeld amber–forest (inclusions, fig. 4)**

More than 20 million years ago large forests grew in the central German area. Some of the trees produced resin, sometimes acting as a trap for spiders, insects, parts of plants and other organisms. The study of these fossils provides information about the composition of the forest, the relationships between the organisms and even the climatic conditions.

Currently about 580 different species from ca. 260 families belonging to fauna, flora, fungi and microorganisms are specified from Bitterfeld amber.

![Fig. 4. Inclusions in Bitterfeld amber: left moss (Hepaticophytina), middle beetle (Elateridae), right midge (Mycetophilidae)](image)

**Plant inclusions** are rare in Bitterfeld amber, but stellate hairs are quite common. Other rare plant inclusions like leaves, needles, flowers and wood–splinters show the coexistence of conifers, other flowering plants, ferns and mosses. Large parts of the Bitterfeld amber–forest will have been interspersed with pools and swampy areas *(swamp forests)*. The most frequent beetles (Helodidae, Elateridae, Ptinidae, Aderidae) indicate the presence of decayed and fungal–infested wood. Mosses, ferns and fungi also refer to wetlands within the amber–forest. Many organisms have specialised in living in the soil and in recycling falling leaves and dead trees. Springtails played an important role in this context. Other inclusions in Bitterfeld amber are mites, woodlice and millipedes. The life on a trunk is divers. The probability to get stuck into the resin was high there. Many beetles and their larvae live in and feed on wood or dead wood. Pseudoscorpions have a flat body. This indicates their habitats: under the bark of trees or in rock–crevices. In addition to forest glades within the Bitterfeld amber–forest large areas will have had *savanna–like character*. Among others spiders, termites and grasshoppers settled in open areas. Spiders span their cobwebs between culms and twigs – so even remains of cobwebs are kept as inclusions in the Bitterfeld amber. The inclusions provide information about the presence of water in the amber–forest. So aquatic insects were included from the amber in some cases. But also the larvae of some midges and caddisflies develop in the water. Caddisflies are common in Bitterfeld amber despite their rather large size and show us the presence of clean waters. Ants often live in the forest *canopy*. They are searching for aphids and are feeding on their sweet excrements. Ants and aphids
are common in Bitterfeld amber, too. The air space was dominated by the large group of diptera (flies and midges). Representatives of this order are the most common inclusions in Bitterfeld amber.

**Fossil resins (fig. 5)**

Most of the Bitterfeld amber is Succinite, similar to Baltic amber. It contains 3 to 8 % succinic acid. The resin originates from pines (*Pinus*), cedars (*Cedrus*), umbrella–pines (*Sciadopitys*) or other conifers.

![Fossil resins from Bitterfeld](image)

**Glessite** belongs to the most common accessory resins of Bitterfeld. Two varieties were found in the Goitsche Mine: a red to black–brown variety with a bubbly or sugar–grainy surface and a grey variety with light–grey to dark grey–brown colours. Incense trees or birches (*Burseraceae, Betulaceae*) were probably the producer.

**Beckerite** belongs to the brown–resins and was found as opaque brown and lumpy masses. Beckerite is harder and denser than succinite and contains only traces of succinic acid and waxes.

**Gedanite** is a light–yellow, transparent fossil resin. In weathered form it has a matt and powdery coating. *Agathis australis* und *Cupressospermum saxonicum* are considered as the resin producer.

**Siegburgite** is an aromatic fossil resin. In Bitterfeld it was found as tuber–shaped aggregates (small dripstones and pebbles) with white–beige or beige–brown colours. Botanically it is assigned to the witch–hazel family (*Hamamelidaceae*).

**Stantienite** is a black fossil resin. In the Goitsche Mine a bulbous and glossy variety was found with conchoidal fracture. The resin is probably a product of exudation in consequence of an ignition on the resiniferous trees. A botanical assignment is not possible at present.
Besides the Stantienite, plated and matt black fossil resins occurred in Bitterfeld. Their classification is difficult. It could be a pine resin, which was also influenced by smoke.

Goitschite is an opaque, dark white to whitely–green fossil resin. Its mother plant is still unknown. However, Goitschite is definitely a hitherto unknown*, new resin from the Bitterfeld resin deposit and was named after the Goitsche Mine near Bitterfeld.

References
A bibliography about Bitterfeld amber is published under following citations. The current state of this bibliography comprises more than 437 publications and unpublished documents.

“Electrum”: why was the same word used for amber and for the naturally occurring alloy of gold + silver?

POSTER

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In pagan tradition and in myth, the Golden Age was a time when men were immortal. In those times–that–never–were, reproduction was unnecessary and women did not yet exist. By the mythic times of the Age of Silver, Death had come and myth speaks of women and genealogies.

The transition from Gold to Silver is not clearly indicated, but a survey of diverse myths shows that that two sub–Ages had been inserted between Gold and Silver. These sub–Ages had mythic and real properties intermediate between gold and silver.

The First sub–Age was of Amber (Electrum), in part because amber may have a color intermediate between gold and silver. In myth, this sub–Age is characterized by “woody imagery”: amber, resin, trees (including Jupiter’s Oak), acorns, acorn–eating pigs, woodpeckers (Picus), honey (including Milk and Honey), spears, javelins, black, black charcoal, ravens, single–bladed axes, carpenter…

The Second sub–Age was of Electrum (the naturally occurring metallic alloy of gold and silver). In myth it was indicated by electrum metal, alloys, swords, armor, chain mail, white, white charcoal, swans, doves, double–bladed axes, smiths, son of carpenter…

The transition involved the crossing of a mythic river, celestial or terrestrial, the River Eridanus, in which amber or electrum metal was supposedly found.

Both sub–Ages were characterized by wars and judgements – two ancient manners of reaching decisions – destined to decide whether humans merited a Return to the Golden Age.

The Golden Age was ruled by Saturn. The Silver Age was ruled by Jupiter/ Zeus. One or both sub–Ages of Electrum were ruled by Mars, god of War and Judgements. These are planetary gods. Planets are “wandering stars” and gold, silver, amber and electrum are “wandering rocks” whose essence “wanders” when heated (in a charcoal fire) as though by the heat of the life–giving Sun.

The geological and gemmological features 
and age constraint of Burmese Amber

LECTURE

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Amber from northern Myanmar, called Burmese amber or merely "burmite", is the only Cretaceous amber deposit in the world that is exploited commercially, as well as the first to have been studied scientifically. The history of its use has been reviewed by Zherikhin and Ross (2000), Cruikshank and Ko (2003), Grimaldi et al. (2002), and Ross et al. (2010). Briefly, burmite had been used primarily in carvings for at least two millennia by Chinese, for which the material is ideally suited (Grimaldi 1996). The deposits in the Kachin state, northern Myanmar are productive (an estimated 83 tons were exported between 1898 and 1940), and some amber pieces are very large (the largest is 15 kg, in the Natural History Museum, London). Moreover, colors vary from a transparent yellow to a highly desirable deep red, the amber resists fracturing and is relatively hard (1.2 times harder than Baltic), and it receives a glassy polish. Burmite mining lapsed from just before the independence of Burma from Britain in 1947, and did not resume until the late 1990's. The greatest value of burmite, however, is scientific.

Amber in general preserves biological inclusions with microscopic fidelity, so as a mode of fossilization it is unparalleled for phylogenetic and paleontological studies of Cenozoic and late Mesozoic terrestrial life forms (Grimaldi and Engel 2005). Amber from the Cretaceous is further significant since it coincides with the radiation of the angiosperms, major tectonic shifts in continental positions, and precedes the famous end-Cretaceous impact event. Of the seven major deposits of amber from the Cretaceous Period, Burmese amber contains probably the most diverse paleobiota. For example, approximately 228 families of organisms (primarily arthropods) have been reported from burmite, compared to a range of 68–125 families recorded thus far in the other six major amber deposits. Only the much larger, commercially–exploited deposits from the Miocene of the Dominican Republic and Mexico, and the Eocene Baltic amber have yielded more families and species. Interestingly, burmite contains an exceptional diversity and abundance of the most diverse order of insects, the Coleoptera (16% of all studied inclusions, representing more than 40 families, vs. 2–8% and around a dozen families in the other Cretaceous ambers).

Among the more significant records of organisms in burmite is the only Mesozoic fossil of the phylum Onycophora ("velvet worms") (Grimaldi et al. 2002), as well as the oldest definitive Mesozoic records of mosquitoes, family Culicidae (Borkent and Grimaldi 2004), and the insect orders Embioidea (Engel and Grimaldi 2006), Strepsiptera (Grimaldi et al. 2005a, b), and Zoraptera (Engel and Grimaldi 2002). Oddly, burmite also preserves the youngest records of several archaic insect groups, notably Postopsyllidium of the hemipteran family Protopsyliidiidae (previously known from the Permian to Jurassic) (Grimaldi 2003); and Parapolycentropus, of the scorpionfly family Pseudopolycentropodidae (Triassic to Barremian) (Grimaldi et al. 2005a) (Fig. 2). Parapolycentropus is remarkable for the loss of the hind wings, specialized antennae, and long, styletiform proboscis, convergently resembling a mosquito. Burmite also preserves early, primitive species in groups that are highly social today, notably Formicidae (ants) and Isoptera (termites) (Engel and
Despite its scientific significance, precise dating of Burmese amber has been elusive. For the first 80 years of its scientific study, burmite was widely considered to be Miocene to Eocene in age, although Cockerell (1917) insightfully considered a Cretaceous age based on the insect inclusions. When Alexander Rasnitsyn of the Paleontological Institute in Moscow examined the burmite collection in the Natural History Museum, London in 1995, he noticed the presence of some Cretaceous insect groups in this amber, notably Serphitidae and the extinct subfamily of ants, Sphecomyrminae (Zherikhin and Ross 2000). This and other evidence established a Cretaceous age for the material, corroborated by expanded studies of myriad arthropod taxa in the NHML and AMNH collections (Grimaldi et al. 2002). Based on 21 insect taxa found within various stages of the Late Mesozoic as well as in Burmese amber, a Cenomanian age was hypothesized by Grimaldi et al. (2002). Cruikshank and Ko (2003) reviewed the geology of the burmite deposits, based on published and original observations, and reported an ammonite specimen taken 2 m above an amber bed at the principal mine at Noije Bum, identified as Mortoniceras and which has a stratigraphic range of Middle to Upper Albian (Wright et al. 1996). Cruikshank and Ko (2003) cited unpublished reports by E. H. Davies (Branta Biostratigraphy Ltd.) of the fossil pollen, spores, and dinoflagellates, which further indicated an age of the sediments and thus the amber as "most likely Albian to early Cenomanian". The late Alban age proposed by Cruikshank and Ko (2003) is widely cited in original and review papers on burmite (e.g., Ross et al. 2010, and references therein).

The burmite–bearing rock is sedimentary and consists mainly of rounded lithic clasts (0.03 ~ 0.15 mm in diameter), with minor fragments of quartz and feldspar (Cruikshank and Ko 2003). Among the lithic clasts are mostly volcanic rocks. Zircons separated from the amber matrix form two groups. Cathodoluminescence (CL) imaging of zircon grains employed a scanning electron microscope (LEO1450VP with MiniCL instrument) at the Institute of Geology and Geophysics, Chinese Academy of Sciences (IGGCAS). Measurements of U, Th and Pb were conducted using the Cameca IMS–1280 ion microprobe at the IGGCAS. Group–I zircons are overgrown and have variable CL patterns, experienced slight geological disturbances after they formed, and their ion microprobe $^{206}\text{Pb}/^{238}\text{U}$ ages fall into a very narrow range of ~102 Ma – ~108 Ma; Group–II zircons are typical magmatic ones with rhythmically flat zones, inferred to be derived from volcanic rock clasts, and yielded a concordia $^{206}\text{Pb}/^{238}\text{U}$ age of 98.79 ± 0.62 Ma. The dating on Group I zircons is only for their interiors, thus hiding what age excursion might come from the overgrowth. Considering the nearshore marine environment and one–meter thickness of the burmite–bearing sediments, and the syn– and post– eruption deposition of volcanic clasts, the age of 98.79 ± 0.62 Ma therefore can be used as a maximal limit for the burmite (either at or after), establishing an earliest Cenomanian age for the fossilized inclusions. The age also indicates that volcanic eruption occurred at 98.79 ± 0.62 Ma in the vicinity of the Hukawng Valley.

**Acknowledgements**

We are grateful to L.C. Chen and M.S. Du for the samples. This investigation is financially supported by the National Basic Research Program of China (2009CB421008), the NCET in China (NCEC–07–0771) and the Fundamental Research Funds for the Central Universities (2001YXL048). Most of this contribution is from “Shi, G.H., Grimaldi, D.A., Harlow, G.E., Wang, J., Wang, J., Yang, M.C. Lei, W.Y., Li, Q.L., Li, X.H. 2012. Age constraint on the Burmese Amber Based on U–Pb Dating of Zircons. Cretaceous Research, 37, 155–163, Doi 10.1016/j.cretres.2012.03.014”

**References**


State of study and industrial development prospects of Volodymyrets amber region of Ukraine

POSTER

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Administratively Volodymyrets amber region covers the territory of Volodymyrets and the western end of Sarnenskiy districts in Rivne area. Volodymyrets amber region (part of the Volodymyrets–Dubrovitska amber–bearing zone) is located within the coastal and shallow–marine parts of small archipelago shelf of mezhhyirskaya sedimentation basin and characterized by its isometric triangular form and general north–north–east direction. Extension of the region at its south–west part is 40–45 km, and in the north–east part – 20 km. The area is framed by river erosion cut all around.

Mezhhyirskaya suite amber–bearing deposits of the region represented by terrigenous sediments (lagoonal–marine and coastal–marine) as well as glauconite–terrigenous lithofacies. Thickness of amber–bearing deposits of mezhhyirskaya suite within the area vary in the range of 4.1–5.0 m, and the depth of their occurrence is 5.0 –9.5 m, up to 15 m in some cases.

Some prospects were distinguished according to the results of exploration in the area of Volodymyrets amber region:

- Volodymytersky;
- Kanonytsky;
- Vyrkivsky;
- Polytsi–Maliy Zholudsk;
- Ivanchynsky;
- Romeyky–Kidrynsky.
Fig. 1. Specialized geological sketch-map of Mezhyhirska suite (Paleogene) on paleogeographic base with zoning on amber. Scale 1:200,000

**Explored objects:** 1 - Klesivske deposit, 2 - Vilne deposit

**Prospecting plots and their numbers:**
1 - Dubivka, 2 - Zhovkyni, 3 - Volodymyrets, 4 - Vyrkvsky, 5 - East Volodymyrets

Objects studied at the stage of prospecting by production association “Zahidkvartssamotsvity”

1 - Fedorivsky

Amber occurrences and place of single amber finds

The most studied amber prospects at the stage of prospecting within the Volodymyrets amber region are Volodomyrets and Vyrkvsky prospects.

The most perspective for industrial development units on the results of geological and economic estimations (GEE–2 and GEE–3) determined followed amber deposits:

- deposit "East Volodimyrets" with approbated by State Committee of Ukraine for Mineral Reserves of Ukraine preliminary estimated reserves of raw amber category C2 (class 122) in the amount of 12 417.8 kg and prospective resources of raw amber category P1 (class 333) in the amount of 46 727.0 kg.
- "Vyrka" plot with estimated reserves and prospective resources of amber in the amount from 21 301.0 kg C2 category and 12 505.1 kg of P1.
- "Dubivka" plot with estimated reserves of amber C2 category in number of 13 469.5 kg.
  If simplified scheme of special permits (licenses) for the subsoil use for amber mining will be ratified, then following plots can be used for non-industrial mining:
- "Zhovkyni" with estimated reserves of amber P1 and P2 categories of 3 916.4 kg and 668.2 kg 3 accordingly;
- "Volodomyrets" with estimated reserves of amber P1 category in the amount of 6 238.4 kg.
  Industrial prospects of amber deposits of "Kanonychi" and "Berezhanka" plots are specified.
Summarized the overall results of geological and economic estimation of exploration and commercial operation expediency of amber deposits for Volodymyrets amber region listed in Table below.

<table>
<thead>
<tr>
<th>№№ n/n</th>
<th>Plots, deposits</th>
<th>Exploration and commercial operation with the condition of implementation as the raw amber end product</th>
<th>Exploration and commercial operation with the condition of implementation as the items from raw amber end product</th>
<th>Exploration (Estimation) and commercial operation by legal entity and individual with the conditions of simplified scheme of special permits (licenses) for subsoil.</th>
<th>Reserves, resources, kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>East Volodymyrets</td>
<td>59144,8</td>
<td>-</td>
<td>-</td>
<td>59 144,8</td>
</tr>
<tr>
<td>2.</td>
<td>Vyrka</td>
<td>-</td>
<td>33 806,1</td>
<td>-</td>
<td>47 275,6</td>
</tr>
<tr>
<td>3.</td>
<td>Dubivka</td>
<td>-</td>
<td>13 469,5</td>
<td>-</td>
<td>13 823,0</td>
</tr>
<tr>
<td>4.</td>
<td>Volodomysrets</td>
<td>-</td>
<td>-</td>
<td>6 238,4</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Zhovkyni</td>
<td>-</td>
<td>-</td>
<td>7 584,6</td>
<td></td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td><strong>59 144,8</strong></td>
<td><strong>47 275,6</strong></td>
<td><strong>13 823,0</strong></td>
<td></td>
<td><strong>Total:</strong></td>
</tr>
</tbody>
</table>

The only official developer of amber deposits of Volodymyrets amber region today is LLC “Sun–craft Centre”, which on a competitive basis received a special permission for subsoil use with amber mining purpose within the East Volodymyrets № 5021 from 25.09. 2009. As of 01.01. LLC “Sun–craft Centre” got all the essential documents for mining purpose, purchases mining machinery and equipment, formed the workforce of the mining company and, starting from the second quarter of 2013, is ready to start amber mining on the "East Volodymyrets" deposit.

The Eocene Climatic Optimum and the formation of the Baltic amber deposits

Lecture

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At the turn of the Palaeocene and lower Eocene, 56.0–47.5 Ma BP, the northern hemisphere witnessed the Cenozoic Era’s period of greatest warming with two clear climatic optima, known as the Palaeocene–Eocene Thermal Maximum (PETM) and the Early Eocene Climatic Optimum (EECO). The EECO lasted ca. 8 Ma and preceded an approximately 13–million–year long period of gradual climate cooling which ended ca. 34 Ma BP with the rapid chilling related to the Antarctic Oligocene glaciation (Fig. 1). These two phenomena make up the timeframe for the evolution of phytocenoses which, at its final stage, led to the development of amber–bearing plant associations.

As a considerable part of Central Europe was covered by the sea throughout the Eocene, the primary geological record of this event comes in the isotopic composition of calcium carbonate in the shells of benthic Foraminifera (the content of the 18O oxygen isotope).

The early Eocene climate was not very diversified, without marked major discrepancies between the equatorial and polar regions. The temperature gradient was much lower than it is today: tropical rainforests developed up to a latitude of 45° north, while subtropical vegetation reached far north to what today is the polar zone.
Fig. 1. The Palaeogene climate change curve (after Knox et al. 2010)
The EECO was a fact of such crucial importance that it got clearly marked in the palaeontological record by the species composition of the marine microfauna and phytoplankton typical of tropical and subtropical water bodies: dinocysts of the genus *Apectodinium* reached their development acme and largest territorial range in the upper northern latitudes. In western and central Poland, a Foraminifera thermophilic assemblage appeared, with the *Nummulites orbignyi, Nummulites germanicus, Spiroloculina grateleoupi* and *Pararothalia lithothamnica* (Odrzywolska–Bieńkowa & Pożarska 1984). On land, the EECO was the reason for the luxuriant development of vegetation, which was also of tropical to subtropical character, in the early stage of the EECO, and of subtropical to warm temperate character towards the end of the Eocene. The Eocene’s warming period stimulated the development of forests and a significant diversification of their species. The luxuriant mixed forest which covered the land masses (Fig. 2) included: the cypress, sequoia, cedar, palm, magnolia, sweetgum, acacia, Juglandaceae, beech, oak, elm, Araliaceae, Rosaceae and pine, hemlock, *Cathaya*, etc. (Krajewska & Kohlman–Adamska 2003).

The early Eocene warming reached its optimum 49 Ma and since that time a gradual cooling process has been observed. One of its reasons was the mass scale development of the water fern of the genus *Azolla*, which reached its peak development in the polar zone waters of high latitudes. This plant was associated with significant amounts of atmospheric carbon, the element which had been responsible for the greenhouse effect in the early Eocene. Along with the drop in the CO₂ concentration in the air, an increasingly accelerated cooling progressed. The northern boundary of the rainforest zone shifted southward, while the forest cover got drier and thinner on increasingly wider expanses of land. The evergreen forest was supplanted by deciduous broadleaf woodland. Already at the turn of the mid- and upper Eocene, Central Europe’s forests included primarily the species typical of subtropical and warm temperate climates. Climate changes were also registered by upper Eocene Foraminifera associations, which included many representatives of cool–loving species, such as the *Globanomalina micra, Lenticulina grodnensis, Lenticulina dimorpha, Siphonia kaptarenki, Nodosaria intermittens* and *Bulimina aksuatica* (Pożarska & Odrzywolska–Bieńkowa 1977). In the late Eocene, it was coniferous trees that had the greatest importance in the pollen diagram, with thermophilous deciduous broadleaf trees much less significant.

Tests on wood tissue encrusted with amber indicated directly that this phytocenosis included trees of the genera *Glyptostrobus, Sequoia* and *Metasequoia*. Although usually limited in content, the palynological spectrum makes it possible to extend this list to include the genera and species of the extinct polyphyletic group of Normapolles and pollen taxa of thermophilous plants of the families Fagaceae, Sapotaceae and *Fususpollenites fusus* etc. It follows from the Palaeogene climate change curve (see Fig. 1) that the progressive climate cooling can be described with an exponential function and that its rate increased with the passage of time.

The primary reason for the climate change was the progressive glaciation of the Antarctic as a result of the geotectonic reconstruction of the Gondwana continent, which the end of the greenhouse (no ice cover) period was related to and where the icehouse (glaciation) period began.

At the turn of the mid- and upper Eocene, the cooling was significant enough to begin to exceed the adaptation capacity of the phytocenosis. An increased resin production by the trees in the Eocene forest certainly became one of the reactions to increased stress levels in plants. It has already been mentioned that the main resin producers may have included trees of the genera *Glyptostrobus, Sequoia* and *Metasequoia*. Somewhat different results were received upon comparing the light absorption curves in Baltic amber and contemporary resins (Lydżba–Kopczyńska et al. 2011; Kosmowska–Ceranowicz 2012): according to this research, succinite shows the greatest similarity to the resins of the *Cedrus atlantica* and *Pseudolarix vehri*
(Pinaceae) and the Agathis australis (Araucariaceae) (Pielińska 2012), whose resin production today, however, is not even nearly as intense. Therefore, various taxonomic groups may have been the source of the resin, which confirms the external nature of the factor which induced the increased resin production. Apart from the cooling as such, the phenomenon may have also been caused by intensified volcanic activity which – next to the impact of the progressive Eocene Sea transgression – even by itself would certainly have a direct influence on the late Eocene cooling as it emitted considerable volumes of volcanic ash into the atmosphere, in this way causing the blockage of the stomata in leaves.

![Fig. 2. A reconstruction of the Eocene forest (after Kohlman-Adamska 2001),](image)

**The coniferous forest of upper mountain ranges:**
- S – Sequoi, A – Abies, P – Picea, Lx – Larix, Sc – Sciadopitys,
- C – Cupressaceae: Libocedrus, Chamaecyparis, Thuja

**The pine-palm-oak forest-steppe of the lower mountain ranges:**
- Pn – Pinus, Pl – Palmae, Q – Quercus, L – Lauraceae, Ac – Acer, M – Magnolia,
- Cs – Castanea, F – Fagus, I – Ilex, Pt – Pittosporaceae (the Pittosporum Family),
- Z – Zamia, G – Graminae

**The moist forest of river valleys with the Glyptostrobus:**
- Gl – Glyptostrobus, Mr – Myricaceae, Cl – Clethraceae, Sl – Salicaceae, Cn – Connaraceae

In Poland, lower Eocene sediments have a very limited territorial range. In NW Poland terrestrial sediments were found only in the Szczecin IG–1 and Goleniów IG–2 boreholes (Grabowska 1983). In these sediments, an important role is played by pollen taxa of the extinct polyphyletic Normapolles group and the thermophilous trees of the families Fagaceae: Fagoideae and Castaneoideae, as well as the Platanaceae, Sapotaceae, Juglandaceae etc. Fragmentary lower Eocene marine sediments, with marine phytoplankton representative of the Ipses: the D7 and D8 dinocyst zones, occur in NE Poland and in the Sambian Peninsula (Ślodkauskovska 2008, 2010a, b). Middle Eocene marine sediments are much more common in the Polish Lowland area. In the marine basin, next to abundant zone D11 phytoplankton (Bartonian), there is a sparse sporomorphs assemblage which represents a mixed mesophilous forest with sporadically observed
Normapolles pollen. Upper Eocene marine sediments are also found quite frequently, especially in NE Poland and the Sambian Peninsula. They are dated as a D12 dinocyst zone (Priabonian). The pollen diagram shows in the foreground the presence of gymnosperm pollen, especially that of coniferous trees: *Pinus*, *Abies*, *Sequoia*, Taxodiaceae. Angiosperms are less abundant but the share of pollen from thermophilous plants is still significant (Słodkowska 2008, 2009, 2010a, b).

The changes in the palynological spectrum are the record of a progressive cooling process. One can trace the Eocene succession of palynomorph associations from the dominant thermophilous taxa of the extinct Normapolles group and others, which represent the tropical palaeofloristic element and do not have their contemporary equivalents either, to the domination of coniferous forest associations with a marked share of temperate–taxa in both gymnosperms and angiosperms.

The fact that the oldest sediments in which Baltic amber is found come from the Bartonian and the Priabonian. It indicates that the factor which brought about the increased resin production must have appeared earlier – in the Ypresian or Lutetian; therefore, it can easily be correlated with the beginning of the lower Eocene cooling, which seems to indicate a direct relationship between the production of resin – the precursor of amber – and climate changes.

References
The Eocene Fushun amber - known and unknown

LECTURE

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Amber is not common in China and only some spare records have been reported. At present, Xixia in Henan Province has the important amber deposit in China. Xixia amber is collected from the Late Cretaceous (Campanian–Maastrichtian) sandstones, which also yield abundant dinosaur eggs (Zhou & Zhao 2005). Xixia amber is minute, very loose, and usually mixed with sand. Therefore, Xixia amber is only used as traditional medicine. A piece of amber was recently discovered from the Middle Jurassic Daohugou deposits. Other amber deposits were reported from Jiayin in Heilongjiang, Yanbian in Jilin, Ganglong in Tibet, and Zhangpu in Fujian (Fig. 1). However, little is known about the precise age and inclusions of these amber specimens.

Fig. 1. Map showing the geographical distribution of Chinese amber. Mesozoic amber-bearing localities: Middle Jurassic Daohugou deposits in Inner Mongolia Autonomous Region; Upper Cretaceous Xixia amber in Henan Province; and Upper Cretaceous Jiayin amber in Heilongjiang Province. Palaeogene amber-bearing localities: Lower Eocene Fushun amber in Liaoning Province; Eocene Yanbian amber in Jilin Province; Palaeogene Ganglong amber in Tibet Autonomous Region. Neogene amber bearing locality: Miocene Zhangpu amber in Fujian Province.
Fushun, a city in Liaoning Province of northeastern China, contains six coal–mining districts. The first significant mining of coal at Fushun began about 1901. Coal production increased, first under the Russians and later the Japanese, reaching a peak in 1945 then dropped sharply and remained low until 1953 when production increased again under the first 5–year plan of the People’s Republic of China (Johnson 1990). The coal and oil shale are found in a relatively small east–west–trending exposure of Mesozoic and Cenozoic sedimentary and volcanic rocks surrounded by Precambrian terrane made mainly of granitic gneiss (Johnson 1990; Wu et al. 2002). These continental sequences consist of swampy to fluvio–deltaic and tuffaceous sediments that were deposited in the basin during the early Paleogene (Hong et al. 1980; Johnson 1990; Yang & Li 1997; Wu et al. 2002). In ascending order (Fig. 2), the sequence is subdivided into yellow–gray sandstone intercalated by coal seams (Laohutai Formation; 59–56 Ma; \( E_{1}^{1}l \)), overlain by gray–green tuff intercalated with coal seams (Lizigou Formation; 55–59 Ma; \( E_{1}^{1}lz \)), followed by a thick coal layer with a roof and bottom of dark shale (Guchengzi Formation; 51–55 Ma; \( E_{2}^{1}g \)), oil shale and black shale (Jijuntun Formation; \( E_{2}^{2}j \)), gray– green mudstone and shale (Xilutian Formation; 39–45 Ma; \( E_{2}^{3}x \)), and brown shale and variegated siltstone (Gengjiajie Formation; 30–39 Ma; \( E_{2}^{2}gj \)) (Hong et al. 1980; Wu et al. 2001; Meng et al. 2012). This sedimentary sequence across the mid Paleocene to late Eocene lacks noticeable unconformities except for the paraconformity between the first two formations, i.e., the Laohutai and Lizigou formations (Hong et al. 1980; Yang & Li 1997). The Guchengzi Formation ranges from 20 to 145 m and averages 55 m in thickness. It comprises subbituminous to bituminous coal, carbonaceous mudstone and shale, and lenses of sandstone. The coal contains red to yellow gem quality amber, it also contains a cannel coal 1 to 15 m thick that is used for decorative carving. The West Opencast Coalmine (Xilutian Opencast Coalmine) (N 41°50', E 123°54'), the largest opencast coalmine in Asia, is among the largest amber deposit in China, but it is now exhausted.

In addition to the palaeobotanical record, the ages of the formations mentioned above have been constrained by evidence of either palaeomagnetism, isotopes, or animals (Hong et al. 1980; Zhao et al. 1994; Quan et al. 2012a). The age of Fushun amber is estimated as early Eocene (Ypresian), it is aged about 49 Ma (Hong 2002a, b). The palaeoclimate in the early Eocene in Fushun is reconstructed as moist subtropical, with variability in seasonal precipitation (very probably monsoonal system), with dry and wet seasons (Hong 2002; Quan et al. 2011, 2012a, b; Wang D. et al. 2013). The estimated mean annual temperature varied between 15–21°C; coldest month mean temperature varied between 9–14°C and warmest month mean temperature varied between 19–25°C. The mean annual precipitation is estimated as varying between 650–1500 mm (Wang Q. et al. 2010; Quan et al. 2011, 2012a).

Floristic composition of Early Eocene Fushun amber forest is based on available data on 50 macrofossil plant species and 47 palynomorph species. The vegetation of the area was composed of mixed mesophytic forests with Pinus, Picea, Abies, Larix, Sciadopitys, Taxodium, Keteleeria, Sequoia, Glyptostrobus, Cycas, Quercus, Zelkova, Fagus, Carpinus, Fraxinus, Ulmus, Alnus, Populus, Betula, woody shrubs and herbs, probably differentiated from dry to moist and swampy types (Wang Q. et al. 2010; Quan et al. 2011).

The Eocene Fushun amber and its inclusions is bringer of numerous mysteries. The amber could be from honey–yellow light, transparent, through various varieties of orange, cherry and cognac colored, translucent to opaque, patchy and not transparent forms of dappled earth–amber. This variety is also related to the depositional conditions. The Fushun amber is naturally autoclaved, in the deposit. The explanation is various geothermal activities in the area of depositional basin of the Fushun area (Wu et al. 2000; Wang X. et al. 2001).
Fig. 2. Sedimentary succession in the Fushun basin.
The history of investigations on this fossil resin is dated back to the thirty-fifth of the 20th century. Plants are very common in Fushun amber. However, little research was done on these fossils. The amber is believed to originate from gymnosperm trees like Sequoia, Metasequoia and Pinus (Hong et al. 2002a, b). However, more chemotaxonomical and phytotaxonomical research are necessary in this matter. There are only a few, very scarce and hardly obtainable data about the infra-red spectra of these resins, and no detailed comparative studies were conducted yet.

The entomofauna of Fushun amber includes 12 orders: Ephemeroptera, Blattaria, Hemiptera, Psocoptera, Coleoptera, Diptera and Hymenoptera (with a vast majority described by Professor Youchong Hong (1981, 2002a, b), and undescribed Orthoptera, Dermaptera, Thysanoptera, Neuroptera and Strepsiptera. Regarding the other arthropoda, a few Araneae, Opiliones, Acarina and Pseudoscorpiones are known and unidentified Diplopoda was reported (Table 1). There are about 60 insect families comprising about 230 species known from the Fushun amber inclusions so far. The knowledge of faunistic composition of Fushun amber assemblage is still far from complete. Also the taxonomic composition, taxonomic diversity and morphological disparity of Fushun amber arthropods inclusions seems to be very unsatisfactory. One of the problems of investigations on the Fushun amber inclusions is the preservation of tiny organisms. In most cases the inclusions are shriveled and deformed. However, we hope that with implementation of new and advanced observation techniques, e.g. X-ray computer microtomography, much more information can be grabbed, even from not perfectly preserved specimens.

Table 1. Taxa of arthropods identified among the Fushun amber inclusions.

<table>
<thead>
<tr>
<th>Family / Rodzina</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MYRIAPODA</strong></td>
<td></td>
</tr>
<tr>
<td>Diplopoda</td>
<td>Family undet.</td>
</tr>
<tr>
<td><strong>ARACHNIDA</strong></td>
<td></td>
</tr>
<tr>
<td>Acarina</td>
<td>Family undetermined</td>
</tr>
<tr>
<td>Araneae</td>
<td>Dictynoidea and undetermined families</td>
</tr>
<tr>
<td>Opiliones</td>
<td>Family undetermined</td>
</tr>
<tr>
<td>Pseudoscorpiones</td>
<td>Cheliferida</td>
</tr>
<tr>
<td><strong>HEXAPODA</strong></td>
<td></td>
</tr>
<tr>
<td>Ephemeroptera</td>
<td>Ephemereellidae</td>
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We believe that Fushun amber deserve more attention and we hope that the new efforts can reveal the mists and fogs over the Fushun amber, its geological history, physical and chemical properties, botanical origin and its inclusions.

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COPAL AND OTHER SUBFOSSIL RESINS

Sub-fossils in Copal: An Undervalued Scientific Resource

LECTURE

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There are two things of which we can be certain. First, all ecosystems and their associated biotas have been in constant and dynamic states of flux since the origins of life on Earth around 3.5 billion years ago. Second, this will continue. There is ample evidence of this in the fossil record (e.g. Selden & Nudds 2012) and in some cases the faunal turnover (usually defining extinction events) has been rather drastic, for example the rise and fall of the dinosaurs and, more recently, the extinction of the Ice Age (Pleistocene) megafauna (e.g. mammoths and woolly rhinos), the majority of which became extinct fairly recently (10,000–40,000 years ago). Even more recent are extinctions of species such as the dodo, the thylacine (Tasmanian Wolf), the St. Helena giant earwig and the impending demise of the giant panda. What do such observations tell us? The fossil record informs us that, regardless of human activity, significant events occur periodically that have major consequences for life on Earth. The more recent examples demonstrate how the behaviour of humans can lead to the extinction of other species rather rapidly. How can this palaeontological information (as described above) be used to inform us about our current ongoing biological crisis, often referred to as the sixth mass extinction event, and its possible consequences? The answer is “with great difficulty”, primarily because we would not be comparing like with like taxonomically, and there are very limited data sets for both large organisms in the fossil record and for recent extinctions.

Today, insects and other arthropods such as arachnids dominate terrestrial ecosystems both in terms of their biodiversity and their biomass (e.g. Mayhew 2007). They represent well over half of the total described biodiversity on Earth. They also have an extremely long and diverse fossil record dating back around 400+ million years (Rasnitsyn & Quicke 2002; Grimaldi & Engel 2005; Dunlop & Penney 2012). Furthermore, throughout their geological history, these terrestrial arthropod groups have been more successful at surviving mass extinction events (e.g. Penney et al. 2003 [updated analysis in Penney & Selden 2011]; Davis et al. 2010) than the larger organisms discussed earlier. Nonetheless, there does appear to have been a transition, with the extinction of more primitive orders in the Palaeozoic to the origination of essentially modern forms in the Mesozoic (e.g. Dunlop & Penney 2012). The Mesozoic is also particularly important because this is when flowering plants originated and diversified and it is also when we first start to see an extremely diverse fossil terrestrial arthropod fauna preserved as inclusions in amber, fossilized tree resin (Penney 2010).

Amber represents a window on past biodiversity of long extinct tropical forest ecosystems over approximately 135 million years. These tropical forests existed in regions that have very different climates today (e.g. the Tertiary of the Baltic region, and the Cretaceous of New Jersey, USA and Lebanon to name but a few). Many fossils in amber are preserved with life–like fidelity (e.g. Penney & Green 2011) and advances in imaging techniques, such as computed tomography and synchrotron radiation scanning (e.g. Penney et al. 2007, 2012a: Soriano et al. 2010) means we can now consider many fossils in amber as taxonomically equivalent to the extant fauna, and conduct phylogenetic studies combining morphological (Recent and fossil) and molecular (Recent) data (e.g. Edgecombe et al. 2012). These scanning techniques are non-destructive and have also been applied to sub–fossils in copal (Bosselaers et al. 2010). Fossils in amber, particularly from the Baltic region, have now been studied for several hundred years with the result that this fossil assemblage probably represents the best studied and most diverse fossil assemblage anywhere on Earth, with approximately 3500 species described to date (Weitschat & Wichard 2010) and new species discovered on a regular basis (e.g. Jepson et al. 2010; Penney et al. 2011).
What is immediately evident, even without any quantitative investigation, is that arthropod taxa, (e.g. families and even genera) have undergone significant changes in their biogeographic distribution ranges throughout their existence. Some examples include Cupedidae (Coleoptera), Formicidae e.g. Gesomyrmex (Hymenoptera), Caddidae (Opiliones) and Archaeidae (Araneae) (fossils in Baltic amber), and such disjunct distributions of fossil and extant species appear to be the norm (e.g. Eskov 1992). On the whole, these observed differences most probably represent shifts in distribution ranges as a response to climate change, rather than current relict populations of a broader distribution in the past, although some current distributions will no doubt be smaller than those of the past and may hence be considered relicts. Nonetheless, the obvious question is: how can these highly diverse extinct tropical fossil faunas help us understand the potential consequences of our ongoing climate change for the fate or our extant tropical faunas? Clearly, they should be highly informative in this regard. However, as yet, no research has focused on this issue, nor have these potentially useful fossil faunas received any consideration in published works on climate change (e.g. see Penney 2012).

As with any fossil deposit (or any extant biodiversity sample for that matter) fossils in amber represent a biased sample of the overall fossil ecosystem as a whole. The importance of understanding the bias associated with preservation in amber has been appreciated for a considerable period of time (Brues 1933; Henwood 1993), although these works were severely flawed and resulted in no reliable conclusions (see discussion in Penney 2002). Indeed, only very limited progress has been made to date, e.g. Penney (2002) and Penney & Langan (2006), who demonstrated that, for spiders, amber is biased towards preserving active, trunk–dwelling faunas and that the different amber forming resins acted, physically, as a trap in the same way. Recent research has focused on the study of syninclosures shared between different amber samples within the Rovno (Ukraine) deposit (Perkovsky et al. 2012). This research is in the early stages and the current conclusions concern relatively few taxa. Moreover, this research is investigating ecological associations found in the amber itself, rather than considering the bias of what elements of the original biota were preserved. The idea that organisms trapped in Recent tree resins can shed light on the bias of preservation in amber has been considered, but data sets are limited and not all organisms preserved in resin in the amber–producing forests would have made their way into the fossil record. The only study to provide any data sets of reasonable size is that of (Zherikhin et al. 2009), which compared arthropods in contemporary conifer resins from northern Eurasia with fossils preserved in Tertiary European and Caribbean ambers. However, few conclusions can be drawn from such an approach because this is not a comparison of like with like. In the example cited, the resin was produced in a temperate climate, whereas the ambers were produced under (sub)tropical conditions with considerably different faunas.

The problem of understanding bias of preservation in amber is further compounded by several other factors. Most pieces of excavated amber tend to be <10g in weight, usually with a single or only a few syninclosures, and thus an indication of the community structure preserved at any one time is limited. This can be overcome to some degree by studying different pieces with shared syninclosures (as mentioned above), but this cannot guarantee that particular species co–existed in the same place and time (particularly for very large deposits spanning millions of years), nor does it provide any evidence of taxonomic bias of the amber as a whole. Many museums around the world have massive collections of amber inclusions, some numbering as many as 25,000 specimens (e.g. Poinar 1992: Table 6), although inherent taxonomic biases of these may exist due to the research interests of past and current curators and collectors who may have donated them, for example the Senckenberg Museum, Frankfurt, which is heavily biased towards spiders as a result of obtaining the Wunderlich collection. Zherikhin et al. (2009) attempted to estimate the true relative abundances of inclusions in two different Dominican amber collections by creating indices based on shared faunal components, which allowed them to identify deficits of specific taxonomic groups in both collections. This idea of a representative sample has been employed by other authors but has been hampered by small sample sizes (e.g. Zherikhin & Eskov (2006), Perkovsky et al. (2007) and lack of quantitative statistical analyses.

Literature derived palaeodiversity data are also problematic, primarily due to the way in which new fossil amber species are described. For newly discovered, or new initiatives for known but poorly worked deposits, the research process from a publications perspective tends to be rather uniform. A general but comprehensive synthesis of the deposit in terms of geological setting, resin chemistry and botanical origin,
and the relative abundance of the various orders present as inclusions provides a good introduction to the fossil locality. This is followed by individual taxonomic papers by specialists working on various different groups of inclusions, in which new species are described. Palaeontological data are scarce by their nature and new species in amber are often described from singletons (only known from one specimen) and only occasionally from a series of specimens, which are usually few in number. Therefore, most of the taxonomic publications do not contain appropriate data conducive to quantitative analyses even when data from multiple publications are combined. Thus, species numerical abundance data are limited, a constraint applicable to all ambers, and this tends to be more significant the further one goes back in geological time. Traditionally, analysis of terrestrial arthropod palaeocommunities has been at family level, which is considered a good predictor of underlying species diversity for some groups and is applied extensively as the “higher taxon approach” by neontologists investigating distribution, ecological correlates and diversity patterns of tropical insects living today (Labandeira 2005), although higher taxonomic resolution studies would be preferable.

Finally, the further one goes back in geological time, the fewer extant genera and families are preserved as amber inclusions, which makes trying to determine entrapment biases based on a knowledge of the behaviour and ecology of Recent taxa problematic (assuming the idea of behavioural fixity—organisms in the past exhibited similar behaviours as their close relatives do today e.g., Boucôt & Poinar 2010; Penney 2011). Similarly, the further one goes back in time, the less similar the fossil and extant faunas in terms of their occurrence in the region, limiting direct quantitative comparisons for studies of taxonomic entrapment bias. Our best opportunity for investigating such biases lies with Miocene amber from the Dominican Republic. It has at least 1000 fossil species described to date (Perez–Gelabert 2008) with new ones still being discovered (Jepson et al. 2011; Penney et al. 2012b) and the fossil and on–island extant faunas are, with a few notable exceptions (e.g. stingless bees, butterflies and termites), very similar at both family and genus levels (e.g. Poinar & Poinar 1999; Penney & Perez–Gelabert 2002; Penney 2005a, 2008; Perez–Gelabert 2008). Indeed, the presence of families and genera in the fossil fauna has been used to predict their presence in the extant fauna (e.g. Penney 1999, 2001, 2005b, 2009) some of which have subsequently been discovered living on the island at present. Hence, although we are now aware of an incredible palaeodiversity as a result of the number of described species, there are barely any data available regarding numbers of individuals of the various taxa conducive to quantitative investigations at species level.

Despite these shortcomings, there is a viable approach for investigating taxonomic bias of fossil inclusions in amber using copal as a proxy. Copal, the precursor of amber, is sub–fossilized tree resin not old or polymerized enough to be classed as amber. It occurs in various locations, but is particularly abundant in Colombia (and also Madagascar, e.g. Penney et al. 2005). Given its poorly polymerized ‘young resin’ matrix it is possible to dissolve the inclusions out completely using chloroform and to examine them under alcohol as if they were recently caught organisms (Penney et al., submitted); this approach is not possible with the vast majority of fossil ambers. This will overcome of the problem of position of preservation obscuring important taxonomic characters, previously encountered by some earlier workers (e.g. Mendes 1997). In contrast to amber, very little research has focussed on inclusions in copal because of its relatively young age. Colombian copal is (sub)Recent in age, with recent Carbon 14 analysis dating it from post World War II (e.g. Penney et al., submitted) to approximately 1700 years–old in some instances (Penney et al. 2012c).

Inclusions in copal can be informative at many different levels (Penney & Preziosi 2010; Penney et al. 2012c, submitted). Specimens of Colombian copal up to 1kg are not uncommon and can be packed with inclusions (several hundreds), all of which perished within minutes (or seconds) of one another, usually no more than a few centimetres apart. If left unearthed and discovered 20 million years from now, this copal (as amber) would provide future investigators with a window on our current biodiversity crisis, often referred to as the sixth mass extinction. Indeed, some of the few species described from Colombian copal are already extinct, e.g. the orchid bee described by Hinojosa–Díaz & Engel (2007) and an as yet undescribed butterfly (T. Emmel, pers. comm.), or may belong to presumed extant species currently undescribed from the Recent fauna (e.g. Penney et al., submitted). Some extant insect families are known as (sub)fossils only from Colombian copal (Azar et al. 2009). To future investigators these fossils would provide an insight into the biodiversity of the Neotropical forest ecosystems we are striving to conserve at present. Such ecosystems have notoriously poor potential for fossilization in the usual sense due to their hot, humid nature and vast
armies of decomposers and recyclers. Thus, as with the long extinct subtropical Cretaceous forests of Lebanon, New Jersey, etc. and the Tertiary of the Baltic region, it can be expected that little will remain of our current Neotropical forests other than arthropods entombed in amber. However, future investigators would be faced with similar problems that amber researchers face today, such as not understanding the biases of preservation or what the implications of these data may be for any conservation efforts directed at their extant forests.

Notably, Colombian copal was formed by the same tree genus (Hymenaea) that produced the Miocene Dominican (and Mexican) amber and in a similar environment (with similar faunas) (Poinar & Poinar 1999). Hence, the community structure of inclusions in Colombian copal can serve as a proxy for understanding and quantifying the taxonomic bias of preservation in Dominican amber, because entrapment in Colombian copal forming resin can be expected to be analogous to entrapment in Dominican amber forming resin for the reasons given above. Furthermore, spiders in Dominican amber have been demonstrated as having South American origins, or at least affinities (Penney 2008) and a study of the ant assemblage preserved in Colombian copal showed greater similarity to that preserved in Dominican amber than to the extant Colombian fauna (DuBois & LaPolla 1999). Thus, both fossil faunas (Colombian copal and Dominican amber) can be considered comparable taxonomically. Any conclusions from such work should be transferable to other ambers, although quantitative comparisons will be required to confirm this. This is not an unreasonable supposition, given that Dominican and Baltic ambers (produced by different tree families) trapped arthropods in the same way (Penney & Langan 2006). Despite the young age of these inclusions and their exquisite external preservation it would appear that their DNA is not preserved (Penney et al., in prep.). Hence, the potential for molecular palaeobiological research is somewhat limited. Nonetheless, we believe they hold great potential for quantitative investigations of palaeodiversity and for understanding taxonomic bias within amber faunas.

Preliminary observations of a 3kg sample of Colombian copal have identified the following arthropod orders: Araneae, Acari, Diptera, Coleoptera, Hemiptera, Hymenoptera, Mantodea, Blattodea (including Isoptera), Thysanoptera, Psocodea, Lepidoptera, Orthoptera, Trichoptera, Dermaptera, Ephemeroptera and Archaeognatha, with interesting instances of replicated co-occurrence that are unlikely to have occurred by chance. For example, an unusual palaeobiocoenosis of (sub)fossil spiders (Penney et al. 2012c) and Termitodius sp. (Scarabaeidae: Aphodiinae) with Coptotermes worker termites. Such observations are unlikely to be evident from amber because of the smaller specimen sizes. Thus, the study of fossils in copal also has the potential to shed light on the current ecology of tropical ecosystems and to provide new geographic records (Termitodius is not recorded from the extant fauna of Colombia). Our aim is to undertake this research over the coming years, by dissolving out inclusions from large quantities of Colombian copal, identifying groups of ecologically informative inclusions to high taxonomic levels, and ultimately applying quantitative analyses (e.g. DECORANA, cluster analysis and software developed inhouse) to the resulting data in order to quantify the sub–fossil biodiversity and compare it with that seen in extant Neotropical faunas and Dominican amber, in order to determine taxonomic bias in the latter.

Acknowledgements. DP is grateful to the conference organizers for funding to support his attendance.

References


Green Amber - a current challenge for gemmologists

LECTURE

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“Green Amber” is a relatively new product on the gemstone market. Natural green amber exists in two very rare varieties. One is coloured by tiny amount of pyrite, the other one receives its greenish appearance by fluorescence. Both varieties have a yellowish—brown body colour. The “Green Amber”, which is available on the market since a few years, is very often free of natural inclusions (Fig. 1). Its greenish—yellow to peridot—green body colour is always a result of an autoclave—treatment. The precursor material may be either amber or copal. In this study we have tested a number of green samples with various analytical techniques including both standard and advanced methods in order to determine the source material.

Copal is a relatively young plant resin with an average age of a few decades to centuries. The main difference to amber is the level of fossilization. Both amber and copal are composed of volatile and insolvable elements and organic molecules. During fossilization, the volatile compounds leak from the resin, while the insolvable macromolecules (hydrocarbon chains) get interconnected and form a stable three–dimensional network. The process of fossilization depends on three factors: time, pressure and temperature (among other things [ed]). As the factors influence each other, the fossilization can be accelerated from millions of years in nature to several days in the laboratory. This accelerated process has been conducted in autoclaves to stabilize copal. By this process not only the maturation of the resin is increased, also the colour and the clarity can be changed. In 2006 “Green Amber” appeared on the market (Abduriyim 2009). The autoclave
process obviously could be controlled in a way, that the colour changes do not only modify yellow and brown hues, but also induce green. To achieve a green hue, the material must be heated and cooled down up to four times. The temperature is increased nearly to the melting point and the pressure is increased up to 70 bars. The only additives are water and nitrogen gas to control the oxygen fugacity (Müller, personal communication). The resulting material has a green core and a yellowish–brown rim and nearly all physical and mechanical properties are consistent with amber. The green colour is caused by the Tyndall–effect, when light is dispersed at submicroscopical fluid inclusions (Abduriyim et al. 2009). As copal is not allowed to be sold as amber on the market, even after the autoclave treatment, much effort has been done to differentiate the starting materials of “Green Amber”. Classical tests as the “burning test”, the “solvent test”, UV–fluorescence and the “scratching test” have been conducted in order to obtain any difference between the two substances. “Green Amber” made out of amber burns with a smooth flame. “Green Amber” made of copal shows the same reaction, while burning. It is in contrast to untreated copal, which burns with a sputtering flame. Both treated materials show nearly no reaction to the contact with ethanol, whereas untreated copal becomes soft and macerates in contact with solvents. Under short wave UV–light green amber and copal exhibit a weak blue fluorescence, while they are both bluish–white under long wave UV–light. Generally untreated amber has a weak to moderate blue fluorescence under short–wave UV–light and copal has a weak to moderate bluish–green fluorescence. When scratching both autoclave–treated materials with a sharp tool, a fine dust is produced. In the untreated state a fine dust is only produced from amber, copal on the other hand produces much coarser pieces when scratched. In none of the conducted classical tests a difference between “Green Amber” made out of amber and “Green Amber” made out of copal could be observed. Due to the artificial aging during the autoclave treatment both amber and copal show the behaviour of amber.

Fig. 1. Different shades of green of the „Green amber“. The colors range from yellowish-green to peridot-green.

A common test to distinguish amber and copal in gemmological laboratories is Fourier Transform Infrared Spectroscopy (FTIR). Two regions are of special significance, the region from 800 – 1700 cm\(^{-1}\) and the region between 2800 – 3100 cm\(^{-1}\). In both areas the vibrations of various C–O and C–H bonds and C–C double bonds become visible. Important for the differentiation between amber and copal is the vibration of a C–C double bond at 887cm\(^{-1}\), which is much more prominent in copal, compared to amber. Between 1150 cm\(^{-1}\) and 1250 cm\(^{-1}\) a significant structure, known as the “Baltic Shoulder”, is caused by a combination of different O–H vibrations of polyesters (Beck 1966). This shoulder is typical for Baltic amber and is not found in copal. A second C–C double bond at 3087cm\(^{-1}\) is diagnostic for copal, whereas it is lacking in amber. Tests with differently treated amber and copal show that a classical autoclave treatment to change colour or transparency influence the appearance of the diagnostic vibration peaks, but they are still present and amber and copal can be distinguished. During the production of “Green Amber”, however, most of the diagnostic peaks are strongly diminished (Fig. 2). The relative size of the peak at 887 cm\(^{-1}\) sometimes reveals the true
nature of the material, but in many cases the multi–step treatment alters the structure of the source materials in a way, that also FTIR cannot separate between treated amber and treated copal. Additional techniques like Raman spectroscopy (Campbell Pederson & Williams 2011), gas chromatography (Vávra 1982), and nuclear magnetic resonance spectroscopy (Abduriyim et al. 2009) may give additional information, but are not available in many gemmological laboratories.

Fig. 2. A sequence of untreated (blue), heated (green) and „green” copal (red). The increase in pressure and temperature mainly affects the strengths of the carbon double-bonding vibrations. The peak at ca. 887 cm\(^{-1}\) and ca. 3070 cm\(^{-1}\) is very obvious in untreated copal, still observable in heated copal and only vaguely visible in “green” copal.

References
PHYSICAL AND CHEMICAL RESEARCH METHODS

Comprehensive research project on the amber and its application in cosmetology
POSTER

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The issue of the structure of amber and its application in cosmetics and pharmaceuticals is of interest to many research centers around the world. Although research in this area is the subject of hundreds of publications, many issues remain unsolved so far and the scientific literature each year brings reports of new applications of amber–like products. For these reasons, considering the increasing supply of wastes from the production of amber jewelry, on the 17th of June 2009 in Warsaw, two research centers: Academy of Cosmetics and Health Care, Laboratory of Technological Processes Faculty Chemistry Warszaw University of Technology and Galvano–Aurum signed the agreement to undertake joint research on succinite and its application in the pharmaceutical and cosmetic industry. The results exceeded the expectations of the research team. They have found out new chemical properties of amber, which resulted in development of methods for producing soluble polyamber esters of defined structure.

Investigations of new amber–like substances allowed for unambiguous confirmation of their biological activity when administered topically. As a result, series of cosmetic formulations were developed and then their activity was tested in vivo on human volunteers. Also new ways of cosmetic use of mechanically treated amber wastes were developed. The scope of use and biological properties of new formulations are under investigation.

Team work resulted in the publication in a refereed journal Chemical Industry and patent application. Further publications, especially on the results of research and patent applications are in preparation.

Chemotaxonomic marks of selected fossil and subfossil resin groups
LECTURE

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I. Introduction

Owing to a considerable complexity of chemical construction of natural resins and of their species diversity, the chemical composition has become the basis of one of more important classification of resins. Classification and fashion of attribution of natural resins to particular groups of plants on a basis of chemical composition, it is a task of chemotaxonomy.

Chemical structure of most of the fossil resins should be, in general, considered as a macromolecular system, cross–linked, in considerable degree composed of condensed resin acids. In the pores of the
macromolecular network the air occurs, as well as water, inorganic salts, and also organic molecular components, which can be gained to investigations by the extraction process of resins. From this general description of the structure it appears that the most accessible to examination is the soluble fraction of resins.

However, as the known classification system indicates, this is just polymerized, unresolved part of resin construction, which decides frequently of variability of the resin types, classification and also of various properties and applications.

The development of the analytical methods enables a more and more precise investigations of chemical amber composition. From a series of methods described in the references (e.g. Matuszewska 2010) the infrared spectroscopy was used the most frequently to investigation of general character of resin chemical structure. However, to the more detail examinations of resin composition, the method GC–MS (gas chromatography–mass spectrometry) is generally used, with additive possibility of including on line the pyrolytic partial destruction of resin macromolecular network.

II. Classification and chemotaxonomy of natural resins

The natural resins are product or manifestation of defence of plants against pathologic agents, or more generally – against environmental agents. As the main producers of resins the conifer (Gymnospermae) are considered. They form so called terpenoid resins. The deciduous trees (Angiospermae) produce, in turn, or the resinos exudates or the ones, containing compounds of the phenol type (so called phenolic resins (Langenheim 2003). As the resins, the gums are also erroneously considered, secreted by some fruit–trees. All these exudations have the same source: carbohydrates photosynthetised by plants. Gums, however, are a polymerization product, as they form the chains of hydrophilic polysaccharides; in the case of resins, there the biosynthetic processes taken place in the direction of terpenoic or phenolic compounds (Langenheim 2003).

The terpenoid compounds form a large group of organic combinations, which, in general, are characterized by existence in the structure of the simple units of isoprene structure. Isoprene is the hydrocarbon of the diene type: 2–methyl–butadiene–1,3 (CH₂=CH–CH=CH₂). The simples interlink of these units forms a group of compounds called terpenes. These are, mainly, unsaturated hydrocarbons but also the compounds with oxygen–functional groups (as alcohols, aldehydes and ketones). The number of isoprene monomers (containing 5 carbon atoms per chain of monomer, C₅) decides of attribution of compounds to particular subgroup. The general formula of terpenes is: (C₅H₈)x, where x is: 1;1,5; 2;3 etc. Number 1 concerns the monoterpenes (e.g. pinene, C₁₀H₁₆), number 1,5: the sesquiterpenes (e.g. cadinene, C₁₅H₂₄), number 2: the diterpenes (e.g. abietyne, C₂₀H₃₂), number 3: the triterpenes (e.g. squalene, C₃₀H₄₈) and number 4: the tetraterpenes (e.g. carotene, C₄₀H₆₄). Among greater combinations related with natural products, the polyterpenes are commonly mentioned with the general formula of: (C₅H₈)x: as caoutchouc or gutta–percha.

The monoterpane group, as the most common and volatile resin component, has a lowest usefulness to the classification of resins. Among monoterpenes, the examples of compounds identified in the molecular phase of Baltic amber– succinite, are terpenic compounds of the hydrocarbon type (α–, m–, p–cymene, alfa–pinene, camphene), alcohols (fenchol, borneol, isoborneol, terpinen–1–ol, terpinen–4–ol) and also ketones (camphor, carvomethone) (Mills et al. 1984).

For various species of coniferous trees the monoterpenoic composition can be different. It was also observed that in the transformation process the alteration can take place of compounds to others, more termodynamically stable. It is possibly one more reason that monoterpenes mentioned earlier were identified also in subfossil resins of the kauri type (Mosini et al. 1980). An example of secondary compound in succinite seems to be e.g. camphor. As a primary component, camphor is instead, more characteristic for the sap of deciduous trees: Lauraceae, Labiatae and Compositae.

The resins of conifers (especially of Pinacea family) the domination characterises of monoterpenes in the volatile fraction and in the case of the deciduous trees resins are the sesquiterpenes predominate in the volatile fraction. Furthermore, the macromolecular fraction of the resin from Pinaceae is composed of diterpenoids, whereas the deciduous tree resin – of triterpenoids. This is confirmed, among others, by the results of own investigations, obtained with the use of chromatographic methods (Matuszewska 2010).
Anderson and coworkers (e.g. Anderson 1995; Anderson, LePage 1995) on a basis of the subject literature data and of own experiments (forming chemical classification of fossil resins, widely nowadays accepted), have described succinite as a resin formed by polylabdanoic copolymer of the communic acid and communol. Succinic acid, instead, is connected as ester partly with communol units and partly with monoterpeni alcohols, as it was suggested earlier by Mills and others (1984). In the classification of Anderson the fossil kauri resin differs from succinite only by lack of succinic acid, whereas its carbon skeleton is the same as for succinite.

The Mexican and Dominican resins have, instead, the same basic structure as succinite and kauri, but are different by the stereochemistry of the methyl group at carbon atom C–4a and of the side chain at the carbon atom C–5. Their structure originate, therefore, not from communic acid but from its epimer at C–4a and C–5 – ozic acid and its hydroxyderivative–zanzibaric acid. Taking into account the similarity carbon skeleton, the three of mentioned groups of resins have been included into I class in the Anderson’s classification (Fig.1). The II class form the resins of the polycadinene carbon skeleton. Its polymeric construction is confirmed among others by contribution of sesquiterpenoic units of monomers and dimers (cadalenes) in the soluble fraction of recent and fossil resins of the same polycadinene type.

Fig. 1. Classification of main groups of fossil resins on the basis of the essential traits of their chemical structure (after: Anderson 1995; Langenheim 2003, loc.cit.)
The chemical construction like that characterises the resins of the “damar” type from deciduous trees from the Dipterocarpaceae family overgrowing enormously the forests of the Southeast Asia. The fossil resins of this type are a probable source of petroleum from this area (van Aarsen et al. 1992). The III group, after Anderson’s classification described, is formed by the resins of the fossil polystyrene character. To this group belongs e.g. siegburgtite (from Liquidambar, Hamamelidaceae, Saxony, Germany). The resins from other groups: IV and V don’t form of polymers but are characteristic by specific components as the cedrane in the IV group and diterpenoids of the abietane or pimaran type in the V group. Abounding with the last mentioned compounds, the recent pine resin (Pinus sylvestris) doesn’t form a material of high hardness—the property which is responsible for the chemical and mechanical resistance of the polymerised polylabdanoid resins.

III. Detailed chemosystematics of extant trees as a potential tool in the classification of fossil resins (selection, after work of Otto and Wilde 2001)

In the case of fossil resins discovered frequently on the secondary deposit, chemosystematics or chemotaxonomy, on a basis of comparison with a chemical composition of the sap of recent trees, can be the one source of the knowledge about parent plants. Comparing the chemical composition of the fossil resins and this one of the secretion material of recent trees, it should be assumed the lack of fundamental evolutionary changes in the chemical characteristics of the metabolic products of the paleo— and recent trees, exuded intentionally in the form of resins.

The selectively presented below the chemical characteristic of the main families of the recent conifers may therefore, at least approximately, to be helpful also for the classification of fossil resins of various origin.

The considerable part of known natural resins was in paleo—history and is in nowadays formed by coniferous trees. For the goals of chemotaxonomy of conifers the described earlier the group of compounds, called terpenoids is used, in this mainly sesqui—, di—, and tri—terpenoids. Some classes of terpenoids mentioned (e.g. cadinanes, humulanes, labdanes, pimaranes) are unspecific and are produced by all conifers. Some structural classes derive, in turn, from the trees of only individual group of families (e.g. totaranes from: Podocarpaceae, Taxodiaceae i Cupressaceae) or are restrained only to one conifer family (e.g. cuparanes in Cupressaceae).

The terpenoid composition of trees from Cupressaceae and Taxodiaceae families shows a considerable similarity (cedranes, thujsanes). It is, however, probable to distinguish them thanks to some sesquiterpenoids because cuparanes and widdranes occurs only in the trees from Cupressaceae family. Pinaceae differentiate, in turn, from other conifers by a lack of some diterpenoid classes (as abietanes of phenolic character, tetracyclic diterpenoids) and differ also by the content of some specific sesqiterpenoids as longicyclanes or sativanes), diterpenoids (cembranes) or triterpenoids (e.g. lanostanes).

This introductory characteristics shows the difficulties (unspecific of some groups of compounds) as well as advantages (some differentiating compounds), both flowing from the use of the knowledge of the chemical composition of resins to description of their phytogenesis.

Taking advantage from the acquirements about the chemical composition for the classification and chemotaxonomy of resins, it should be also taking into account, that a great number of chemical precursors could be transformed (or disappear) upon influence of various environmental factors and also as a result of slow diagenetic processes. Among these changes are e.g. disappearance of functional groups and aromatization of the chemical structure. The authors cited here have presented taxonomy of conifers in the division onto 9 families: Pinaceae, Cupressaceae s.str., Taxodiaceae, Sciadopityaceae, Podocarpaceae, Araucariaceae, Phylloccladaceae, Taxaceae and Cephalotaxaceae. A series of examples has been chosen here of the use of some characteristic chemical components of conifers.

A. Sesquiterpenoids

The class of sesquiterpenoids is widely distributed in conifers in the form of: cadinanes, copaanes, muurolanes, caryophyllanes, humulanes, eudesmanes, elemanes, germacranes, farnesanes, aromadendranes, bisabolanes and cubebenes. It is because these compounds are unspecific here. Some of them allow, however, to differentiate among the species of particular conifers.

Pinaceae and Cupressaceae show certain similarities, observing the continuance of guaianes, ylanganes and himachalanes. Sesquiterpenoid of the type of bisabolane, cubenane and indane have been identified in
the trees from the families of: Pinaceae, Cupressaceae and Taxodiaceae (only Cryptomeria). The genus of families of: Pinaceae, Cupressaceae and Podocarpaceae contain longibornanes, longifolanes and longipinanes.

B. Diterpenoids

1. Bicyclic diterpenoids and related compounds

There are mainly labdanes, the main part of which is formed by acids (e.g. communic acid). The labdanoic compounds are the most common diterpenoids in conifers and were identified in all families with the exception of Cephalotaxaceae.

2. Tricyclic diterpenoids: pimaranes, abietanes and related compounds

Both of the classes of compounds derive from the labdanoic precursor. Besides the common acids (isopimaric, sandaracopimaric, pimaric) also related compounds were identified in conifers, of the type of alcohols or some hydrocarbons.

Izopimaranes and pimaranes are common components of conifers. Abietanes it is the greatest class of the cyclic diterpenoid wit the domination of the following acids: abietic, dehydroabietic, palustic, levopimaric, phenolic drivatives (as e.g. ferruginol) and some hydrocarbons (dehydroabietane, abietadienes). Phenolic abietanes are especially characteristic for the species of families of: Cupressaceae, Taxodiaceae, and Podocarpaceae but are rarely found in the case of Pinaceae, with the exception of presence of ferruginol in Cedrus atlantica and ferruginol derivative in Pinus silvestris.

3. Tetracyclic diterpenoids: cauranes, beyeranes and related compounds

Tetracylic diterpenoids occurs in conifers mainly as hydrocarbons (caurene, phyllocladane, hibaene). Among conifers, only in Pinaceae phyllocladane type of compounds was not identified.

Beyeranes in conifers were identified in some species of w Cupressaceae, Podocarpaceae and Araucariaceae. Among trees of these families very common is caurane, found in turn, only in one species of Pinaceae: Pseudolarix amabilis.

C. Triterpenoids

They are derivatives of squalene, their main representative in conifers. The compounds of this group as lanostane or gammacerane were identified only in several genus from family Pinaceae (Abies, Larix, Picea, Pinus, Pseudotsuga).

IV. Summary

Owing to lack of direct evidences concerning the phytogenesis of particular fossil resins, for the cognitive goals, the use (in the limited range) can be made of a great potential existing in results of analysis of compounds characterising of recent trees. A series of them has since the distinctive relation to the paleo–species. Dipterocarpaceae trees from indonesian islands, described as an example in the Introduction, secrete nowadays the resins of the composition similar to their paleo–counterparts. However, the older is fossil resin, the lower is adequacy in relation with recent trees or composition of their sap (evolution of plants, diagenesis of resins etc.). The results of own investigations and a broad review of the literature of the subject indicates however, the considerable potential for chemotaxonomy of fossil resins by comparison with the results of phytogetic investigation of the recent plants.

References


An atlas of the Raman spectra of amber

POSTER

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Raman spectroscopy is currently becoming the main non-destructive method applied to the research on amber and other fossil and subfossil resins of various age. One of the reasons why it is used to an increasing extent is the fact that the highly specific Raman spectra make it possible to identify the studied items without having to prepare any special samples. While carrying out an analysis to identify the type of amber or to determine its origin, it is extremely important to use the right reference spectra. A Raman spectra database used for this purpose must be based on reliable and well documented reference material [1] and contain the information about measurement conditions under which the spectra were recorded because, for example, the use of different laser line excitation, different time of acquisition or laser power will have a significant impact on both the quality and shape of the recorded spectrum.

Although there are publications with the Raman spectra of amber and other fossil resins, they are not a comprehensive reference base and cannot be used to determine the origin of various items made of these materials. That is why work has been undertaken to create a database of reference spectra which will contain a catalogue of the Raman spectra of various succinite (Baltic amber) colour varieties and other fossil resins.

The database is compiled from fully documented samples of fossil and subfossil resins from the “Poland and the World” regional collection at the Polish Academy of Sciences Museum of the Earth, Warsaw. The collection was established in 1951 and has continued to be actively enlarged for science since the mid-1970s. Under B. Kosmowska–Ceranowicz’s research programme, since 1985 the collection has been studied using IR Absorption Spectroscopy. Numerous papers presenting this research were published both nationally and internationally [2]. As the IR spectra were measured on KBr pellets – a technique that is destructive to a degree and as such cannot be used to analyse unique and valuable specimens – it became necessary to additionally compile a catalogue of Raman spectra for the collection of amber and other fossil resins.

The continuously growing database of Raman spectra includes more than 100 items from Europe, Asia and Oceania. Fully documented Raman spectra benchmarks have been produced for succinite, walchovite and other fossil resins which have been identified with certainty.

The reference spectra from this database were used for example during research carried out to determine the influence of preservation treatment on the possibility to establish the origin of the amber used to make archaeological artefacts [3]. The systematically growing database has also been used in the research on the origin of a 100 piece jewellery collection (Fig. 1) found during archaeological work carried out in Domaslaw near Wrocław, Poland [4].

At present, work is underway to develop a database of Raman spectra with reference samples of fossil resins from various parts of the world, compliant with the recommendations of the Infrared and Raman Users Group (IRUG) [5], to be included in the IRUG database.
Fig. 1. The Raman spectra of amber: A) succinite from the Gdańsk Port, Poland; B) succinite from the Sambian Peninsula, Yantarny Amber Mine, Russia; C) amber from archaeological sites in Domasław, Poland; D) walchovite from Walchov, Czech Republic.

References
Positron Annihilation Spectroscopy (PAS) in amber research

LEcTure

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Positron Annihilation Spectroscopy (PAS) is a method used in research on solids and liquids, based on
the phenomenon of positrons annihilating in contact with the electrons of a substance. Annihilation (in the
sense of destruction) should not be taken literally as what we are dealing with here is not the disappearance
of matter or energy but a transformation of some particles \((e^+ \text{ and } e^-)\) into others \((\gamma-\text{quanta})\) and a
transformation of one form of energy into another.

The PAS research focus is the gamma radiation released upon annihilation, with the following primary
experimental methods:

- Positron lifetime measurement \((\bar{\tau} \text{ [ns]})\)
- Examination of the angular distribution of the annihilation quanta in the two–quanta annihilation of
  the electron–positron pair
- Measurement of the Doppler broadening of the annihilation radiation.

PAS has been used in mineralogy science since the early 1980s (Sachanbiński, Suszkiewicz,

The amber was analysed by means of standard measurement equipment, i.e. an ORTEC time
spectrometer. The positrons came from a radioactive \(^{22}\text{Na}\) isotope (20 µCi). The tests on the amber samples
were run at room temperature, in the presence of air at normal pressure. PAS does not require any special
techniques to prepare samples. It is a non–destructive method. The tests were performed on the surface of
the samples’ fracture. The most frequent sample size was 1x1 cm, with a minimum thickness of 1 mm. The
obtained \(\bar{\tau}, I, R_0, D\) measurements are presented in Table 1. The analysis of the table’s data shows that the
amber samples have different values of annihilation parameters, depending on the degree of weathering and
age, with an average lifetime \(\bar{\tau}\) of 1.7 to 1.9 ns.

The measurements have demonstrated that positronium is formed in the amber samples (Table 1),
which indicates the presence of empty spaces (nanopores) with a linear size not exceeding 0.1 nm (up to 10
nm). The analysis of the results (Chojcan and Sachanbiński 1993) using simple models of pores known in the
literature – positron traps – has allowed a conclusion that in all the unweathered amber varieties that were
analysed, the positronium–trapping pores (nanopores) were of a similar diameter: 0.68–0.70 nm (see
parameter D (Table 1)). But in the weathered part of amber, the so–called crust, these sizes were larger –
0.92 nm – and the nanopore concentration was much higher than in unweathered amber. The concentration
of nanopores depends on the degree of weathering and probably on age. The highest nanopore
concentration was recorded in Upper Eocene (50–40 Ma) amber from the Northern Port in Gdańsk, Poland,
at 26.0%, while the lowest – in Upper Cretaceous (90–80 Ma) walchovite from Walchov, Czech Republic, with
the respective figure of 9.91%, and in the weathered crust of amber from Belchatów, Poland at 14.4% (Czechowski et al. 1991).

The $\tau$ (ns) parameter, which describes positronium’s average lifetime in amber’s nanopores, also makes it possible to determine the type of substance that fills the nanopores. These parameters are almost identical for the nanopores in (Upper Eocene) Baltic amber at $\tau$ 1.79–1.89 ns, which proves them to be filled with the same type of substance, probably air. For Upper Cretaceous walchovite, in turn, the parameter was somewhat lower ($\tau$ 1.7 ns), which may indicate that it contains some other substance, probably a liquid (Table 1 (5)).

Table 1. Positron annihilation characteristics of succinite and walchovite.

<table>
<thead>
<tr>
<th>Lp</th>
<th>Location and symbol of amber sample</th>
<th>Colour</th>
<th>Age</th>
<th>Degree of weathering of sample</th>
<th>Average lifetime of positron in nanopores $\tau$ (ns)</th>
<th>Nanopore concentration $I$ [%]</th>
<th>Average radius of nanopores $R_0$ [nm]</th>
<th>Average diameter of nanopores $D$ [nm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Succinite (Northern Port, Gdański, Poland)</td>
<td>yellow</td>
<td>Upper Eocene (50-40 Ma)</td>
<td>Unweathered</td>
<td>1.84(2)</td>
<td>26.0(3)</td>
<td>0.40(2)</td>
<td>0.80(4)</td>
</tr>
<tr>
<td>2</td>
<td>Succinite (Yantarny, Sambia Peninsula, Russia)</td>
<td>yellow</td>
<td>Upper Eocene (50-40 Ma)</td>
<td>Unweathered</td>
<td>1.8136(42)</td>
<td>19.77(24)</td>
<td>0.43620(37)</td>
<td>0.87240(74)</td>
</tr>
<tr>
<td>3</td>
<td>Walchovite (Walchow, Czech Republic)</td>
<td>yellow</td>
<td>Upper Cretaceous (90-80 Ma)</td>
<td>Unweathered</td>
<td>1.7487(85)</td>
<td>9.91(17)</td>
<td>0.42954(89)</td>
<td>0.8591(18)</td>
</tr>
<tr>
<td>4</td>
<td>Succinite (Belchatów, Poland) (1)</td>
<td>yellow</td>
<td>Secondary deposit</td>
<td>Unweathered</td>
<td>1.85(1)</td>
<td>25.7(3)</td>
<td>0.39(2)</td>
<td>0.78(4)</td>
</tr>
<tr>
<td>5</td>
<td>Succinite (Belchatów, Poland) (2)</td>
<td>yellow</td>
<td>Secondary deposit</td>
<td>Unweathered</td>
<td>1.89(2)</td>
<td>25.0(3)</td>
<td>0.43(2)</td>
<td>0.68(4)</td>
</tr>
<tr>
<td>6</td>
<td>Succinite (Belchatów, Poland) (3)</td>
<td>yellow</td>
<td>Secondary deposit</td>
<td>Weathered</td>
<td>1.82(2)</td>
<td>14.4(2)</td>
<td>0.46(2)</td>
<td>0.92(4)</td>
</tr>
<tr>
<td>7</td>
<td>Succinite (Jaroszów, Poland)</td>
<td>milky</td>
<td>Secondary deposit</td>
<td>Unweathered</td>
<td>1.79(2)</td>
<td>25.3(5)</td>
<td>0.42(2)</td>
<td>0.84(4)</td>
</tr>
</tbody>
</table>

References


Application research on cosmetics made of Baltic amber

POSTER

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Baltic amber has been used for centuries by mankind. In the literature there are references to the cult objects made of amber, which related to assigning its magical and medicinal properties. Currently succinite is also used as a raw material in many fields. These include jewellery and decorative arts, medicine and pharmaceutics, chemical industry and cosmetics. On the cosmetics market there are a number of products in which amber can be found in various forms: extract, oil, purified succinic acid and amber powder.

The effects of the emulsion containing the extract of the Baltic amber on the skin were examined. The primary assessment of the cosmetic ingredients – extracts of Baltic amber – were the compatibility of extracts with the skin, as determined by Repeated Open Application test and standard apparatus tests to evaluate performed stratum corneum barrier function – research transepidermal water loss (TEWL), level of hydration, stratum corneum greasiness and colour of the skin (chromameter) during the application of emulsions containing various extracts. The instrument tests were carried out during 1 month in order to verify the lasting effect the extract of the Baltic amber can potentially cause. All the tests – the test release of raw beauty – of the extracts of Baltic amber have given positive results.

Contemporary methods for determining the structure of amber and the application of amber in cosmetics

LECTURE

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Baltic amber (succinite) is a natural fossil resin. Due to the healing and care properties it is used more and more likely in the manufacture of pharmaceutical products and cosmetics with the potential biological activity. During machining succinite for jewelry large quantities of the wastes are being produced, which can be a valuable raw material for the production of medicine and cosmetics. In the literature, there is no complete information [1] about the construction, composition or structure of amber. Biological effects of amber are popular science. Lack of objective evidence to support the efficacy and mechanism of action of amber was an inspiration to research the structure and the biological activity of amber [2].

References
An overview of the properties of biologically active ingredients in Baltic amber

POSTER

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Baltic amber (succinite) is a fossil resin occurring in the Baltic Sea region – mostly in Poland, Germany and Russia. For centuries a variety of biological properties were assigned to amber and many medicinal preparations containing amber were created. However, their effectiveness was not clearly proved. Many advantageous biological properties are due succinic acid, which is an important ingredient of succinite among many others e. g. monoterpenes, sesquiterpenes and their esters. The purpose of this review is the attempt to answer the question which of the components of amber are responsible for its biological effects. For this purpose, the databases have been searched looking for the biological properties of individual chemical compounds identified in succinite.

Instrumental methods in amber (succinite) and other fossil resins investigations

LECTURE

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“What we know is a drop, what we don’t know is an ocean.” (Sir Isaac Newton)

Humanity’s desire to reveal the secrets of succinate appeared almost at the same time as this extraordinary substance was discovered to exist. A breakthrough in the research on Baltic amber and other resins is related to the appearance of instrumental methods which, in parallel with technological development, provide us with more and more information about the broadly understood properties of both natural substances and those which are man–made. In 1831 Justus von Liebig [1], continuing the pioneering research on the composition of organic substances commenced by the outstanding Lavoisier, developed the ground–work of Elemental Analysis (EA), where combustion reactions carried out under strictly defined conditions are the basis of quantitative analysis. Elemental analysis replaced destructive distillation (dry distillation, pyrolysis) – a process of thermal decomposition of substances in the absence of air – used previously for determination of organic and inorganic substances composition. However, this is precisely how Georgius Agricola (1546) proved the presence of succinic acid in Baltic Amber. Modern elemental analysis
provides information about the content of not only carbon and hydrogen but also other elements. Advanced high–resolution Mass Spectrometry (MS) (especially as a method of unequivocal confirmation of the structure of a defined chemical compound) is competitive technique for elemental analysis. However, direct mass spectrometry has also been used in investigations of resins, which are substances of complex composition, varying in age and origin [2].

Contemporary science offers a wide range of methods that can be used to study resins [3–10] and it would be difficult to mention them all without omitting any of them. The choice of a method depends strictly on the analytical purpose but financial factors are also of some importance. Examples include Thermal Analysis (TA) [11,12] or Scanning Electron Microscopy (SEM) [11,12].

Nevertheless, spectroscopic methods predominate in resins investigations, providing invaluable information when coupled with chromatographic separation methods, such as Gas Chromatography (GC) or Pyrolysis Gas Chromatography (Py–GC) [16–23].

Since Beck’s work was published [24, 25], much attention is paid to Mid–IR absorption spectroscopy, which is also a leading method for resin identification [24, 25]. Structural information is also provided by Nuclear Magnetic Resonance (NMR) Spectroscopy (both 1H and 13C) [35–37].

The available literature also contains numerous reports on the application of FT–Raman Spectroscopy [38–41] in the research on resins of various origin.

Among the possible research methods, only a few of which are described above, in most cases make possible studies of organic substances, providing relatively scarce information about their mineral composition. Application of Capillary Electrophoresis (EC) [42] has enabled the identification and determination of ionic analytes in water present in the samples of succinite.

The result of interdisciplinary research is not only wider and wider knowledge about the composition, structure and origin of the resins. Methods of their reliable identification are also being perfected, allowing the systematization and classification of these complex substances.

References


CRAFTING TECHNIQUES FOR RAW BALTIC AMBER AND IMITATIONS

The wealth of colours in natural amber

POSTER

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“The colour of these strangely shaped gifts of the sea was most multifarious: the cherry of the purest new honey or the almost black of ancient honey – the yellow as if waxen or the light–blue of living resin which drips from pines in the spring. Some splinters and fractions were misty in colour, milky, greenish, brown – while some others held as if a likeness of smoke billowing inside. Still others, in their immaculate transparency, concealed puny whitish veins that were deceptively similar in this particular diminution to the branches and ribs of a cabbage leaf.” Stefan Żeromski – Wind from the Sea.

To promote amber – its natural beauty and properties – I established The Amber Planet JANTAR Association several years ago.

Amber has been associated with the Sun since time immemorial not only because of its beauty but also as a living image of the Sun. It is its magnetic properties – good energy, warmth and colours – that are medicinal:

Orange – supports well–being and the joy of life; it is constructive, inspirational and creative. The colour of vitality and warmth. A source of energy and mental strength.

Yellow – the colour of insight, knowledge, wisdom and intelligence. It is the lightest colour, transparent and warm, inspiring and stimulating. This colour allows you to fight melancholy, discouragement, apathy, depression and deep pessimism.

Natural amber is “living” (maturing) amber and this feature keeps it apart from modified amber, giving it the capability to positively influence human health.

Baltic amber stands out in its wide array of colours and diversified “crust” – its weathered outer layer. It is like the amber’s fingerprint. The weathering processes have naturally enriched its beauty.

The naturally transparent nuggets have beautifully spatial landscapes within them.

In opaque varieties and translucent ones, which combine various colours and shades in a single nugget, you can find more or less abstract and immensely interesting outlines.

I attempt to uncover this remarkable beauty and to show it, also in photographs.

The fact that modified amber jewellery is being marketed as natural has depreciated the value of natural amber. There are many methods to obtain transparent, coloured or shaped amber to make jewellery from. Admittedly, despite the high temperature and pressure of an autoclave, the treated amber will preserve some chemical properties of succinite but neither its appearance nor its effect on the human body will have much in common with natural amber.

When seeing natural amber in museums, already the second generation of Polish young people or tourists from other countries are now wondering: “Is this what amber really looks like?”

Every piece of natural amber requires painstaking handwork to bring out its unique beauty to the full.

Let me quote Stefan Żeromski again: “this... extraordinary Baltic stone, this seemingly lifeless lump, is a living being with a tender soul.”
Modified Baltic amber identified in transmission and reflectance IR spectra

POSTER

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The aim of the research was to determine the possibility of the instrumental identification of natural resins, especially succinite, and those which were subjected to certain modification processes. Mid–IR Spectroscopy is currently the leading method of Baltic amber authenticity determination. Its relative simplicity and general accessibility have made it the choice method for research on both natural and modified amber material. The analysed spectra had been obtained using the transmission method (KBr pellet), Attenuated Total Reflectance (ATR) and Diffuse Reflectance Infra–red Fourier Transform (DRIFT) Spectroscopy. It has been found that IR spectra can be used not only to identify succinite but also as a basis to distinguish between natural and modified i.e. treated with high pressure and temperature in the autoclaving process, succinite. A comparative analysis of IR spectra recorded for representative samples of natural and modified succinite has made it possible to select diagnostic bands which enable an unambiguous identification of succinite after pressure and temperature treatment. The characteristic changes in the FTIR spectra of modified succinite include the vibration range of the C=O group (~1736 and 1705 cm\(^{-1}\)), the \(-\text{C}=\text{C}–\) group (~1642, 888, 981 cm\(^{-1}\)), the bands related to C–O–H stretching vibrations (1012 cm\(^{-1}\)), deformation vibrations bands (~ 981 cm\(^{-1}\)) and a region known as “the Baltic shoulder.” It has been also demonstrated that the process of amber pressing and/or shaping does not have a significant impact on the FTIR characteristics of Baltic amber. The conclusions have been presented against the background of current literature reports. The research findings indicate that instrumental methods make it possible to identify both natural resins and those which were subjected to certain modification processes.

*The authors express their heartfelt gratitude to Mr Stanislaw Całka for having prepared the research material.*
MZ IRS785. Modified Baltic amber (clarified, sparkles, flamed )

Bibliography
AMBER INCLUSIONS

Bird traces in Dominican Amber

LECTURE

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At Amberif 2012 in Gdańsk, the exhibition stand organised for the second year running by Janusz Fudala and Doug Lundberg presented Dominican amber. Just as at the stand organised by the University of Gdańsk Museum of Amber Inclusions, the chance to see J. Fudala and D. Lundberg’s joint Amber Safari collection through a binocular magnifier has attracted considerable interest for some years now. In 2012, a specimen discovered by Lundberg in 2008, named “A Bird Egg with a Baby Bird,” made its appearance there.

The specimen was found in the La Bucara mine located in the Cordillera Septentrional mountain range, which stretches across the northern part of the island of Hispaniola, almost parallel to its northern coastline. According to Doug Lundberg, the amber produced from this mine develops a strong shine when polished. La Bucara is an area with the highest concentration of mines where Dominican amber is produced in very difficult conditions, from sedimentary rock.

Recently, the discoverer said “that the baby bird was partly eaten by a predator and what is viewed are the remains of another animal’s ‘dinner.’” As for the preservation of these remains in amber, he postulated a thesis that “… the remains of ‘the last egg’ after a ‘carnivorous predator’s attack... must have dropped into a pool of resin.”

Given the value of these specimens, the USA–based co–authors have made, as I understand, a difficult decision to leave the specimens for research in Poland, and in my care at the PAS Museum of the Earth, Warsaw. The decisive factor may have been the fact that the Amber Department’s Dominican amber collection, established as early as 1979, has by now reached 177 inventory numbers, out of which more than half are specimens donated by Fudala and Lundberg (see Annex 1 in Kosmowska–Ceronowicz 2012).

The research material

When excavated, this unique piece of Dominican amber was, like many others, a small dripstone form, of the stalactite–like group; when polished by its discoverers, it split into 5 variously sized parts, which received numbers from 1 to 5 to reflect their decreasing mass (from ca. 7 g to 1 g).

Stalactite–like amber forms are dripstone forms which cling to a tree trunk with one of their sides. Such forms are located in smaller or larger wounds sustained by the tree. They can also originate in a scar left by a branch torn away by a hurricane or in some other type of hollow, convenient, for example, as a bird’s nest.
The test equipment

A Carl Zeiss Jena IR Specord M80 Spectrophotometer (Double Beam), at the Chemical Laboratory, Warsaw University of Technology. An EDAX SEM Philips XL20 microscope, with SE detectors for general imaging, BSE detectors for materials with various density distribution, EDS detectors for the X–ray microanalysis of elements. The tests were run at the PAS Institute of Palaeobiology, Warsaw. A Hitachi S–3000N Scanning Electron Microscope with a Thermo Scientific USA UltraDry EDS (Energy Dispersive X–ray Spectrometry) Detector, at the Białystok University of Technology, Faculty of Mechanical Engineering, Department of Material and Biomedical Engineering. A Nikon Stereomicroscope at the PAS Museum of the Earth and at Białystok University, Institute of Biology. A 3D Hirox KH 8700 Digital Optical Microscope at the Military University of Technology, Warsaw.

The tests

In each of the 5 component parts, the inventory of identified inclusions is different and needed to be tested using various available methods. To begin with, based on an IR spectrum, the material was re–identified as Dominican amber, genetically related to a broadleaf tree of the family Leguminosae, genus Hymenea.

The following inclusions were studied, beginning with the most unique ones:

The eggshells, which C. Kulicki compared with a contemporary hen’s eggshell, were SEM tested and confirmed to have come from a bird. The shell’s external part, i.e. the tegumentum, is strongly decalcified in several places. The increased content of elements such as titanium, iron, silicon and aluminium indicates that this complex destruction occurred before the liquid resin flowed out.

Fig. 1. A. Cross-section of the non-decalcified part of the shell. Typical three layer structure of a bird’s egg: external tegumentum, below the spongy middle layer and the internal mammillary layer.

B. Egg shell in specimen No. 3 of mass 4.4 g. Photo: D. Lundberg

The feathers and down were thoroughly photographed and measured. In collaboration with ornithologist Dr. Małgorzata Bujoczek, it was determined that the remains of the bird feathers were very likely those of a baby bird.

The analysis of the weight and mole % and of the photographs of the items suggests the presence of micro–bones. The presence of phosphorus and calcium turned out to be significant in many measurements. From the ratio of mole % of calcium to phosphorus, Münzenberg (1970) draws a conclusion on the presence of hydroxyapatite, with a quotient of ca. 1.667, and of carbonate apatite -- ca. 2.00, in the bones. Out of 12 measurements performed on the samples, 6 times the quotient was 1.72–1.96, five times 2.57–2.9 and once 3.75. These elements may also be constituents of coprolites, or the subsequently developing guano, i.e. poorly diagenetically transformed bird faeces, feathers and bones in a dry environment.
Fig. 2. Afterfeather (down) with a span a little over 0.2 mm. The alternating lighter and darker sections visible in the rachis may hint at the bird’s colouration. Specimen No. 5 (photo: Military University of Technology, Warsaw)

In the three larger specimens of the Dominican amber one can clearly notice areas which disturb the resin’s transparency; many tests suggested that it is very thin torn skin, including parts of pinfeathers (the hollow shafts of a developing feather). These areas have to be studied further, although the preservation of these remarkable specimens in as intact a condition as possible will certainly pose a limit to such research.

**Arthropod inclusions**, identified and photographed by J. Kupryjanowicz and photographed by Jan Marczak, have proven extremely important in tracing the history of how the bird inclusions in various states of preservation have originated.

**Specimen 1**
- *Acarina*: Ixodidoidea: Argasidae or Ixodidae (larva, 1 specimen); Acarina – 2 specimens
- Coleoptera: Dermestidae (larva, exuvia – 1 damaged specimen)
- Blattodea: Blattidae ? (larva – 1 damaged specimen, fragmented pieces)
- Psocoptera (larva or wingless form – 1 specimen)
- Moreover, forms which resemble a baby bird’s claws have been identified.

Fig. 3. **A.** One of the 7 preserved claws, ca. 4 mm in length. Specimen 1 (photo: Military University of Technology, Warsaw)

**B.** Pinfeathers - the early structures in the feather development hierarchy which protect the emerging barbs, which in turn precede the growth of the rachis and barbules. Photo: J. Marczak
Specimen 2 Coleoptera: Dermestidae (larva, 1 damaged specimen, exuviae – 2 specimens)
   Blattodea: Blattidae ? (larva – 1 damaged specimen, fragmented pieces of another specimen)
   Hymenoptera: Formicidae (worker – 1 specimen, head? fragments – 1 specimen)
   Psocoptera (larva or wingless form – 2 specimens, larva – 1 damaged specimen)
   Homoptera: Cicadellidae (larva, 1 specimen)
   Acarina 11 (?) specimens
Specimen 3 Coleoptera: Dermestidae (larva, exuvia – 1 specimen)
   Blattodea: Blattidae? (larva – 1 specimen, remains of a large specimen – antennae and fragments of legs)
   Psocoptera (1 larva or wingless form – damaged)
   Acarina 1 (?) specimen

Fig. 4. A. The larva of a skin beetle (Coleoptera: Dermestidae), one of the three found in Specimen No. 2. Skin beetles are a necrophagous species whose larvae feed on carrion, often significantly dried up. Photo: J. Kupryjanowicz
   B. A Psocoptera in Specimen No. 1. Photo: J. Kupryjanowicz

Specimen 4 – mass ca. 1.0 g
   Diptera: Brachycera, Calyptratae (1 specimen)
   The presence of Dermestidae skin beetles (according to J. Kupryjanowicz), whose larvae feed on dried-up carrion, suggests that the baby bird, probably already after hatching, was dead and at least partly decomposed (this is additionally confirmed by the presence of Brachycera, Calyptratae). A relatively large quantity of dead organic matter in the form of a dead baby bird also attracted the omnivorous Psocoptera, Blattodea and Acarina, whose inclusions are quite numerous in the researched amber pieces.
   Moreover, in all the specimens plant inclusions are quite rare and coprolites are quite numerous. Also visible are black forms of various shapes which are as yet unidentifiable.

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The team of our collaborators are now conducting research which they will conclude only in mid-March; some of the research will still be preliminary due to the value of the specimens, which must remain intact. Much more will be written about these specimens; there is material in them for many increasingly detailed dissertations.

Bibliography
The presence of primitive dipterans of the family Tanyderidae in Baltic amber

LECTURE

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The oldest family of true flies – Tanyderidae – is extremely important to the knowledge of the evolution and phylogensis of the entire order Diptera. It is currently thought to be a sister group with the family Psychodidae. Representatives of the primitive family Tanyderidae are comparatively rarely found in fossil material; however, the family is represented across various geological eras. Specimens are known already from the Jurassic, through the Cretaceous period, up until the Eocene Baltic amber.

The family Tanyderidae has a contemporary representation of 37 species, living mainly in tropical and subtropical zones.

To date, only one genus Macrochile LOEW, 1850, which includes two species, has been described from Baltic amber. But in the latest study by Krzemiński et al. 2013, a new species Macrochile hornei KRZEMIŃSKI, 2013 was described from Baltic amber and a new genus – Podemacrochile KRZEMIŃSKI, 2013 – was distinguished, with the typical species of Podemacrochile baltica PODENAS, 1997. The study shows how many more secrets Baltic amber is still keeping from us. It also illustrates how important it is for the knowledge of dipteran evolution to further study Baltic amber inclusions.

Moreover, the material described to date and the material in our possession allows us to trace evolutionary changes from the Jurassic period until the present and to establish a coherent phylogenetic tree. In order to understand these issues, Baltic amber inclusions are very important, as the specimens there are preserved in a condition which allows us to observe and study all the crucial morphological features of species.

The most important information about Baltic amber and its significance to science have also been discussed.

References
The Collection of Animal Inclusions at the University of Gdańsk, Museum of Amber Inclusions

LECTURE

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The scientific collection of inclusions at the University of Gdańsk originated in the 1980s when, as a PhD at the time and now also the head of Laboratory, Prof. Ryszard Szadziewski has began his research on fossil biting midges (nematocerous flies of the family Ceratopogoniade). His collector’s nature and researcher’s inquisitiveness gave rise to a small private collection of inclusions which, in 1998, appeared what the second largest collection of inclusions in Poland is nowadays.

In two months’ time, in June 2013, the Museum of Amber Inclusions Laboratory at the Department of Invertebrate Zoology and Parasitology, will celebrate its 15th anniversary. Over this period, more than 5500 pieces of amber with over 14,000 animal inclusions have been collected. It was a great enterprise, considering that almost all the collection’s items were donated by amber artists, researchers, students and other people supporting the idea of the University of Gdańsk amber collection. The fastest grow of the number of amber pieces donated took place during the first 5 years of the Museum existence: by the year 2003 almost 80% of the present inventory has been accumulated.

Table 1. Animal inclusions at the Museum of Amber Inclusions, University of Gdańsk

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Although this growth rate has dropped considerably in the recent years, the collection has definitely gained in terms of scientific value. At present, the University collection contains 32 type specimens (29 holotypes1, two paratypes2 and one plesiotype3).

1 holotype - a specimen selected from the series and used to describe a species
2 paratype - the remaining specimen from the described series
3 plesiotype - a specimen used to re-describe a species
Type specimens at the Museum of Amber Inclusions:

**Flies (Diptera):**
- *Eatonisca tertiaria* MEUNIER, 1905 (plesiotype)
- *Stilobezzia dominikana* SZADZIEWSKI & GROGAN, 1998
- *Forcipomyia (Lepidohelea) antilleana* SZADZIEWSKI & GROGAN, 1998 (paratype)
- *Metahelea serafini* SZADZIEWSKI, 1998
- *Aedes serafini* SZADZIEWSKI, 1998
- *Dicranomyia kalandyki* KRZEMIŃSKI, 2000
- *Mllochohelea martae* SZADZIEWSKI, 2005
- *Gedanoborus kerneggeri* SZADZIEWSKI & GIŁKA, 2007
- *Corethrella baltica* BORKENT, 2008
- *Tanytarsus serafini* GIŁKA, 2010
- *Tanytarsus fereci* GIŁKA, 2011

**Beetles (Coleoptera)**
- *Colotes sambicus* KUBISZ, 2001
- *Phymatura electrica* PAŚNIK & KUBISZ, 2002
- *Lathrobium jantaricum* PAŚNIK & KUBISZ, 2002
- *Dictyon antiquus* PAŚNIK & KUBISZ, 2002
- *Paleosepedophilus succinicus* PAŚNIK & KUBISZ, 2002
- *Lathrobium succini* PAŚNIK & KUBISZ, 2002
- *Atheta (Datamicra) jantarica* PAŚNIK, 2005
- *Tachyporus bicoloratus* PAŚNIK, 2005
- *Baltioligota electrica* PAŚNIK, 2005

**Hemipterans (Hemiptera)**
- *Glisachaemus jonasdamzeni* SZWEDO, 2007
- *Hoffeinsia foldii* KOTEJA, 2008
- *Protodikraneura ferraria* SZWEDO & GĘBICKI, 2008
- *Worskaito stenexi* SZWEDO, 2008
- *Thionia douglundbergi* STROIŃSKI & SZWEDO, 2008
- *Thionia douglundbergi* STROIŃSKI & SZWEDO, 2008 (paratype)
- *Loricula (Loricula) polonica* POPOV & HERCZEK, 2008
- *Paernis gregorius* DROHOJOWSKA & SZWEDO, 2011
- *Patollo natangorum* SZWEDO & STROIŃSKI, 2013

**Mayflies (Ephemeroptera)**
- *Burshtynogena fereci* GODUNKO & SONTAG, 2004

**Neuropterans (Neuroptera)**
- *Hemisemidalis kulickae* DOBOSZ & KRZEMIŃSKI, 2000

**Damselflies (Odonata)**
- *Electropodogrion zwedoi* NEL & AZAR, 2008

The collection of inclusions stored under protection of University, preserves not only the material for taxonomic research, but it is also the basis for studying Palaeogene biodiversity, palaeobiology and palaeoecology. That is because the collection preserves whole amber nuggets with the amber specimens only subjected to the necessary but minimized treatment without the inclusions being removed at the preliminary description stage. Such a methodology and the possibility to obtain material that has not been pre–selected have resulted in more than 50% of the nuggets containing syninclusions. A detailed description of this inventory method, which enables easy access to individual specimens, was presented at the 2008 Amberif Seminar (Sontag 2010).
In September 2012, the Museum of Amber Inclusions moved to the new building of the Faculty of Biology in Wita Stosowa St. in Gdańsk. In the new facility, the Museum has received a 25 m² laboratory and a 50 m² display-room for the exhibition specimens (Sontag 2013).

The almost fully equipped laboratory has encouraged the Museum’s staff to begin work on “renovating” the collection. As many researchers avoid large nuggets which require cutting, a decision has been made to cut the larger pieces to gradually facilitate the collection’s research development. Large nuggets with syninclusions will be cut (provided that this does not damage the inclusions), but the pieces will be stored in the same container and under the same inventory number. Such a solution will make easier to provide new materials for taxonomic elaboration, while at the same time preserves the information on the co-occurrence.

References

Publications with description type specimens at the Museum of Amber Inclusions
Chironomidae inclusions at the Polish Academy of Sciences
Museum of the Earth, Warsaw

POSTER

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In the Eocene, a period which extended between 56 and 39 Ma, Europe did not resemble its present shape: it was not a uniform continent but a network of islands. What is now Scandinavia and the Baltic Sea, known as Fennoscandia, was covered with amber-bearing forests which were more like the subtropical forests of today. Two climate zones intersected here: a warm temperate zone and a subtropical zone, therefore the local flora of the time was very diverse, with plants from various floras co–existing here, represented by mountainous, lowland and marshland vegetation, with diverse climate requirements.

Resin is a perfectly selective trap which would mainly catch small–sized animals living in the close vicinity of the amber bearing trees. Its most frequent victims were mainly arthropods: insects, arachnids and myriapods. Many inclusion finds, including the Chironomidae (nonbiting midges), are evidence to the presence of water within the forest, as their larvae are related to water environments, whereas the adult forms (imago) live close to trees.

The family Chironomidae belongs to the order of Diptera, suborder Nematocera. The representatives of the family described here are the dominant group in the Diptera order.

The Museum of the Earth’s collections of specimens have been systematically accumulated since 1950. Chironomidae are frequently found in specimens as synincusions, with many individuals often found in a single piece of amber. After the complete transformation, the adult individuals would travel in swarms towards the amber bearing trees and fall into the sticky resinous death trap. In the collection of nonbiting midges, the number of females largely exceeds that of males; this is not advantageous for research because the morphology of fossil Chironomidae males is more reliable in taxonomic research and for this reason has been better described in literature so far. In the Museum of the Earth’s collection, more than 600 specimens of the family Chironomidae have been analysed to date. Based on the completed research, a large proportion of the subfamily Orthocladiinae has been observed, largely exceeding Chironomidae in terms of quantity.

In comparison, the quantitative composition of nonbiting midges in the Cotui copal shows a reverse tendency. Furthermore, among the Diptera found in this copal from the Dominican Republic, the suborder Brachycera largely dominates over Nematocera.

When compared to the nonbiting midges of today, the ones that dominate in amber are those whose larvae lived in quiet ponds, while midges living in clean, well oxygenised and open lakes are rare (Krzemiński et al. 1993). Individuals of this family are small in size, with long legs and a body shape reminiscent of mosquitoes. Sexual dimorphism is strongly marked, with males, in contrast to females, equipped with long feathery double antennae. The contemporary Chironomidae are cosmopolitans, to be found anywhere from the temperate climate to the tropics, as well as in the Antarctic. They are very common in Poland.

Bibliography
The Balt’s Amber route to classical civilization

LECTURE

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The tradition of collecting, producing and amber trade in East Baltic and Lithuania started about 6000 years ago in the Neolithic period.

This tradition continued throughout the early metal ages, they also reached not only Egypt, Greece, Eastern Mediterrania, but also territory of Etruscan lands.

But it became very important in the period of Roman Empire, when the desire of Roman’s for luxury goods made it particular impetus, during the first five centuries A. D. This tradition brought the Aestian (the Balts) into unbroken zone of cultural contacts with Southern Europe.

Amber tradition became an inseparable part of Lithuanian national cultural identity, applied art, mythology, folklore, theatrical and musical culture and belles letters during the period of the formation of national identities in the nineteenth and twentieth centuries.

Throughout this period the production of and trade in amber artefacts was a very important in the country’s economic life.

It is mentioned in the Odyssey: “the halls of the king were decked in copper, gold, amber, ivory and silver”. Penelope is said to have worn an amber and gold necklace “like the sun” (Gimbutienė 1985). Amber is also mentioned in the Bible.

Perhaps the Ancient Greeks already knew something about the Balts in the fifth century BC because of amber. In the fifth century BC the Greek historian Herodotus (190(480)–425) and in the fourth, Pytheas mentioned amber among the many wonders of the world, that is, about a journey to distant lands which led to the land of amber. The latter author, the famous writer from Marseilles (Massilia) and traveller mentioned the Ostiaioi in ca 325 BC. This may be the same tribe as the Aestiorum gentes noted by Tacitus four centuries later and whom Jordanes mentions in the sixth century, when writing of how Hermanaric used his ingenuity and courage to conquer the Aestii, who dwelt by the very long shore of the Germanic Ocean. In the ninth century they were mentioned by Einhard and Wulfstan, who showed very clearly where these people lived.

Pytheas was a contemporary of Alexander the Great (he was cited by Strabo from a no longer existant Greek account of the journey) and asserted that in this cold area people do not enjoy the fruits of the earth, have few domestic animals and live on millet, herbs, roots and wild fruits. From honey and corn they make a drink and because of the weakness of the sun’s rays the people thresh corn in large barns because it rots in the open air because of the heavy rain and lack of sunlight. One day’s sailing from the land of the Goths is the isle of Abalus, whither the spring tides wash up amber, which he says is ‘the excretion of the frozen sea’ (concreti maris purgamentum).

On the basis of this information, especially the excretion of amber, the production of mead, the cultivation of millet and the isle of Abalus, the Prussian history J. Voigt claimed in his 1827 Geschichte Preussens that the land mentioned here was none other than the shore of Prussia (Ivinskis 1995).
Archaeological sources, such as amber finds, can tell us much about the material and spiritual culture of ancient peoples and even in part about social organisation but they can not establish the names of ethnic groups and peoples. Therefore even small, sometimes seemingly insignificant references in early written sources can provide a ray of light to illumine the complex development of historical events and allow us to form a different discussion of the lives of peoples and the surviving scarp of ancient material culture.

Undoubtedly the most trustworthy data about the Aestii come from the work of Tacitus, who wrote in AD 98:

“The Aestian peoples (aestiorum gentes) dwell on the right-hand shores of the Suebian Sea; they have the customs and dress of the Suebians and their language is similar to that of the Britons. They worship the Mother of the gods. As a sign of their devotion to her they wear something in the form of a boar, which is a talisman in lieu of weapons that keeps worshippers of the goddess safe even amid their foes... They make rare use of iron (swords) and more commonly use clubs. Grain and other produce they nurture more patiently than is the idle wont of Germanic peoples. They also search the sea and alone among all the rest they collect amber, which they call “glaesum”, among the waves and the shore itself. The nature of this substance and whence it comes they, being barbarians, have neither asked nor discovered. Amber lay for a long period among other things tossed up by the sea until our thirst for luxury put a name to it. They do not use amber themselves; they collect it as it is and sell it unwrought and take payment for it in amazement. However, it is not hard to understand that this is resin from trees because often you can see earthy or even flying creatures showing through it; they fell into the liquid and as the liquid solidified they were trapped inside it... If you test the qualities of amber by applying a flame to it, it flares up like a pine torch, exuding a greasy, odoriferous flame...” (Germania xlv).

This quotation from Tacitus is interesting first of all because after almost 2000 years our basic knowledge of how amber is formed, where it is found and what some of its physical qualities are has not changed. His knowledge of the Aestii, supported by data from linguistics, archaeology and anthropology, becomes very informative. First of all, we conclude that the Aestii were Balts because Tacitus says clearly that they were not Germans, while he mentions Slavs and the Finno–Ugrians separately. Even Pytheas calls the Balts Aestii (sic!) as in later times Cassiodorus (sixth century AD), Jordanes and other authors undoubtedly do. The northern part of the Samland Peninsula is wealthiest in amber but available archaeological linguistic and anthropological data evidence. This allows us to expand the Aestian territory mentioned by Tacitus throughout the southern Baltic coastlands on the basis of toponyms, material culture and anthropological similarities. Most amber and Roman coins with which Romans and their intermediaries paid for amber are to be found in Prussian Samland, the lower reaches of the Nemunas and on the shores of Klaipėda and Palanga. Copper coins are most common but silver and gold ones were found in the Dargiškė hoard. One especially rare find has been made, namely of a medallion of the type that were awarded to military commanders. Most often one coin would be placed in a grave, perhaps as payment for transport to the Other World but there are also cemeteries such as Aukštakiamis, where 21–26 coins were placed in noble man graves (according to Michelbertas). This allows us to claim that the Aestii mentioned by Tacitus and other classical and early mediaeval authors were Balts because amber and roman coins are found more seldom than in Estonian territory (only 3–4 find sites).

Because of amber two south–western Aestian (Balts) tribes, the Galindians and Sudovians, came to the attention of classical authors (as L. Niederle created the Latin version in 1917). In his Geography, written in the mid–second century AD Claudius Ptolemy records tribal names that are undoubtedly of Baltic origin. These tribes did not leave the area. More than 1,000 years later they were discovered once more by Peter of Dusburg and other authors of the twelfth–fourteenth centuries (Dusburgietis 1985). Therefore we may conclude that throughout those thousand years the land inhabited by the western Balts (Prussians, Galindians, Sudovians) did not change very much. Most likely other tribes mentioned by Ptolemy as dwelling to the north–east of the River Chesin were also Balt, namely the Kareoti (perhaps the Curonians), and the Sali (perhaps the Selonians).
Classical texts and archaeologists’ interpretation of their finds allow us to determine the extent of the amber trade routes during this period too. In his Natural History Pliny the Elder (AD 23–79) wrote not only about amber, its origins and its qualities, but also about the amber trade.

While, according to Pliny, until the first century AD amber was transported along the Rhine and Elbe to the Frisian Islands, during the first century it came from the Baltic lands. Archaeological evidence reflects this change in the amber route, although it may not have been so drastic. Archaeological research and old written sources allow us to claim that amber from the lower reaches of the Nemunas and the Curonian coast and the Samland Peninsula may have been brought to the lower reaches of the Vistula and thence the trade route continued along the Vistula until to flowed eastwards and from there to the Warta along the Prosna via Kalisz to Lower Silesia and further along the Oder to the Moravian Gates, the Mark and Carnuntum. It would be too great a simplification to claim that this was the only route. Most likely several routes were followed during the same period to join Denmark, Germany and the Baltic coast with Italy. It is always difficult to pinpoint where this route began on the Baltic; it was determined by interregional alliances. However, Italy was always the southern endpoint of the route (Sherrat, 1955). Carnuntum in Pannonia was a large settlement connected with a Roman fort. Today there are two settlements in this area, Petronell and Deutsch–Altenburg, on the high left bank of the Danube, approximately 35 km east of Vienna. Pliny tells us that “from Carnuntum in Pannonia, to the coasts of the sea shore from which amber is brought, is a distance of about six hundred miles, as we have discovered only very recently; and there is still living a member of the knightly order, who was sent thither by Julianus, the manager of the gladiatorial exhibitions for the Emperor Nero, to procure a supply of this article. Traversing the coasts of that country and visiting the various markets there, he brought back amber, in such vast quantities, as to allow the nets, which are used for protecting the podium against the wild beasts, to be studded with amber. The weapons too, the litters and all the other apparatus, were, on one day, decorated with nothing but amber, a different kind of display being made each day that these spectacles were held. The largest piece of amber that this personage brought to Rome was thirteen pounds in weight” (Pliny, Historia naturalis xxxvii). Thus Pliny writes of direct links between the Balts and the Romans (special expeditions), rather than links via intermediaries, as other writers would have it. It is very probable that such trade was organised in the earlier metals’ period. And a Roman of equestrian rank, undoubtedly, must have travelled hither with a larger group of merchants.

From Carnuntum amber made its way to Aquileia on the Adriatic coast. Here, whilst still unwrought in the hands of craftsmen it became an expensive object: vases, vessels to contain cosmetics, lamps, figures of the gods, men and animals, decorative bas reliefs and various pieces of jewellery, such as rings, beads and pendants (Strong 1966) and various amulets were made from it. These artefacts were taken to Rome and other imperial cities and even the riverside settlements inhabited by Germanic tribes. The slave–owning society of the empire valued amber highly. In Rome a tiny amber figurine would be sold for more than hefty, strong male slaves.

We can learn of the amber routes from hoards of unworked amber and artefacts and the wares brought by the imperial Romans to the Baltic shores in exchange for amber. Large hoards found on the Samland Peninsula, in areas in what is now Poland and along the great rivers of Central and Eastern Europe reveal the massive scale of this trade. In 1867 a 50–litre barrel containing amber was found in Samland; in 1900 a hoard weighing 9 kg was found near Gdańsk; in 1924 near Leizūnai in East Prussia a hoard of amber weighing 3 cmt was unearthed; in the surroundings of Wrocław three amber hoards or ancient stores containing 3,000 kg of amber with marks of having been polished were found in 1936. Many large hoards have been discovered near the Elbe, Rhine, and Danube, as well as in northern Italy.

Roman copper and silver coins came to the Baltic lands in exchange for amber; the odd golden sesterce has been found too. The western Balts who dwelt by or near the sea became particularly wealthy. Archaeologists have found a hoard of 6,000 Roman denarii near Olsztyn in land once inhabited by the Sudovians (Jatwings). In modern Lithuania alone 110 find sites (17 hoards) with ancient Roman coins have been found; in Latvia we know of 42 find sites (11 hoards), in Estonia 3–4 find sites while the number found on Prussian territory, especially on the Samland Peninsula, is higher still (Vasks 2001). In Latvia, unlike in
Lithuania, the coin find sites were concentrated not so much on the coast but on the banks of the Daugava, which seems to reflect the future importance of this trade artery during the Viking Age. Bronze vessels such as jugs, ladles, small glass bowls from workshops along the Rhine and the Black Sea coast, thousands of multicoloured glass beads, fine bracelets, and silver and even gold jewellery from workshops of the highest quality were also brought to the Baltic lands (Okulicz–Kozarzin 2006). Imported objects from workshops in Southern Italy and Capua have been discovered. As an analysis of Baltic bronze jewellery from the Roman period shows, the metal composition of these artefacts was the same as those of ancient Roman coins. The Balts melted down some of the coins they received to make jewellery, while some coins may have been used as currency.

Did the Balts trade in more than amber? In those days the Balts’ fields produced four sorts of wheat, rye, oats, barley, millet and legumes. Perhaps these zealous husbandmen, as Tacitus called the Aestii, also traded in grain to feed Roman legionaries during their campaigns. Roman coins were found in the grain stores of Gabrieliškės hill fort (Raseiniai rajonas), (birch–bark lined pits measuring 2m by 2.5 m), when Ludwik Krzywicki excavated the site. One of them was from the reign of Marcus Aurelius (AD 161–180) (Krzywicki 1931).

We also find a considerable amount of amber artefacts in Baltic sites of that period. In Lithuania alone around 950 objects have been found in 35 cemeteries. The wealthiest sites in this case are the cemeteries at Mazkataužiai, Šernai, Baltai, Dauglaukis, and Lauksvydai (Bluijenė 2007; Jovaiša, 2001). These included not only amulets and jewellery but also work tools (spindles). A necropolis, which was particularly rich in amber artefacts, was discovered at Weklice near Elblag in territory later inhabited by Warmian and Pomesanian tribes (Okulicz–Kozarzin 2006). Over 1,000 amber artefacts were found after excavating more than 500 graves. Men's graves contained mostly amber amulets enclosed in bronze or iron rings, while in female graves hundreds of the best–quality amber beads and pendants of various shapes were found. In the wealthiest graves archaeologists found necklaces with amber beads in their centre measuring 4.5–5 cm in diameter. Octagonal beads were the most frequent amber finds and they were often decorated with fine amber–working techniques. Many amulets of various shapes have been found in graves: small axes, or rings with amber beads inside them. This cemetery is interesting not only for the variety of the forms of its amber jewellery but also for the way the amber was worked and the “ideological” importance of amber for society of those times. In modern Lithuania in sites of the West Lithuanian Graves with Stone Circles Culture (second half of the second century–third century AD) we find either wealthy female graves with exceptional necklaces, where amber beads are found singly among beads of variously–coloured enamel, or poor graves with single amber beads or pendants.

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Amber in Europe 3000 years BCE

LECTURE

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The Third Millennium BCE was a watershed in the process of amber’s growing cultural role in Europe. The archaeological evidence indicates two poles, so to speak. In ca. 3000 BCE, amber was a local material, present in the areas where its natural deposits were located. But by ca. 2000 BCE it was known much more widely, not only in the regions of Northern Europe, but also in the Carpathian (Pannonian) Basin and in the central part of the Mediterranean Sea basin. How did it happen that over the third millennium BCE amber went from a local material to a well–known entity practically throughout the entire European continent? This is the subject of our paper.

We cannot rule out that one of the reasons for the initial interest in amber over a wider area was the earlier glacial activity, which spread out sediments, which also contained amber, across large stretches of Europe. Raw amber appeared in cultural contexts quite early, already in the Palaeolithic Age. However, on the broad geographical scale this was an incidental phenomenon, which should come as no surprise given the nature of the sources of raw amber that were available at the time. The incidents were scarce and ephemeral. They could have, however, been enough to create a certain “cultural demand” for this unique and mysterious “burning stone.” Therefore, we can say that the people of Europe were aware of amber very early on: already in the Stone Age. However, it took a long time before the notion could develop owing to the difficulty in obtaining sufficient amounts of raw amber. Before 3000 BCE amber had a consistent cultural presence only in areas where it was most readily available: on the coast of the Baltic Sea. Only in the beginning of the 3rd millennium BCE did its cultural “career” begin. The first archaeological culture to export amber artefacts to regions far away from the Baltic Sea coast was the Globular Amphora Culture in the first half of the 3rd millennium BCE.

Progress in the distribution of amber was made in the times of the Bell–Beaker Culture, i.e. in the second half of the 3rd millennium BCE. As demonstrated by C. du Gardin in her work, amber reached the Mediterranean for the first time together with the Bell Beakers. This happened in south–eastern France. The next known styles of amber artefacts were already related to the Early Bronze Age, the Únětice Culture to be exact, where a northern and southern style of amber artefacts may be discerned.

The present paper describes the main typological features of the individual amber styles and the geographic and temporal scope in which they developed. Furthermore, it is an attempt to explain the cultural mechanisms which led to such a wide–scale distribution of amber across Europe, by linking this process to transformations in social structures.

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A unique symbolic votive deposit with Early Bronze Age amber ornaments

POSTER

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Discovered in 2011 on a bank of the River Narew old river bed (site 49 at Skrzeszew, Wieliszew Commune, Mazowieckie Region, Poland), an item shaped like a receptacle with funnel–shaped walls and a rounded bottom contained selected artefacts from four material categories (8 fragments of differently ornamented, hand moulded clay pottery, 15 used flint tools, 2 fragments of amber beads and a tin bronze wire). The item itself does not have any direct analogy among prehistoric finds while certain evidence related mainly to its content (the intentional choice of pieces which had been pre–fragmented or had come from damaged tools or weapons) is indicative of a symbolic burial or a votive offering from an Early Bronze Age community.

Fig. 1 Fragments of the amber beads

The nature of the components of this symbolic deposit signifies the genetically complex tradition in which they were made. Both the pottery fragments and the flint tools display overlapping stylistic components of several cultural groups. Among them, one can distinguish the local and genetically oldest style of the Linin group with the addition of Iwno and Bell Beaker components from the west and the Proto–Mierzanowice style of the south. They are accompanied by Trzciniec Culture features, which are most likely an expression of the beginning of unification in the Early Bronze Age cultural patterns. The most interesting artefacts – the amber beads (1 spherical and 1 trapezoid) (Fig.1) – are unique among the Early Bronze Age finds in Mazowsze. The style is typical of the cultural groups which were settled at the time in what are now Poland’s regions of Lower Silesia and Wielkopolska (the Unětice Culture) and Kujawy (the Iwno Culture) where equivalent forms of amber beads styled as necklaces were buried in graves or deposited in so–called treasures. Therefore, the specimens found in Mazowsze need to be thought of as a western import, most likely from an Iwno Culture community. This direction is additionally confirmed by the presence of a fragment of an Iwno–style pottery dish.
The presented set of symbolic and prestigious artefacts which make up this specific item indicates that a complex cultural mosaic had existed along the lower River Narew in the Early Bronze Age before it was fully unified under the Trzciniec Culture. The presence of amber ornaments may in turn emphasise the growing importance of this material for the Mazowsze–based community. One may suspect that amber beads had a prestigious function here, similar to the areas where their style originated from. As there are no direct analogies to the presented item, the Skrzeszew discovery should be considered unique.

Amber routes in Central Europe’s prehistory - an overview

LECTURE

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Today it is a well–known fact that Central Europe’s prehistoric communities had commercial contacts with one another.¹ In many cases, the goal was to trade amber both as a raw material and as ready–to–use items.² In the literature and popular knowledge it is identified with the functioning of amber routes. But rather than as an actual road network with merchant factories, the term should be understood as the most likely distribution directions between the groups which produced raw amber and its end users.

The oldest amber finds related to human activity come from the Upper Palaeolithic. The latest research in Nowa Wieś, Dolesławiec Commune, Poland allows us to associate them, with high likelihood, to the Federmesser Culture.³

The evidence of the organised raw amber production and its distribution comes from the Late Neolithic.⁴ It is related to the south–eastern coast of the Baltic Sea and the Żuławy Wiślane (Vistula Lowland) region inhabited by the people of the Globular Amphora and Rzucewo Cultures. Złota Culture communities lived near the town of Sandomierz, where they both used the amber and acted as agents in its further distribution to the South. In this case, the River Vistula was the most likely transport route. One can distinguish two side–branches of the “Neolithic Route” in the area of present–day Poland. Both began in the lower Vistula locations. One of them ran to the north–west through the region of Mazury,⁵ the other through the region of Kujawy towards the middle Warta river basin.⁶

The changes which took place in the Bronze Age, except for a few episodes, continued until the end of prehistory. The role of the Vistula axis as the main distribution direction (with the exception of its lower part) diminished and was taken over by the rivers Noteć, Warta and Oder. In the Bronze Age one can also indicate two periods related to the different intensity of amber distribution. The first of them was related to the Early Bronze Age and was characterised by intense exports. Still obtained in its raw state near the Baltic Sea, amber would travel through the region of Kujawy to the Unětice communities which were part of the then–forming Central European proto–civilisation of the Early Bronze Age.⁷ The Unětice people kept some of the raw amber for their own needs and exported the rest.⁸ At the time, amber was also a very precious and, consequently, sought–after material in the Mediterranean cultures.⁹ The “routes” most likely ran along rivers to the Black Sea, the Aegean Sea and the Adriatic.¹⁰ It is possible that an organised form of amber trade on this route can be confirmed by the so–called loaf–of–bread idols which, according to some researchers, based on an analogy with the eastern part of the Mediterranean basin, were used to record and confirm commercial transactions.¹¹ Clusters of such artefacts are mainly known from the areas located between the River Po and the Alps as well as along the middle Danube, with two similar idols also found in the area between the Vistula and the Oder.¹² Their distribution is therefore consistent with the area of the Early Bronze Age Amber Route, which may be related to organised amber commerce. Discovered in 2011 at Wieliszewo near Warsaw, a
deposit which, next to pottery and flint artefacts, also included amber beads from the Únětice or Iwno Cultures, indicates the presence of a regional longitudinal route (routes?).

The second period was mainly related to the dominant Lusatian Culture which has yielded relatively few amber finds. It’s a paradox that in the south of Europe raw amber was still a prized commodity at the time, with burial ground finds demonstrating its significant inflow. Therefore, one may assume that almost all of it went to southern Europe where it was crafted into the region’s typical cylindrical beads with circumferential ribbing. Such beads were found in Crete, Rhodes, Syria, Western Balkans, Italy, Sardinia and Ukraine.\textsuperscript{13} As no locations can be indicated as intermediate stages on this distribution trail, it is not possible to mark out the most probable transport route(s). Recently, Volyhyn in Ukraine has been indicated as a centre of raw amber production, alternative to the Baltic Sea coast.\textsuperscript{14} It is from there that amber would presumably travel to the area dominated by the Mediterranean and Black Sea civilisations. However, as there is no archaeological proof for any prehistoric raw amber production in Volyhyn, such a concept can only be treated as a purely theoretical assumption.

The interest in amber increased in the Early Iron Age. The raw material would travel from the south–eastern coast of the Baltic, up the lower Vistula, the Warta and Oder river basins and the middle Elbe to the Alpine foothills and further to northern Italy. A special role was played in this case by the people related to the Hallstatt Culture, whose sites abounding in ember artefacts have recently been discovered near Wrocław, Poland.\textsuperscript{15}

During the domination of the Celts and, after their downfall, the domination of the Roman Empire, there was long–distance organised trade substantiated not only by archaeological finds but also by written records. Amber workshops were located in present–day Hungary, Bohemia, Moravia and Silesia, accompanied by the raw amber storehouses of Hradiště near Stradonice, Staré Hradisko, Wrocław–Partynice.\textsuperscript{16} Since a Roman colony was established in Aquileia in the 2\textsuperscript{nd} cent. BCE, it had become the centre of amber trade and a starting point for northbound expeditions.\textsuperscript{17} It is possible to mark out, with quite a high degree of precision, the routes within the Roman Empire associated with the excellent road network that linked towns such as: Virunum, Lentio, Emova, Poetovio, Savaria, Scarcantia and Carnuntum. One of them ran further on along the River Vltava to central Bohemia, then up the Elbe through Lusatia and Lower Silesia, down the Oder towards the Warta and further on towards the Lower Vistula, branching off to Sambia. The second one, after crossing the Roman \textit{times} at the Danube near Carnuntum, continued along the River Morava to the Moravian Gate, then further north along the Warta, through Kujawy to the mouth of the Vistula and to Sambia. Some researchers suggest that there was a third “eastern” route which connected the south–eastern coast of the Baltic through the region of Mazury, northern Mazowsze, along the River Bug to the Carpathians, southward through the mountain passes and Transylvania towards the coast of the Adriatic.\textsuperscript{18}

The main routes of Central Europe would also branch out locally at the time. One of such branches led to Mazowsze, where many settlements were focused around a thriving iron smelting centre near present–day Warsaw.

The social unrest of the Migration Period destroyed the social and political status quo, and in many cases contributed to changes in commercial linkage and consequently a decay of the European commercial routes of the time. In the early Middle Ages, the completely new political and commercial relations caused the complete disappearance of amber distribution in Central Europe. Amber was still traded commercially but the route would lead across the Baltic Sea and along the rivers of Eastern Europe, as the so–called “Trade route from the Varangians to the Greeks”.

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Amber trade in Medieval Rus’: the current state and prospects for research

LECTURE

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In Middle Ages amber trade had a wide distribution in Eastern Europe. Amber finds alongside with amber goods are frequently discovered on the archaeological monuments in Baltics, Byelorussia, Ukraine, Caucasus and Middle Asia. Special workshops on the territory of Ancient Rus’ were found in Kiev, Novgorod, Ryazan, towns of Volga Bulgaria, from where the largest (before the find in Vladimir) treasure of raw amber 16 kg in size is originated.

In 12 – first third of 13 c. the largest amber–users were towns, where stone church building was conducted. The greatest number of amber–treasures of different character and traces of amber workshops is found in Kiev. One of such centers was Vladimir–on–Klyaz’ma. In 2008 the amber store 207 kg in size was discovered in the historical part of Vladimir, so called Pecherniy town, by the archaeological expedition of Institute of archaeology of RAS. Archaeological materials proved the highest social and financial status of the
owners whose manors were situated in this part of ancient Vladimir. (Pecherniy town was destroyed and burnt in February of 1238 during Baty invasion. Amber treasure is dated by the same time.)

Raw amber (collection of pieces general square to 24 sm and width – about 24 sm) was found on the very bottom of the storage space underneath. Morphology of the pieces, its physical, structural and chemical analysis showed that all discovered amber is succinite from the Baltic’s deposits. Chemical analysis was conducted by the help of the specific diagnostics on the basis of infra–red spectroscopy; qualitative specification of the composition of the accompanying elements was conducted by the X–ray fluorescence method; specification of the weight content of the sulphur – by the gravimetric method (lifting bar – 2 g); specification of the weight and atomic content of the sulphur – by the X–ray fluorescence method (lifting bar – 3 mg).

There is still no answer to the question – from where the amber could come to Rus’ – from the Baltics or from the Dnieper region. There are three different versions in the archaeological literature. According to the first, the amber was brought to Ancient Rus’ from the Dnieper region (before Mongols), and after – from the Baltics. According to the second, there was only one source of amber till 19 c. – deposits of the Sambian peninsula. The third version says that in 10—11 cc. the amber was brought to Rus’ from the Baltics as finished goods, at the same time the amber of 12—13 cc. is supposed to come from the Dnieper region. Conducted complex analysis of the treasure from Vladimir testifies that the discovered amber had baltics provenance.

From all appearances, the amber from Vladimir was aimed for sale. The need in amber on the inner market of ancient Rus’, which includes Vladimir, was very high at this moment. The fragments of cooper and stone boilers that were found not far from the amber collection, point to the connections with the East. Such boilers are very unusual finds in ancient Russian towns – most probably they were brought to Rus’ from Khoresm and Volga Bulgaria.

Vladimir–on–Klyaz’ma was one of the main passing points of the international amber trade alongside with Poland and Volga Bulgaria towns, where through the amber from Baltics come to Volga Bulgaria and, probably, further to the East. The find from Vladimir proves that there were large lots of amber from the Baltic’s deposits. Collection of amber, discovered in this Russian town, is the largest not only in ancient Rus’, but in the whole Europe in Middle Ages in general.

Vladimiro–suzdal merchants had direct trade contacts with the region where the amber was obtained. It is confirmed by the text of the birchbark manuscript № 439 and some writing records belong to the second half of 13 c. New archeological data prove that there was existence of the constant and direct contacts between the Prussians and Russian lands.

We analyzed the amber goods and raw amber originated from the monuments of Ancient Rus’ and Volga Bulgaria 10—13 cc. and situated on the Dnieper (“from the Varangians to the Greeks”) and Volga trade ways and also on its branches (Gnezdovo, Smolensk, ancient Beloozero, Bulgar hillfort, Novgorod, and Old Ryazan”). The conducted analysis showed that all discovered amber was obtained in Baltics. (Such research for the monuments of the medieval Rus’ was conducted for the first time.)

The analysis of the chronological distribution of amber and goods from it originated from Novgorod, Old Ryazan and Murom showed that one of the peaks of its trade’s evolution in medieval Russia falls within second half of the 12 – first third of the 13 c.

Identification of the direction of the certain trade ways demands separate investigation with the involvement of the additional sources. There are no writing records directly pointed to the ways by which the amber was brought to Rus’. In this case new scientific methods should be worked out.

Conducted investigations are unfinished: we still should to compare the obtained results with the result of analysis of the samples from excavations in Kiev. Wright now the composition of the amber is still analyzing by the joint efforts of the scientists from the Institute of archaeology of RAS (Moscow, Russia) and the PAS Museum of the Earth in Warsaw (Poland). We hoped that these investigations would be very much in help in case of verification of the early obtained results.
AMBER COLLECTIONS IN MUSEUMS AND TREASURIES

Amber from the collections of District Museum in Toruń. Objects dated from Neolithic to the early Middle Ages

POSTER

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The article aims to present amber objects from the collection of Archaeology Department of District Museum in Toruń. Among these artifacts there are beads, pendants and crucifixes as well as pieces of raw material. The items are dated to periods from the Neolithic to early Middle Ages. The objects were acquired for the museum collection in various ways, some of them have old inventory numbers of Towarzystwo Naukowe w Toruniu [Scientific Society in Toruń] – one of the oldest collections of the Museum – others come from subsequent excavations and some are loose finds. The article focuses on presentation of all known data concerning these objects and their graphical documentation. Presented artifacts can be treated as a supplement to data sources of this type of objects stored in museum collections.

Translated by Maciej Majewski

Finding the Divine Falernian: Amber in Early Modern Italy

LECTURE

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In 1985, Marjorie Trusted1 published the first comprehensive catalogue of the amber wares in the Victoria and Albert Museum. This was also one of the first truly scholarly book in the English language on amber and its artistic use. Though amber art has seen growing interest in Germany in the 30 years since, especially following the fall of the Berlin Wall, Trusted’s catalogue has remained the only serious work in English. A Catalogue of Ambers in the Victoria and Albert Museum is, what is more, the only art historical treatment of amber to extensively acknowledge Italian amber. This article picks up Trusted’s baton and returns to some of the objects she linked with Italy. It begins with a case study of an amber relief of “The Rest on the Flight into Egypt”, explores this exceptional object, and provides further evidence in support of this attribution. In the second half, it looks at amber in Italy and draws the contours of the context in which an amber Head of a Saint, also discussed by Trusted in 1985, was produced. The aim of this paper is to refocus skupienie attention on Italian–made works of art in amber which have been barely discussed since Trusted broached the issue.

Part 1

Among the objects made of amber in the V&A’s collections The Rest on the Flight into Egypt is exceptional. In her catalogue entry on this piece Trusted noted a similar piece in the National Museums of

Scotland, Edinburgh; and a further similar work can be found in private hands. The evidence connecting these works to Italy has been both stylistic and circumstantial. Dowody łączące te prace do Włoch byla zarówno stylistyczne i okolicznościowe. Trusted discovered stylistic and compositional similarities between the V&A piece and an engraving showing The Rest on the Flight into Egypt by Domenico Pellegrino, called Tibaldi (1527–1596). She also noted that the inked inscription ‘Batista’ on the Edinburgh Baptism suggested that this piece was ‘at least at one time […] in Italy’. In my view, inventories and written accounts provide a further type of evidence to link these objects to Italy and, to date, none has been linked with the ambers in the V&A.

There are many similarities, for example, between a description of in the 1708 inventory of Francesco Maria Farnese’s (1628–1727) ‘Galleria delle cose rare’ and the panel in the V&A. There are good grounds for suggesting that the pieces must be closely related if not one in the same, which if the latter is true, means we must imagine The Rest on the Flight as having once been elaborately framed with filigree silver flowers.

Similar amber objects can be found referred to in a cross section of sources concentrated in the first half of the 18th century. We find a ‘quadro di Ambra rappresentate la SS.ma Annunziata con cornice di lapislazzaro, e filetto d’oro’ in the ‘Stanza dipinta a porcellana’ of Cardinal Fabrizio Spada’s (1643–1717) eponymous palace in Rome in 1717, a comparable piece of ‘the descent from the cross, of amber set in ebony and lapis lazuli’ in the audience chamber of the papal apartment in the Vatican around a decade later, and a more simple ‘presepe d’ambra’ among Alessandro Gregorio Capponi’s (1683–1746) possessions in his Roman palace in 1746. Two further objects are inventoried ‘Dentro la galleria’ in the Neapolitan palace of the Duchess of Sicignano (d. 1716) where there were ‘[…] due quadri ottangoli d’argento; à uno di essi vi sta in mezzo la ss.ma concezione d’ambra, et all’altro una croce d’ambra con cornice d’ebano, et otto cantoni d’argento, et anello d’argento per cornice’. On backgrounds of lapis lazuli and encased in frames of ebony, the aforementioned Annunciation, Deposition and Nativity may well be related to the Rest on the Flight into Egypt, Adoration and Baptism noted above. Though a number of these objects appear to have existed, information provided in the inventories suggests that such pieces were relatively rare, and highly valued.

The sale of an amber, ebony and lapis lazuli altar at auction in 2009 has not only illuminated a new aspect of the history of these pieces but also given us a concrete date. According to the inscription it was a gift from Agostino Cusani (1655–1730) to Silvestro Valièr (1630–1700), doge of Venice. Given that Valièr died in 1700, Cusani must have presented him with the object in the four years between May 1696, when he became papal nuncio to Venice, and July 1700. It was potentially during the winter of 1698/99, when, between November and January, we find Cusani writing to the already-mentioned Fabrizio Spada about the expected arrival of the exiled queen of Poland, Marie Casimire (1641–1716). There may be a case for linking the Nativity sold at auction in 2009 with this visit, and it may have been given to Valièr by Cusani in recognition of his help in preparing for and organising the dowager queen’s stay. Only further research has the potential to uncover the true story behind these amber and lapis lazuli altarpieces.

Part 2

Amber was nothing new in Italy in Marie Casimire’s time. By the late 17th century amber had not only been being imported in worked and raw form for many years but it was also being dug from Italian ground and fished in Italian waters. The first reports of its natural occurrence on Sicily date to the late 1630s. Before long, amber was also being found elsewhere in Italy. In 1650, Antonio Masini (1599–1691) noted its discovery near to Bologna. In 1684, a new supply was found in Umbria, by a farmer who, breaking apart limestone for his kiln, had found a chunk of amber ‘as large as a cap and in the shape of one’ inside. Near to Ancona, farmers tilling the fields soon began finding amber too.

The idea that the arrival of the exiled queen in Italy inspired the reliefs discussed at the beginning of this article is supported by the fact that few Italian-made objects are known to have been made before about 1700 though amber had long been available. There is no evidence that Italian amber was worked on any notable scale before this date, and it was first in the 18th century that Italian, especially Sicilian, amber and collections of it became well known enough to be noted by Grand Tourists. According to Francesco Ferrara, writing in 1805, the industry developed in direct relationship with the inclusion of the island and Mount Etna in the Grand Tour. Catanian workshops had been producing amber ‘snuff boxes, rosaries, bracelets and other female ornaments’, as well as much more complex objects, such as amber crucifixes with holy water stoops, as early as the 1740s. We do not know how many craftsmen were working amber in Catania. In Trapani, a town in the far west of the island, there were at least eight individuals the 17th and 18th centuries, some with their own workshops. Sicilians had a long tradition of working coral, a similarly soft
organic material whose naturally twisted form both required and inspired inventiveness, whose mastery involved the same simple tools and which was also used in conjunction with other materials, including amber, for example, in small devotional scenes, ivory and mother–of–pearl, and tortoiseshell, experience with which would have prepared the craftsmen for the numerous techniques involving heat which could be applied when working amber. There was also a tradition of making large nativity scenes or crèches for Christmas. One of the features distinguishing Sicilian from Neapolitan crib figures is the plinth on which the represented person or group of persons stands. We find the same plinth on some amber objects which I believe points to Sicily as the place of their making. These pieces may have a Trapani provenance, for in Trapani amber working appears to have been viewed as a form of sculpture. So highly regarded was it that one of the tasks allotted to the city’s school of design when it was established in 1804 was ‘the perfection the art of disegno, very necessary for sculpture in ivory, alabaster and amber, [...] practiced and traded in this city’.

The Sicilian amber ‘industry’ was clearly a flourishing one and Sicilian amber was also available abroad. As early as 1728, John Browne (active 1725–1736) claimed that amber was one of Italy’s most traded products. Craftsmen entered into agreements to transport and sell their work on nearby Malta and used mainland Italian ports to export their produce. The question arises: where are these ambers today?

Much research remains to be done in the area of Sicilian ambers, not to mention amber sculpture in Italy more generally. This contribution will touch on a number of subjects which are worthy of further consideration. Were, for example, Italian craftsmen working with amber aware of a parallel industry in Prussia and of the types of objects being made there? How did Italian consumers acquire art made of amber? Were they interested in the geographical provenance of the material and objects in their possession, or did their fascination lie primarily with this curious and unusual yellow “stone” itself? What status did objects in this material have and did the finding of classical ambers lead to their re–evaluation or changed appreciation? Where are the many works produced on Sicily in this period today?

Marjorie Trusted pioneeringly highlighted the existence of Sicilian/Italian ambers in the London collections nearly thirty years ago. The overwhelming focus on historical amber art from Prussia bolstered by recent publications of amber in the royal collections at Dresden and in Vienna, combined with the strong popular association of amber with the Baltic region has meant that varieties of amber art from other parts of the world has been largely overlooked since. Given that no geological or natural–historical text would fail to mention Sicilian amber, for art historians specialising in this material the time to do the same has come.

Amber in Legnica

POSTER

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The Gallery of Art in Legnica is a cultural institution that deals with promotion, popularization and education in the field of contemporary art in general and over the past three decades it has specialized in the presentation and promotion of contemporary artistic jewellery, winning a significant position in Europe in this area. So far the Gallery has organized more than two hundred individual and group exhibitions and dozens of artistic actions and happenings, and finally it has published everything from brochures to professional catalogues; and Legnica has become an iconic place for the community of jewellery artists. The annual culmination of the “silver” activity of the Gallery takes place in May and it is Legnica Jewellery Festival SILVER, in which artists from all over the world have participated for years. The Festival consists of a series of exhibitions, presentations, academic sessions, happenings, concerts and the main event of the Festival: Legnica International Jewellery Competition.
Amber “climates” appear at the SILVER Festival, for example, through the annual presentation of the results of Gdańsk Amberif Design Award competition, presentations of group exhibitions with amber (this year’s "Hardened Tears") and presentations of works by artists who specialize in working with amber. The high visual appeal of large amber pieces framed in silver is confirmed by our shows of jewellery fashion of, among others, M. Gliwiński and B. Kamińska. Alongside theoretical seminars accompanying the festival, much attention is paid to the issue of amber.

The promotion of amber in Legnica and by Legnica is of a somewhat "dual" nature: intentional, focused on the conscious popularization of artistic jewellery work with the use of amber, and indirect, which is the consequence of the Gallery’s activity related to goldsmithing. The first type of activity involves the intentional organizing of exhibitions, competitions or shows of jewellery, both in Poland and abroad. Such large exhibitions have been presented in many places in Poland and abroad, including Silver and Amber Time (2008, five presentations in Poland and Germany), Designed in Poland (2009, two presentations in Kazakhstan and Belarus) or Natural, Mystical Avant–garde (2007, 2010, two presentations in Italy). It should be noted that in all the jewelry exhibitions prepared for presentation abroad we have tried to emphasize more strongly the presence of amber as a Polish spécialité de la maison, such as in the exhibitions: Polish Contemporary Jewellery (Italy, Florence, Dicomano), Polish Contemporary Jewellery Art (Sweden, Germany, Czech Republic, Slovakia, France, Hungary, Serbia).

![Silver and Amber Time](A: Andrzej Boss, B: Pawel Kaczyński, C: Jarosław Westermark)

Some of Legnica’s presentations have been partially limited by the nature of the subject or the curatorial selection of participants, such as in the case of the exhibition Natural, Mystical, Avant–garde, but most were open projects which were represented by almost all the major jewellers in Poland, which is a group of about 60 people, being the leading Polish jewellery designers. We find among them those specializing in amber jewellery as well as those who rarely use amber. In the last decade, while amber is no longer de mode and the enfant terrible of Polish contemporary original jewellery, it has become consciously appreciated by the artists, and the satisfaction of its use in art has no longer purely "patriotic" sources. Maybe that’s why the many young artists, such as Kozubowicz, Schiffrs, Śliwowski, Ostrowski, Gackowska and others have reached for it.

The amber exhibitions of the Gallery in Legnica have resulted from a specific need or curatorial preferences. However, the "truth" about the actual, real interest in "Polish gold of the North", manifested by Polish and foreign artists, can be seen only in all the other artistic activities of the Gallery such as review, competition, theme, occasional group exhibitions, so in those in which the use of amber was not required, but it was there by the will of the independent artist. The percentage rate of amber jewellery in these exhibitions has been the highest in the last few years (6.74% compared to about 4% in the previous decades), which can prove that artistic anathema has been taken off amber and it is no longer treated as substitute or “embarrassing” material and that after banishment it has come back to artistic studios. We hope that the Gallery associated with the presentation and promotion of amber jewellery has contributed to this effect at least to a little extent.
Amber classification principles in archaeology

LECTURE

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Amber (succinite) has played an important and growing role in the cultural development of European
societies as early as since the decline of the Paleolithic period (ca. 13000 years ago until the present). This is
confirmed by both raw amber finds and amber artefacts discovered in archaeological sites and by individual
specimens found by chance in our contemporary times. Based on the analysis of the finds in correlation with
other source data, archaeologists have made difficult attempts to reconstruct the ways these finds were
used, distributed, the significance they had in the development of contacts between groups on a regional and
macro-regional scale, covering usually the Baltic coastal zone and the broadly understood South, including
the areas located south of the Carpathian Mountains as far as ancient Greece and Italy or even the Middle
East and ancient Egypt.

The author’s opinion is that such sweeping conclusions of historical nature were, and unfortunately
still are, a consequence of a stereotypical assumption that the amber found south of the Carpathians had
come from the Baltic shores. This of course is profoundly contradictory to our current state of knowledge
about the wide distribution of succinite resources in both continental Europe and the British Isles, as well as
about the numerous amber–like resins found throughout the world.

The results of superficial and macro-regional cartographic analyses, reference to the rather imprecise
mentions by ancient writers or even certain stylistic similarities between amber artefacts and the presence of
southern imports on the Baltic coast cannot at present be sufficient as premises for definitive conclusions
about the origin of the succinite and the artefacts made of it within the range of the Mediterranean
civilisations in the broad sense of the term.

The situation described above and the considerable gaps or outright errors in the descriptions of
archaeological amber artefacts are certainly the consequence of a rather typically narrow interdisciplinary
background among archaeologists and prehistorians concerning the knowledge of succinite and other fossil
resins. Hence, the commonly perfunctory descriptions, missing or mistaken characteristics of the artefacts’
material features (type of resin, variety and colour), completely missing or mistaken technological
classification, the absence of weight or even size indicators. Of course, the author is aware that this situation
is the result of many determinants, even those beyond the researchers’ control. They include the various
degrees of the artefacts’ oxidation, which can take up as much as almost 2 mm of the external crust; their
fragmentary preservation; concern about damaging a specimen while taking samples and its loss of exhibition
value; the absence of any basic equipment for the preliminary analysis of, for example, succinite’s structure
and weight; and the marginal nature of the individual or few amber artefacts in relation to the dominating
amount of ceramics, flint or bone specimens and attractive registered finds. Taking into account Poland’s
daily reality of research work, one cannot fail to notice the financial limitations regarding the possibility to
carry out lab analysis of samples taken from fossil resin artefacts by means of FTIR spectroscopy or to
determine the succinic acid content.

In the author’s opinion, determining the succinite’s sulphur content coefficient and micro hardness
(MPa or kG/mm²) is important to be able to indicate indirectly its place of origin. It is especially telling in
combination with studies on the interdependency between the succinite localities in nature and the location
of prehistoric settlements with amber artefacts or raw amber, including their quantitative saturation. Two
methods are remarkably useful for this type of research: isochoric correlation and rank correlation. They have been successfully used in the research on Stone Age amber craft in Poland.

Over the last 30 years, however, a number of positive changes have also been observed in the research on prehistoric amber craft. Introduced by the author, the principles of the multi–aspect classification of prehistoric amber have been adopted by quite a large group of students and also by other researchers, including in reference to younger chronological periods. The suggestion that humans from bygone periods may have potentially been using succinite from local resources in the vast interior, in turn, have significantly undermined the previously indisputable hypothesis that the succinite found in the settlement complexes of southern European civilisations was of Baltic origin.

The author’s more than 40 years of experience in research on prehistoric amber, including his direct involvement with a collection of more than 200,000 amber artefacts and an analysis of the shifts in amber research enacted by representatives of other fields of science, call for a new attempt to introduce a somewhat modified universal benchmark for research procedures regarding the amber sources from all the past eras.

The proposed model is based on a proper multi–aspect classification of amber sources. It will allow their comprehensive analysis, while the findings, combined with the knowledge about the settlement, economy and the inter–group relationships among the researched communities, will provide the foundation for studies on the amber industry of such cultures and areas. The amber industry of these communities needs to be understood as the total of their behaviour related to raw succinite exploitation and gathering, crafting, distribution and use. With such an approach, the amber industry may represent a set of distinctive features for a given production unit, settlement, cultural group, archaeological culture or a complex of archaeological cultures.

A multi–aspect classification of amber sources must absolutely include: preliminary, morphological and technological (production) classification, raw material typology, metric, functional, cultural and chronological classification.

Preliminary classification divides the analysed set of amber artefacts into the following subsets: raw amber, amber ornaments and their semi–manufactured pieces (half–products), and production waste.

Morphological classification distinguishes between specific forms of manufacture, based on the artefacts’ shape, the proportion of selected structural elements, their specific features including, for example, the type and location of holes, the type of side edges and the type of the top and bottom surface or their circumferential surface. These features can become a basis for a multi–level classification of artefacts made of succinite.

Technological (production) classification arranges the analysed set of amber artefacts in terms of how advanced the production process was. The selected criteria of the way the specimens have been crafted should lead to distinguishing between specific Technological (Groups (TG), which will reflect the successive production stages, from preliminary processing to finished and ready–to–use ornaments. The technological classification should also include the reworking and repair of damaged ornaments by their users and the same performed while the production process was still underway.

The aim of the raw material typology of a set is to determine the succinite variety used to make each product. In this case, it is typology, rather than classification, that is the method behind dividing the set into varieties. The reason for choosing a typologisation of varieties is the inability to single out classification criteria which would meet, in each researched case, the disjoint criterion for the data characteristics of resin subsets (varieties) due to the multiple transitional states between one variety and

another, sometimes having a very fluid form with a very extensive chain of properties. As an organic material with very strongly developed amorphous qualities, even at its primary formation stage amber reluctantly yields to any mineralogy classification that follows uniform criteria, which is the primary condition for a proper research procedure. These features are met by a classification of succinite’s primary varieties carried out by S.S. Savkevich (1970, p. 101) which, after its significant development by the author of this paper, has been used in practical archaeology for 40 years now.

The modified version of succinite’s mineralogy classification covers pure primary varieties, transitional varieties between one variety and another, combinations of various succinite varieties in a single amber nugget and secondary varieties. Secondary varieties formed at various points in the succinite’s lifetime, but only after the primary varieties had developed. The author also presents a proposal for a kind of record of the mineralogical characteristics of succinite specimens, which includes all the basic mineralogical features, including the primary and secondary colour.

Another important feature in describing the properties of amber specimens, including archaeological amber finds, is to determine their primary colour, usually visible inside the lump (in the core), as well as its oxidation-induced transformation through shades of yellow, orange and red to dark brown, and the external matte crust which can be as much as 2 mm thick. An archaeologist has to remember that they are very often dealing with such highly advanced oxidation processes in the artefacts as to make them completely covered with the brown external crust described above, under which the oxidised layer of transparent dark-red, cherry-coloured succinite is concealed. It can even go as deep as the very core of the specimen. In such a case, neither the transparent variety nor the colour corresponds to the specimen’s original condition, being only the consequence of the progressive resin oxidation processes.

Metric classification covers the artefacts’ dimensions provided in millimetres: length, width, thickness, diameter, height, hole diameter and weight in grams down to 0.001 g. The metric features may be significant in studies on the size and efficiency of amber artefact production on various levels: in individual workshops, settlements and cultural groupings. The diverse dimensions of specific ornamental forms may sometimes also be an indication of their age and cultural affinity.

Functional classification of amber ornaments is used to determine their function in simple arrangements (single beads, pendants, rings, discs, badges etc.) and complex arrangements (necklaces, plastrons, diadems, bracelets, greaves). By additionally considering the information about the relative position of the ornaments to each other and to the body found in a grave or some other site, it will be possible to determine the styles used to decorate the body and clothing with succinite ornaments specific to given populations at various levels of cultural classification. Once a parallel analysis is carried out on the arrangement of decorations made of other materials at the same sites, together with the extremely difficult reconstructions of clothing and hairstyles, it might be possible to recreate the contemporary fashion in women, men and children.

Cultural and chronological classification. Both these classifications are founded on the information obtained in analytical procedures based on all the amber artefact classification forms described above and on comparative data related to other archaeological complexes and groups and the specific cultural content of such artefacts’ parent complexes.

References
Amber in collections of Polish museums

POSTER

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The Amber Department of the PAS Museum of the Earth is currently running its third resource query on “Amber in Polish Museums”. Recent findings have shown that amber is kept in at least 140 Polish museums. This overview only mentions selected Museum collections.

Amber museums

The Amber Museum Branch of the Gdańsk History Museum has been operating since 2006. Its modern display arrangements present natural science collections (even a lizard inclusion in amber), traditional craft, a collection of artwork by the Gdańsk masters of the 16th to 18th cent. and contemporary works of art.

The University of Gdańsk Museum of Amber Inclusions has collected more than 14,000 inclusions of animals and plants from the Palaeogene amber forests, with some of them displayed at a permanent exhibition.

Three smaller amber museums, including two private ones, are located in the towns of Stegna, Jantar and Słupsk.

Amber masterpieces

Since 1965, the Malbork Castle Museum has been collecting historical amber artefacts (250), contemporary artefacts (900) and natural specimens (750); some of them are displayed at the Amber Contexts exhibition, including a 1687 altar, coffers by 18th century Gdańsk amber craftsmen and King Stanislaus Augustus’ cabinet.

At the Czartoryski Museum in Pulawy you can see an 17th century cup which belonged to Charles V.

Cracow’s National Art Collection at Wawel Royal Castle has a chessboard with amber pieces (17th cent.) and an amber chalice; the Cathedral Museum preserves an amber tumbler (17th cent.) and a medallion with a portrait of King Stephen Báthory.

Contemporary jewellery art

The Jewellery Art Museum in Kazimierz Dolny has a collection of silver jewellery with amber by 28 artists, made in 1960–1980, and more than 100 Etudes (in Jewellery) or Jewellery Illustrations made in 2001 of amber combined with silver and/or other materials by several dozen artists.

Amber jewellery art – contemporary and from the late 20th century – is also part of museum collections including: the Regional Museum in Konin, Copper Museum in Legnica, Gliwice Museum, Mazovian Gentry Museum in Ciechanów and the National Museum in Warsaw.

Archaeology collections, amber treasures, reconstructions

Since 1997, the City of Gdańsk Archaeology Museum has been displaying a permanent exhibition on Amber through the Millennia. Next to archaeological artefacts, it presents the origin of Baltic amber, amber in medicine, Polish folk amber craft and a selection of contemporary amber artwork. At the Blue Lion Archaeology Education Centre, the Museum’s display includes a reconstruction of a Mediaeval amber craftsman’s workshop.

The National Archaeology Museum in Warsaw has an exhibition on The Prehistory of Poland, with Neolithic amber beads from Bronze and Early Iron Age sites in the town of Złota, turned beads from the period of Roman influence, for example from Basonia, and Early Mediaeval beads, pendants and crosses.

The Archaeology and History Museum in Elblag presents, for example, beads from Goth burial grounds from the period of Roman influence and an “imported” wine drinking set from the early 3rd century CE found in the village of Weklice. The exhibition dedicated to the Early Mediaeval (9th–10th cent.) emporium in Truso
showcases Hnefatafl pawns made of amber. Moreover, a treasure of ca. 10 kg of amber is displayed within a reconstructed old amber workshop.

The Pruszcz Gdański Archaeology Park is a 1\textsuperscript{st}–5\textsuperscript{th} century trading settlement with a set of houses and an amber craftsman’s workshop.

In the National Museum in Szczecin, there is a Neolithic amulet which deserves special attention; it is a figurine of a bear found in 1880 near Słupsk which returned to Szczecin after its post–World War II displacement.

The Archaeology Museum in Wroclaw presents some of the amber found in a 1\textsuperscript{st} cent. CE storehouse from a site in Partynice. Another 1\textsuperscript{st} cent. CE amber treasure can be found in the Puck Region Museum in Puck.

The Archaeology Museum in Toruń has Neolithic amber artefacts from the period of Roman influence and the Middle Ages; Neolithic artefacts can be found in the Regional Museum in Toruń.

The Podlaskie Museum in Białystok has a large collection of artefacts from the Balt and Przeworsk Cultures.

The Kalisz Region Museum in Kalisz presents amber at permanent exhibitions in Kalisz and the Archaeology Park in Zawodzie.

The Regional Museum in Konin has been carrying out field research in archaeology for many years – some amber finds can be seen at the "Amber Route" site. Konin is identified with the settlement of Setidava on Ptolemy's map.

A 5\textsuperscript{th} cent. CE amber sword bead with amaldine is stored among other amber artefacts at the Archaeology Museum in Cracow. A reconstruction of a Bronze Age amber workshop is presented at the Open–air Archaeology Museum in Trzcinica, known as Carpathian Troy (Branch of the Subcarpathian Museum in Krosno).

**Polish folk amber craft traditions**

The Northern Mazovia Museum in Łomża has an Amber Department with a regional collection of 1300 artefacts accumulated by Adam Chętnik. Systematically enlarged, the outstanding ethnographer’s original collection documents the presence of amber in the River Narew basin – an enormous selection of forms, varieties, samples of amber–bearing sediments, tools used for exploration and excavation, amber crafting workshops, a wealth of Poland’s Kurpie region ornamental clothing accessories and items from the interiors of peasant cottages. The collection is complemented with fossil resins and products made of them beyond the Narew basin, contemporary resins, imitations and unique archive materials.

The Kurpie Culture Museum in Ostrołęka, Kadzidło Branch, and the privately–owned Kurpie Museum in Wach have developed a joint programme to present Kurpie region amber artefacts, demonstrations of amber mining and traditional Kurpie amber crafting techniques. Similar activities are performed by the Cultural and Natural Heritage Ethnography Centre in Lelis.

The National Ethnography Museum in Warsaw has built a collection of amber artefacts from Poland’s regions of Kurpie, Łowicz and Sanniki, plus archive material, including Dr. Piotr Szacki’s papers on amber in Kurpie and Sicily.

The Museum in Łowicz exhibits amber necklaces and elements of Łowicz folk dress.

Amber artefacts from Poland’s region of Kashubia can be found, for example, in the Puck Region Museum in Puck, the Kashubia Museum in Kartuzy, the National Museum in Gdańsk.

**Amber collections in natural science and university museums**

The amber collection accumulated since 1951 by the Polish Academy of Sciences Museum of the Earth in Warsaw currently includes 29,500 inventory numbers which, taken in terms of specimens, has already exceeded 30,000. These are forms, varieties, plant inclusions and animal inclusions (at present with 128 holotypes), archaeological as well as contemporary pieces and ethnographical artefacts (for example: some Kurpian artefacts of Chętnik collection; Kashubian collection enlarged with a donated necklace made of typical disc–shaped beads made by Jerzy Budnik, exhibited next to double necklaces), specimens from Poland’s regions and the entire world. The collection is accompanied by an extensive library of amber literature.
The Natural Science Museum at the Polish Academy of Sciences Taxonomy and Animal Evolution Institute in Cracow has collected: organic amber inclusions, natural amber forms and varieties, archaeological items and contemporary amber jewellery.

The Natural Science Museum at the Nicolaus Copernicus University in Toruń displays Professor Jan Zablocki’s historical collection of Baltic amber varieties and microscopic preparations with organic inclusions. The University of Silesia has Professor Jan Koteja’s collection of scale insects (Coccidae) in amber.

University of Wroclaw’s three museums keep amber specimens from H.R. Goeppert’s collection; these are: the Geology Museum, the Mineralogy Museum and the Natural Science Museum.

Poland’s location in the “amber-bearing North” has caused amber’s presence in the life of our ancestors and ourselves, which is demonstrated by Polish museum collections (Gierłowska 2005; Kosmowska–Ceranowicz 1982; Kosmowska–Ceranowicz, Popiolek 1981; Kosmowska–Ceranowicz, Pietrzak 1985; Pieśnińska 2011; Pieśnińska, Gronu–Dutko 2009). Some of them can be seen at the exhibition Amber not only by the Baltic Sea, currently on display at the Polish Academy of Sciences Museum of the Earth, Warsaw, devised by Wanda Gontarska and Barbara Kosmowska–Ceranowicz, accompanied by a monograph of the same title (Kosmowska–Ceranowicz, Gontarska 2012).

References


Exhibition Amber in medicine in Museum of the Pharmacy in Warsaw, April-November 2012

POSTER

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From April until December 2012, the Antonina Leśniewska Museum of Pharmacy, a branch of the Historical Museum of Warsaw, on 31/33 Piwna Street, presented the exhibition Treasure of the Baltic. Amber in Medicine, initiated by Prof. Iwona Arabas Ph.D., the Museum’s head and the exhibition’s curator. The exhibition was devised by Alicja Pieśnińska (PAS Museum of the Earth, Warsaw) and Dr Joanna Popiolek (the Historical Museum of Warsaw). Marcin Więcek (Museum of Pharmacy) developed the graphic design for the display and Stanisław Miszkiel (the Historical Museum of Warsaw) handled the exhibit layout.

¹Map of Amber in Masovia’s Museums, 2011, designed by Barbara Gronuś-Dutko, developed by Alicja Pieśnińska and Michał Kazubski.
With diagrams, maps and amber specimens from the PAS Museum of the Earth, Warsaw (selected by the Amber Department’s staff), two display cases illustrated: [1] the resinous origin of Baltic amber in Fennoscandia’s Palaeogene forest; [2] its travel down the Eocene river Erizanos to the Gdańsk Delta; [3] the Pleistocene transport of some of the amber by continental glacier, including to the Polish lowlands; [4] the accumulation of amber in Baltic beach sediments in the Holocene; [5] the use of amber in prehistory. Copies of animal figurines made of amber 7000 years ago, from the collection of the National Museum of Archaeology in Warsaw, demonstrated that Europeans believed in amber’s magical power already in the very distant past.

Illustrations and texts outlined amber routes, ancient authors’ views on amber’s medicinal properties, the dry distillation of amber, the use of amber in pharmaceutics and in the production of utensils. The illustrative boards were set against I. Shishkin’s Pine Forest.

A pharmacy counter displayed many para–pharmaceuticals, cosmetics, peeling products, incense sticks made with amber, succinic acid preparations, amber oil and even anti–rheumatic socks made of yarn finished with amber powder – all selected from the products available in Poland, Russia and Lithuania. Pine resin syrup was also presented.

There was a chemist’s receptacle for amber oil, a baby teething ring from Poland’s Kurpie region, eye–treatment sticks, nugget used for acupressure, incense, ointment and snuff, spirit and red wine tinctures, rings, bracelets and necklaces from the regions of Kashubia and Kurpie, including small children’s necklaces from the collections of the Museum of Pharmacy in Warsaw, the Northern Mazovia Museum in Tomža, the Malbork Castle Museum in and the PAS Museum of the Earth, Warsaw. White amber was presented as having the most medicinal properties – exemplified by necklaces made by Barbara Gronuš–Dutko, from her own collection. The products of amber distillation were displayed: oil, acid and colophony, along with pine resin distillation products: turpentine and colophony.

Pharmaceutical packaging for pine products and a binocular magnifier for viewing amber inclusions were presented, with bibliographic information and captions in English.

The exhibition was accompanied by a Polish and English brochure by J. Popiołek, A. Pielirinka and I. Arabas and a poster by Marcin Więcek. Amber ointment and tincture amber were on sale.

Paula Alabarska (Museum of Pharmacy) prepared a diverse schedule of classes and competitions for children, including special adaptations of amber legends. Movies about amber were shown during Museum Night, with coffee sweetened with amber sugar, while the Museum’s staff dressed up as the goddess Jūratė (Jurata), the god Kastytis (Perkun) and a Roman equestrian.

Since the temporary exhibition was dismantled in 2012, the Museum of Pharmacy in Piwna St, Warsaw, displays a cabinet about amber medicine with selected specimens and illustrations, and you can still buy the brochure, some ointment or amber to make a tincture with.

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Amber medication has been the subject of several papers by the staff of the Amber Department, PAS Museum of the Earth, Warsaw. Adam Chętnik, the founder of the Museum’s Amber Department, collected information about amber medication traditions in the Kurpie region, which he included in his publications. The Museum of the Earth publicised this subject with its Amber in Folk Medicine display cases presented at monographic amber exhibitions, both permanent and touring. More was written about the topic by Róża Kulicka (1980) and the results of research on specialist literature were published by Barbara Kosmowska–Cernowicz (1991). Joanna Popiołek (2006, 2010) researched old Polish writings to compile information about amber treatment; she presented the history of research on and the use of the properties of amber, including the latest applications of amber in medicine, at the AmberIf Seminar.

The findings of research on amber’s influence on human tissues and cells, carried out by a German researcher team centred around Edwin Kaiserling (2004, 2008) were published in The Proceedings of the Museum of the Earth. The achievements of Russian researchers were popularised by Gabriela Gierlowska (2002) and N. Moshkov (2011), with Zoya Kostyashova (2012) adding a recent contribution. The findings* from current analyses are also published by the Warsaw University of Technology team of chemists under Ludwik Synoradzki (2012). Italy’s Eugenio Ragazzi (2005) is known for his achievements. Amber–finished fibre
for anti–rheumatic textiles were developed at the Institute of Biopolymers and Chemical Fibres in Łódź (Brussels Eureka 1998 Award; implemented in production by Krystyna Twarowska–Schmidt 1999–2000), while special–purpose fibres for medicine were developed by Inga Liashenko, Riga University of Technology (awards: Seul 2009, Kiwie 2010).

This research gives hope that the expected range of amber therapy methods, which are already used in spas in Japan, Russia and the USA, will be enlarged. The Museum of Pharmacy exhibition was an opportunity for some recap and reflection from its makers (Arabas et al. 2013).

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Amazing Amber: the challenges of creating an exhibition on amber and possible solutions

LECTURE

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There are many challenges to be overcome to produce an exhibition on amber. There is a vast variety of objects to consider, from ancient brittle artefacts, through large ornate carvings, to tiny insects. The creative team working on the ‘Amazing Amber’ exhibition have come up with some innovative solutions.

The biggest problem is that amber is an organic material that is prone to oxidation which causes it to darken and crack. So normal exhibition conditions of bright lights (including daylight), with daily changes to heat, humidity and air circulation can be damaging to amber.

Among the items to be displayed in the exhibition are parts of a 4000 year old amber necklace, and dress accessories of amber, that were found at the Knowes of Trotty, Orkney, in 1858 and 2005. These pieces have oxidised and lost some of their translucency. Archaeological amber is often very brittle and needs to be treated with extreme care.
In the ideal situation, an exhibition gallery needs to have environmental controls, but these are usually set for the comfort of the visitors, not the objects. So the exhibition cases need to be designed to protect the objects as best as possible within the budget available. The ideal exhibition case for amber needs to be secure and alarmed to prevent theft, sealed to prevent air circulation, and with cold lights that have adjustable intensity.

The solution to preventing the amber degrading is by using oxygen scavengers and humidity regulators. Three years ago we experimented with a single case to display 24 pieces of amber with inclusions. The case was made from translucent acrylic sealed with silicone, which was sealed within a larger glass display case. It was narrow, with the specimens pinned to the back with acrylic pegs and back–lit with fluorescent strip–lights set well back to allow heat to rise upwards and away. In the bottom of the case there was a hidden compartment where we put sachets of oxygen scavenger. The type we used removes all the oxygen and any nasty gases, but keeps the humidity constant. The case had to be sealed very quickly once the sachets were exposed. Oxygen scavengers are expensive, can only be used once and the amount you need depends on the volume of the case. To show up the insects, photos of the insects were printed onto the back. This exhibit was very popular. It was in place for two years and was monitored regularly. Over this time there was no change to any of the specimens. They did not darken or craze, so it was a great success.

In ‘Amazing Amber’ we are using oxygen scavengers in all the cases that contain specimens with inclusions. These pieces are small so the cases are narrow with a limited volume, so the amount of oxygen scavenger required is low. For the other objects, for example large raw pieces of amber, carved objects and the archaeological artefacts that are already oxidised, we will be using humidity regulators. These are available in sheet or sachet form. They maintain a constant level of humidity so stop specimens drying out and cracking. Humidity regulators are much cheaper than oxygen scavengers and can be re–used again and again.

Then there is the issue of how best to display the object– sitting on a shelf, fixed on a slope, pegged to a vertical surface, or hanging down? All these methods will be used in the exhibition. Amber objects can be opaque or transparent so can be lit from the top, below or behind (or a combination). Lighting from the front is impractical as it can cause reflections, or the visitor may get in the way if the light source is a long way back. You may want to display several different objects together to tell a story, but they may require different conditions and lighting, so then a compromise has to be made. Transparent amber pieces look best lit from behind or below, however opaque amber pieces do not look good if lit like this. However any pieces can look OK if lit from the top, preferably on a white background.

The other major problem is how to show the small insects at their best. For this we have come up with a variety of solutions. Some specimens will be mounted in vertical cases with close–up photographs as we did before. We are also planning to show close–up images projected onto a large screen. We considered showing 3D images and providing 3D glasses but this would be too expensive. For some specimens that have a more interesting story to tell we will be displaying them within interactive tables with different ways to study them. For the larger inclusions we are using sliding magnifiers and for the tiny inclusions we are using images viewed with 3D stereoscopes.

There is also the issue of making sure that the items are what you are saying they are. In the process of producing this exhibition there have been a few surprises. An old piece labelled from ‘Austria’, came from a region of the Austrian empire which is now part of Romania. A Japanese netsuke, when tested with infra–red spectroscopy, turned out to be made of celluloid. I purchased a ‘pressed amber’ pendant on the internet but it is made of polyester. There are several other objects in our collection that were labelled as amber but are actually copal. There is a section in the exhibition explaining how to recognise fakes.

We hope many of you will be able to visit the National Museum of Scotland in Edinburgh to see ‘Amazing Amber’, which is on from 10th May to 8th September, and it is free entry.
Fig. 1. Early Bronze age amber jewellery and dress accessories, excavated from the Knowes of Trotty, Orkney in 1858.
2. Pseudoscorpion holding an ant in Mexican amber.
3. Part of back-lit case of amber with inclusions, which was on display in the National Museum of Scotland for 2 years.
4. Japanese netsuke. Originally registered as ‘amber’ but when tested was found to be made of celluloid.
5. Pendant purchased on the internet as ‘pressed amber’. When tested it was found to be made of polyester.
The Development of the Malbork Amber Collection

LECTURE

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The aim of this paper is to present the development of the amber collection which has been accumulated by the Malbork Castle Museum since its establishment in 1961. It is one of the most valuable collections of its kind in the world. Every year, it attracts crowds of tourists and experts to Malbork; those who are interested in exploring amber’s history and its forms in art. The 50th anniversary of the Museum and the Collection, which we celebrated in 2011, became an impulse to present this most eagerly visited exhibition in a modern display format, attractive to the public, but also to look at the collection from a new perspective.

The collection has been developing through gifts, governmental funding and most of all through a consistent purchase scheme. The most precious artefacts were bought in the 1960s through a Paris auction house involved in tracking down Polish heritage items, the Studziński Family and Poland’s Desa art and antiques state-owned company. The current shape of the collection has been determined by its two long-standing curators: inestimable amber researchers and hunters for genuinely unique pieces in the antiques market and in the contemporary amber art – Janina Grabowska and Elżbieta Mierzwińska. The collection’s development was hugely supported by the great involvement on the part of the Museum’s successive directors – mainly Edward Raczyniewski and Mariusz Mierzwiński. Fifty years have passed since the initiative to establish the Malbork Castle Amber Collection and we can see that it was built upon a well thought out agenda, with items collected in two main departments: historical artefacts and contemporary products.

One of the aims of the collection’s development, next to furthering the knowledge about amber and protecting the most valuable heritage items, is to show the relationship between amber and the place of its origin. The decision to establish the Castle Museum collection was in fact a conscious reference to the many centuries of tradition which connect this place with amber. On the one hand amber, the resin of coniferous trees which had fossilised about 45 million years ago, is now deposited around the present-day Bay of Gdansk. On the other hand, since the Stone Age, it is mainly in this region that amber has been artistically crafted.

For many years, the Castle Museum Amber Collection was the only collection in the Gdansk region to present the history of amber and amber craft. Looking at the recently growing number of institutions which promote amber, it is worth emphasising what is the most important for the Malbork collection – to highlight its artistic dimension. Today, the Museum continues to develop its collection by placing emphasis on the artistic quality of new acquisitions, both antiques and the most contemporary ones. It is also the Museum’s latest acquisitions and the reasons for the choice of its purchased items that this paper will be about.
Leopold Schmid and Bachofen-Echt - two forgotten amber specialists from Austria: their studies and collections.

LECTURE

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Austria and amber – this combination is usually suggestive only in respect to a discussion of ancient trading routes for amber, or for the production of mouth pieces of pipes and cigarette holders in by–gone times, or perhaps for a report about the early production of pressed amber (‘ambroid’) as performed by Trebitsch already in 1879. Only a few specialists will remember two Austrian amber researchers from the 20th century, who are otherwise nearly completely forgotten nowadays: Leopold Schmid (1898 – 1975) and Adolf Bachofen–Echt (1864 – 1947). Both have been dealing with completely different topics and had also completely different careers and social backgrounds.

Bachofen–Echt´s family came to Vienna as immigrants in 1865: his father Karl Adolf Bachofen–Echt (1830 – 1922) having been born in Westfalia (Germany) was a Prussian lieutenant. Having studied chemistry and technical sciences at the university of Praha he had a distinct scientific background however. At Vienna he was finally one of the owners of a big brewery. Thanks to his activities this brewery became finally one of the most important in the whole Austrian–Hungarian Monarchy. He became also mayor of Nußdorf (at this time a village near Vienna) and later a member of the municipal council of Vienna (1891 – 1895). He was one of the co–founders of the Ornithological Society and a collector of Roman coins; part of this collection was finally donated to the Museum of Fine Arts at Vienna. He has been raised to nobility in 1906, therefore “Freiherr von Bachofen–Echt”. The financial background enabled one of his sons – Dr. Adolf Freiherr Bachofen von Echt (1864 – 1947) to become what at this time was called a ‘private scientist’. The wealth of this family is also documented by the fact that there exists a painting by Klimt of one of the female members of the Bachofen–Echt family – something which only the social betters could afford.

Adolf Bachofen–Echt is important for amber specialist mainly because he built up a large collection of Baltic amber inclusions. His scientific interests were obviously rather wide – he studied also Pleistocene mammals, to mention just one example. Being already aged 80 and already rather ill he compiled nevertheless a detailed manuscript on amber: “Der Bernstein und seine Einschlüsse” – which has been published not until after his death by Dr. Max Beier, then curator of the entomological collections at the Museum of Natural History at Vienna. A reproduction of this book has been published by Wunderlich in 1996.

Bachofen–Echt was throughout his lifetime in close connection with the Institute of Palaeontology of the University of Vienna; his collection having been his private property has been sold by his family after his death. The main part of it became thus property of the ‘Bayerische Staatssammlungen für Paläontologie und Geologie’, Richard–Wagner–Straße 10, 80333 München (Munich, Germany); a small part of it however had been bought by an Austrian private collector (E. Weinfurter 1904 – 1968) who donated this collection together with an excellent collection of fossils to the Institute of Palaeontology. Based on a treaty between this institute and the Museum of Natural History of Vienna, this material has recently been transferred to the museum. Preliminary studies of this material (more than 400 inclusions) have been done by Prof. Ponamarenko (Institute of Palaeontology, Moscow) during his visit to Vienna in 1985; a smaller part of this
collection (Hymenoptera, Coleoptera) has been studied in detail in the course of two (unpublished) master theses (Leopold 1996; Mahler 2002).

The other amber specialist to be discussed here is Leopold Schmid (1898 – 1975), chemist and university teacher at the Institute of Chemistry of the University of Vienna. Though he had been appointed in his later years (1955, resp. 1964) full professor for food chemistry at this institute, he dedicated a lot of time during his earlier scientific career to studies of the chemistry of amber; the results have been published in six papers in 1933 – 1939 (two examples are given below). He focussed his studies on amber from the “Baltic Sea”, which he purchased from Merck (Darmstadt), applying extremely time-consuming extraction techniques as described already by Berzelius in 1829, respectively Tschirch, Aweng and others. Starting with 2 kg of amber he followed a complex scheme of extractions using ethanol, petroleum ether and diethylether – a procedure lasting more than 250 days (!) and resulting finally in the separation of about twelve different fractions, which he tried to characterize by means of classical methods of wet chemistry, as usually applied in those days. Two methods which he used in the course of his studies have been new for amber chemistry: dehydrogenation with selenium and (in his later publications) also an early type of liquid chromatography to yield separations of the substances in the soluble fractions. By means of dehydrogenation it is possible to transform terpene structures into the corresponding aromatic hydrocarbons, which can be rather easily identified by “classical” methods of wet chemistry; thus he isolated from the residue remaining after extraction with ethanol (about 65 %) two aromatic hydrocarbons: 1,7-dimethylphenanthren and 1,2,5-trimethylnaphthene (“agathaline”). He has been therefore the very first author isolating building units of the “polymer backbone” of succinite. Moreover by identifying one of them as a derivative of naphthene (“agathaline”) he has also shown that units with an open C-ring where involved in this structure – an important item, which has been confirmed not until 1972 by Gough & Mills by means of gas liquid chromatography and mass spectroscopy. Among the soluble compounds he identified not only camphor, borneol, succinic acid etc., but he tried also to characterize a number of resin acids – with the possibilities of those days a time-consuming and rather difficult achievement.

Decades later Rottländer repeated these studies as performed by L. Schmid and found that Schmid had yielded the maximum of results possible at this time with his methods (pers. commun., Rottländer 1985).

**Bibliography**

CONSERVATION

On the conservation of ancient amber

POSTER

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Amber is the solidified resin of amber forests, where the majority of species were pine and oak, with some thuaya, cypress, glyptostrobus as well as palm, magnolia, cinnamon trees as indicated by the inclusions. There are hundreds of kinds of fossil resins all over the world, among which amber as succinate has been distinguished. A precise definition what is amber contra copal as a subfossil resin is still under discussion. One of the criteria is age.

This interesting material has become an object of work and creation to many artists, sculptors and craftspeople due to its easy mechanical processing and diverse transparency and colour.

The oldest amber artefacts originate from the late Palaeolithic (ca. 12 000 BCE). They are animal statuettes and ornaments discovered in Meiendorf n. Hamburg in Germany and in Siedlica (Wielkopolskie voivodship in Poland). Amber was even more popular in the Neolithic (ca. 5000 – 1800 BCE). Various amber beads were found in Poland in sites such as Zaborze, Nosewo, Wierzbowo, Złota, Rzucewo and Suchacz.

Much fewer artefacts have been preserved from the Bronze Age (1800 – 700 BCE), although more from the turn of the Bronze and Iron Ages (ca.700 – 400 BCE). Among the most interesting finds one can list amber beads and swords with amber knobs found in Hallstatt, which proves commercial contacts between the Hallstatt region and the source areas of amber.

The period from 400 BCE until 400 CE is when amber trade flourished and the technique of its processing developed. The Migration Period (400-700 CE) is connected with lower interest in amber. In the early Middle Ages (700 – 1300 CE) amber became a widely applied material to produce ornaments again, and since the baptism of Poland – also crosses. The most spectacular development of amber crafting techniques dates to the 15th-18th centuries in the towns of the southern Baltic coast, especially Gdańsk and Koenigsberg.

Artefacts made of amber are very often examples of the highest class handicraft. Their state of preservation is varied and depends on different factors: internal, due to the structure and characteristics of the material itself and the technology, and external ones, i.e. the conditions of storing and exhibiting.

Amber is a mixture of better or less identified organic compounds, among which terpenes, abietine acid, and in case of the Baltic amber (succinate) 3-8% of amber acid. The elemental composition is diverse: ca. 67-81% carbon, 8,5-11% hydrogen, ca. 15% oxygen (depending on the degree of oxidation) and ca. 0,5% sulphur.

Amber is very vulnerable to corrosive factors, especially oxygen and low humidity atmosphere. Deterioration is manifested by disintegration and loss of cohesion in external layers and substantial changes in the texture and optical properties. Oxidation and atmospheric deterioration are considered as the main factors of amber decay.

This process affects the compounds which have double bonds (C=C) that oxidise to hydroxide, peroxide and carboxyl groups. In the course of amber’s ageing, the content of carbon, hydrogen and sulphur decreases, while the amount of oxygen increases. The mass of the amber may grow but it may also drop, due to the evaporation of low-molecular oxidation products. The amount of volatile terpenes can also drop. The factors that accelerate the weathering of amber are variable humidity and temperature conditions.

1 Research financed by the National Centre for Science within a project: „Konserwacja zabytkowych bursztynów” NN 105248438
2 K. Kwiatkowska, Bursztyn w archeologii,[in:] Bursztyn - Skarb dawnych mórz, B. Kosmowska-Ceranowicz (Ed.), Warsaw 2001, pp. 25,134
Archaeological objects that are preserved in swamps show a remarkably better state of preservation than the objects exhibited in museum conditions.

Amber is not resistant to high temperature, cracks if rapidly heated and burns in an open fire. Mechanical factors are another threat that leads to deterioration: due to its low hardness, amber is prone to fissuring and cracks and crumbing when hit.

It should also be noted that some museum exhibits undergo secondary destruction due to ageing of the conservation materials applied for their restoration, which affects the state of the amber artefacts.

Also the technique of production is of considerable significance. The simplest amulets and beads that are made of a single fragment of amber resin with a hole drilled in them stay in contact with linen (cellulose) or silk (protein) thread. However, very often an amber object has contact with materials such as ivory, nacre, metal, wood, paper (e.g. newspapers), brass bands, paints or gold foil. In such cases the state of preservation depends on the resistance of these materials and their interactions.

The objective of the reported project is a complex investigation of the structure and identification of original materials (amber, copal, ivory) and secondary materials, applied for repairs and conservation. It is also a summary of the techniques of production and decoration of the objects from the Castle Museum in Malbork and from Grünes Gewölbe in Dresden as well as an elaboration of modern restoration methods with the use of traditional and contemporary materials.

Research on the structure of amber and other fossil resins as well on its external weathered layers was done with the use of FT-IR spectroscopy. Also old methods of impregnation of weathered amber with natural and synthetic resins were investigated. The method of thermal differential analysis and capillary isotachophoresis for the identification of fossil resins was discussed. A catalogue of reference spectra was elaborated.  

Imaging methods in UV and IR, esp. Optical Coherent Tomography OCT, were revealed to be useful in order to define the technique and technology used to make the objects and to evaluate their state of preservation.

With the assistance of the staff of the Museum in Malbork the objects for the investigations were chosen so that they represented various historical periods, technical structure, technology and state of preservation. At the beginning an analysis of their form and content was executed. The objects in the set are not homogeneous in terms of typology, functionalism or iconography, and they do not belong to the most recognized, reproduced and exposed examples of the amber art. However, they illustrate artistic elaboration of the objects imbued with symbolic meaning. On the other hand, they provide a reliable example from the conservation point of view. This concerns mainly their technical construction and the related problem of deterioration and restoration.

The following objects were investigated:

1. A Neolithic pendant as an example of objects made of a single flattened amber nugget with a central hole
2. An orthogonal case – made in Gdańsk, 2nd half of the 18th cent. with subsequently added decoration on lateral walls, figural and acanthus, on the background of plates with finely engraved decoration made in multicolour amber with elements of ivory.
3. A relief representing Noah’s Ark, or rather Noah’s conversation with God, The Ark and the animals, described in the literature as a “relief in a frame” or simply as “a frame”. It is dated to the end of the 17th cent., most probably to the years 1690-1700 as can be deduced from the shape of the ornament. The relief is made of ivory framed in amber and nacre.
4. A small lace loom?, originating from an unknown studio, dating from the 18th cent., made of multicolour amber, on a wooden support with small metal elements and a textile cushion.

In the next step the authors concentrated on the investigation of the technique and technology used and a precise evaluation of the state of preservation. The research program was two-fold – the museum objects were investigated with the use of non-destructive testing ‘in situ,’ while reference material was taken by sampling different objects of amber, copal and other resins in various states of deterioration.

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4 This research was performed on material obtained courtesy of Prof. B. Kosmowska-Ceranowicz and her staff at the museum of the Earth, Polish Academy of Sciences.
5 OCT tests performed by Prof. dr hab. Piotr Targowski and his group, Institute of Physics, NCU
6 Research elaborated by Dr M. Woźniak, NCU Torun
This type of research will contribute to the development and improvement of the methods of amber identification. As far as non-destructive methods are concerned, the imaging of the objects was performed with the use of electro-magnetic spectrum UV, VIS and IR and FT-IR spectroscopy (with a refection adapter which enabled the evaluation of the structure without taking samples). Also OCT – Optical Coherent Tomography was applied for the first time (no research of this type on amber has been reported so far in the literature) to evaluate the structure and the state of preservation.

The results provided very interesting information on the object’s technical structure, an evaluation of the adhesion of the metal foil on the reverse side which is possible only when the object is disassembled, the state of preservation of all the plates (depth of the weathered layers, a qualitative and quantitative description of the defects in the material structure, e.g. the cracking of the amber plates), a precise description of the carving on the reverse side of the plates (also without dismantling). Very important information on the spectrum and range of deterioration and on previous restoration treatment was also obtained thanks to UV-VIS-IR imaging and non-destructive ATR FT-IR spectroscopy. For the identification of authenticity, such methods as capillary electrophoresis of water extracts and thermal differential analysis were applied.

Furthermore, investigation on consolidation and filling cavities in amber was also done as well as on adhesives, with special attention to the possibility of applying natural reversible glues, including mixtures of wax with natural resins.

We hope that the results of this project, which will be prepared for publication as a monograph, will be of great help in the conservation of precious objects of amber art.

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**The Preventive conservation of interior architecture features decorated with amber**

**LECTURE**

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It may seem that 30–35 million years’ worth of fossilisation processes has completed all the chemical changes in Baltic amber and made it sufficiently resistant to the influence of the contemporary environment. Unfortunately, this is not the case. Used as a material in decorative art, amber is subjected to mechanical and physicochemical treatment in order to obtain specific effects. As a result of such operations, its unprotected layer becomes very sensitive to various factors including air pollution, increased ozone concentration, variable humidity or UV light. In consequence, not only do amber’s decorative properties deteriorate but it can also suffer complete destruction. That is why, since the dawn of time, amber products have been protected by means of coating or saturating their surface with various substances: shellac, poppy-seed oil, glycerol, paraffin oil, turpentine oil, alcohol vapour, Dammar resin essence or diluted Capon varnish [1]. But these types of safeguards do not guarantee that amber will be fully protected. The protective layer itself will progressively degrade under corrosive factors. Once damaged, it is just as poor a protection as the lack of it would be. In some cases, it may even do more harm. Periodic inspection of the surface of amber artefacts is recommended, as is recurring repair of the protective layer. The problem can be encountered in many museums. When reviewing its amber collection, the Danish National Museum in Copenhagen found damage to almost 25% exhibits out of a 17,000–piece collection [2]. Many research centres work on developing effective methods of preventive conservation.

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³B. Kotwica, Problematyka konserwatorska zabytków z bursztynu, praca magisterska pod kierunkiem dr hab. Jadwiga W. Łukasiewicz, prof. UMK, 2010, typescript

In museum displays, one can create conditions to minimise the environment’s detrimental effect on amber; but if amber is used in architectural features, what we’re dealing with is an open system. It becomes necessary to develop an amber protection method already at the design stage.

The paper presents methods for protecting amber against the harmful influence of the display environment used in the Amber Room at Catherine’s Palace, Tsarskoye Selo, Russia [3–6]. Preventive conservation principles for the externally displayed amber elements of the Amber Altar (at the design stage) have also been presented [7–8].

References

Amber beads from Szelków, Poland, from 2nd/3rd cent. CE and the conservation method used on them

POSTER

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Prehistoric amber artefacts have a significant historical value. Removed to museums, after thousands of years in the ground, they usually require conservator intervention as the dramatic change in the environment is conducive to their degradation process. The surface of archaeological amber artefacts is brittle, cracked and weathered because the material is sensitive to atmospheric oxygen, changes in humidity, UV light and/or temperature. The studies on the conservation of prehistoric amber, available to date, do not exhaust the subject. The research methods tested by the author aimed at choosing the best possible impregnating preparation available today and an optimised method of its application. The findings had a practical application in conserving a set of prehistoric amber beads. They were found during archaeological excavations in 2006, at Site 1 in Szelków Municipality, Maków County, Mazowieckie Region, Poland. It is an area with burial grounds of the Przeworsk and Wielbark cultures. The artefacts originate from the late period of Roman influence and are a product of the Wielbark culture. Their date of origin was established at the 2nd half of the 2nd cent. CE to the mid–3rd cent. CE. They are the property of the National Archaeology Museum in Warsaw, with temporary inventory number PMA/IV/10472.

Archaeological amber artefacts require a special preservation approach. Treatment should be very sparing and reduced to a minimum. In this study, the weathered (oxidised) layer was treated as a valuable artistic and historical tissue, although the literature does contain reports of it being removed. The preliminary work was limited to cleaning the surface with a soft brush. Based on previous experience, the strengthening and preserving treatment was performed with Paraloid B–72 in xylene, by using solutions of increasing
concentration: 1.5%, 3% and optionally 5%. The microscopic observation of the impregnation results, after the 1.5% and 3% solutions had been used, was the basis for a decision to possibly repeat the treatment with the 5% solution of Paraloid B–72. The 5% solutions were used in two ways. One of them was, as previously mentioned, by immersion performed on pieces whose surface was highly oxidised and absorptive. The second way was by spot–specific impregnation used for wider cracks and surface scales, where impregnation by immersion did not yield satisfactory results. If treatment by immersion and lining with 5% solutions did not reinforce the piece enough, spot–specific lining was used for very wide cracks (ca. 0.5–0.8 mm wide) with 10% Paraloid B–72 in xylene. In order to control the process, a “00” brush was used under a microscope for the treatment. In order to avoid the surface shine effect, any excess solution was removed with absorbent paper. When dry, the treated area was wiped with a brush soaked in xylene. This method of lining wide cracks made it possible to avoid a layer being formed on the surface. This treatment was only used for specific areas which did not get reinforced during prior impregnation. SEM photographs taken after the impregnation process have shown that the cracks and crakles were not filled completely, nor was an impenetrable layer formed on the surface. The effect is subtle, while at the same time fulfilling the purpose of consolidation and preservation. After the impregnation, the colours of the amber changed slightly as its internal colour, previously concealed by the matte weathered layer, got highlighted.

In order to bond the beads, pre–impregnated in 1.5% and 3% solutions of Paraloid B–72 in xylene, a 20% solution of Paraloid B–72 in acetone was used, heated up in a water bath to accelerate the solvent’s evaporation.

The proposed method for consolidating amber beads has not been presented in the literature to a large extent, although the application of Paraloid B–72 has been mentioned several times. For example, it was used at the Split and Belgrade Archaeology Museums, but the information is incomplete and we do not know what application method was used (Palavestra 2006). The idea to use Paraloid B–72 was entertained at the British Museum but in spite of good test results they decided to drop–apply 5% Paraloid B–67 (Thickett et al. 1995). Paraloid B–72 was tested at the Thessaloniki Archaeology Museum, Greece, but microcrystalline wax was eventually used (Palavestra 2006).

The combined impregnation method described above (by immersion and with a brush) was evaluated by the author as the best one to reinforce amber beads. The method is practical and safe, without causing damage related to, say, changes in pressure, which may occur in vacuum impregnation. It strengthens the surface of amber thoroughly and evenly. That is why it was used to conserve all the 58 Szelków amber beads. The method can be considered good and suitable for reinforcing fragile and dry amber artefacts found at archaeological excavation sites – a description which covers the majority of museum pieces. However, it requires meticulousness and time. Amber beads are very small items. The largest one treated in the Szelków set was not even 3 cm, with the smallest one a little over 1 cm. The scale of these artefacts requires a laboratory equipped with a microscope or a binocular magnifier with appropriate lighting. The toxicity of the solutions makes it necessary to use a fume cupboard and a mask with appropriate absorbers.

To provide the treated items with the best possible storage conditions, they have been thoroughly protected in special boxes and inside airtight bags secured with a 1 cm weld. The bags were equipped with oxygen absorbers and instruments indicating the need to replace them, selected on the basis of tests run by the National Museum in Denmark (Shashoua 2002). The absorbers contain labile substances which last up to 6 months, which is why they need replacing.

By storing the items properly, from the moment they are unearthed, we can minimise the risk of damage resulting from oxidation and environmental change, as well as reduce the conservator’s intervention.

References
Shashoua Y. 2002. Degradation and inhibitive conservation of Baltic amber in museum collections
PRIVATE COLLECTIONS

Baltic amber in Gabriela Gierłowska’s Collection - a presentation
POSTER

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Introduction
The collection was accumulated for the purposes of commodity science, research and exhibition. It is related to my work as an amber identification expert; it helps and makes it easier for me to judge the quality of the material and to determine the technological process used on it.

It is a collection of Baltic amber – succinite – ranging from the raw material in all its typical forms, through semi–finished products, with examples of crafting methods and techniques, to products available on the market in various periods and works of art.

Pressed amber is an important part of the collection. It provides an overview of amber pressing methods from the 2nd half of the 20th century until today from Poland, Russia, Lithuania and Germany.

The collection also includes tools and machines used to craft amber and selected jewellery–making and testing equipment.

One of the collection’s curiosities is a wooden workshop for the cutting, rolling, polishing and drilling of amber, modelled after 19th century amber workshops from Poland’s Kurpie and Kashubia regions.

The collection has over 10,000 items and is currently being inventoried and described.

All the items have been examined by amber identification experts. Selected pieces have been examined by academics – amber researchers, others helped to further knowledge about amber, others still illustrate books by authors who have written about amber.

W skład zbiorów wchodzą następujące kolekcje:

1. Raw amber 1,200
2. Natural forms 800
3. Coloured varieties 1,500
4. Amber inclusions 2,900
5. Semi-finished amber products 3,200
6. Semi-finished and finished products made of pressed amber 215
7. Amber artefacts from Gabriela Gierłowska’s workshop 198
8. Works from the studio of Gabriela and Wiesław Gierłowski 10
9. Antique artefacts 4
10. Argentan pieces from the 1970s 8
11. Original art 75
12. Sculpture and sculptural compositions 48
13. 1980s Jewellery 10
14. Contemporary jewellery 17
15. Technical equipment 25
The amber (succinite) departments listed above came about and developed over many years of my work with amber.

With over 200 items to date, the Collection of Semi–finished and Finished Products made of Pressed Amber is largely the result of the interest in this material and the technologies used to make it on the part of my husband, Wiesław Gierłowski, and my desire to present ever–better and more diverse examples of pressed amber used in products at Amberif and Ambermart’s Amber Laboratory exhibition stand. Through comparison, the collection makes it possible to determine the place and time of origin of pressed amber products. It provides insight into the differences in the quality of the pressing processes in individual workshops and countries at a given time.

The items from the Original Art Collection and the Sculpture and Sculptural Compositions Collection came and remained as souvenirs: of events, travels, some of them were custom made, others purchased at artists’ exhibitions.

The instruments in the Technical Equipment Collection make the necessary comparative studies possible.

The Raw Amber Collection contains raw Baltic amber mostly from beaches and hydraulic mines located in the Vistula River Delta. The collection includes boards which illustrate the commercial classification of raw amber according to, among other things, its internal structure and impurities.

There are also raw amber (succinite) specimens from deposits in Sambia and Ukraine and from post–glacial accumulations, including large nuggets weighing over 300 g.

The Natural Forms Collection has specimens of all forms of amber known to science. These are: amber drops, stalactites, dripstone and in–bark forms, forms with natural holes and others.

The Coloured Varieties Collection contains cut and polished nuggets of various shapes and sizes, which illustrate the many colours of amber, its diversity and unique beauty. At the turn of the 1980s and 1990s, it became the basis for the Amber Pictures: boards with amber nuggets of various colours presented at the Museum of the Earth’s Amber, the Treasure of the Ancient Seas exhibition series developed by Prof. Barbara Kosmowska–Ceranowicz, which toured several Polish cities and also went abroad.

My habit of carefully examining amber nuggets at pre–selection made it possible for me to notice and reveal a lizard in one of them in 1997. The lizard became Specimen Number One (GG1), the beginning of the organic Inclusions Collection of plant and animal inclusions in amber with about 2,900 items to date. Meanwhile, the lizard specimen has become an important exhibit at the Amber Museum in Gdańsk. I took an interest in inclusions seen under a stereo microscope and became fascinated by them, I collected and photographed them. A Look into a Collection of Inclusions (Spojrzenie na zbiory inkluzji) is in part four of my book on Amber Collections of Old and the Gdańsk Lizard (O dawnych kolekcjach bursztynu i gdańskiej jaszczurce) (2005).

The Semi–finished Amber Products come from my own studio. The collection documents and illustrates manual and mechanical amber crafting methods: polishing, cutting, turning, drilling, improving, bonding, various methods and techniques used at different stages of the technological process and at various phases of progress.

Semi–finished and Finished Products made of Pressed Amber, in turn, give an overview of various amber pressing methods, with different technologies from Poland, Russia, Lithuania and Germany used from the second half of the 20th century until the present day. The collection has examples of all the important, market–significant amber pressing methods based on both patented and workshop technologies: pressing amber dust, small nuggets, larger multi–coloured nuggets with the addition of young amber at a comparatively low temperature (ca. 140° C) and a pressure of up to 1000 kg/cm – to form a product known as “spotted amber.” There is also pressed amber which is subsequently modified and sparkled, amber which is formed from a single irregular nugget into a particular shape, known as shaped amber, and other examples. The collection has both the (pressed) source material and various finished stones. It also contains numerous finished products: necklaces, brooches, earrings, rings, bracelets, Muslim prayer beads, figurines and sculptures.
The Amber Artefacts Collection includes pieces based on the most ancient traditions: pendants, brooches, bracelets, buttons of various diameter – irregular flat disc which are only partially cut, with an archaic appearance to highlight the amber’s natural colours and texture, and necklaces made of natural amber of varying degrees of transparency with rich array of colours and various bead shapes. Their beauty is the result of meticulous, precise finishing of the surface, nuggets selected by colour, their shape and multi-faceted cutting which brings out amber’s characteristic light effects.

The collection’s necklaces are expedient in showing the diversity of amber on a single string. There is a necklace made of “figure–eight” beads, modelled after an archaeological artefact found in the vicinity of Pruszcz Gdański, as a reference to the most ancient traditions.

Examples of folk tradition include an amber “kierec” modelled after a traditional ornament hung from the ceiling in a peasant’s cottage at the Museum in Tomża. The collection has one of the three such ornaments that were made; of the other two, one is displayed at the Amber Museum in Gdańsk, the other belongs to an amber expert from Germany.

Artefacts modelled after Kashubian folk art, such as: brooches, a cross, two rosaries, two sliced–amber bead necklaces and three natural amber necklaces, where the relatively flat beads were polygonally cut on the edges in order to obtain intriguing light effects – all play an important role in this collection.

As a memento of the 1993 Exhibition of Amber from the Danish Royal Collection at the Royal Palace in Warsaw, a lens was added to the collection, made of naturally translucent amber with its handle shaped like a putto’s hand with the thumb placed between the index and middle fingers, modelled after the 17th century lenses shown at that exhibition.

The collection also includes traditional pieces and gemstones made of amber improved in the thermal process with access to oxygen, without the use of an autoclave. All the amber artefacts were made in Gabriela Gierłowska’s studio towards the end of the 20th century. Selected pieces are displayed at all the Polish museums with amber collections: the PAS Museum of the Earth in Warsaw, the Castle Museum in Malbork, the Amber Museum in Gdańsk, the Archaeology Museum in Gdańsk and in other European museums.

The joint Studio Collection of Gabriela and Wiesław Gierłowski is based on items made in the 1980s and early 1990s and includes a copy of a pendant modelled after a medallion of Duke John Frederic of the Piast Dynasty, buckles, badges, a cup with an amber knop, amber magnifying glasses set in silver on chains, brooches, pendents and other items. There is also a silver coffer made by W. Gierłowski in the early 1980s; its lid was decorated with amber at Lucjan Myrta’s studio in 2011.

Antique Artefacts – a collection of amber products from the Staatliche Bernstein–Manufaktur, Königsberg. These are: an incomplete 1930s brooch and two post–World War II brooches imitating the Manufaktur’s production. There is a pre–1945 amber butterfly – the central fragment of a bracelet, with the recurring components of the bracelet made after the Second World War.

My small Collection with 8 amber–decorated pieces made of Argentan (also known as German or MZN 18 nickel silver, an alloy of copper, zinc and nickel with the addition of manganese) comes from the 1970s, which was a period of economic hardship in Poland. All of them bear a MET hallmark. Argentan had been supplied to its jewellery suppliers by the Art–Region Handicraft Co–operative in Sopot since 1966. These items are intriguing in terms of design: there is a bracelet by chemical engineer Janusz Fietkiewicz, another bracelet by art historian Wiesław Gierłowski, two pendants with chains made with great technical precision by a talented and professionally meticulous mechanical engineer Leszek Galecki. An amber–decorated pendant with a designer chain, a cufflink and two small rings from the period were made by an artist unknown to me. All these products were marketed by Art–Region.

The Original Art Collection developed over a longer period of time and was inspired by personal contacts with amber artists from Gdańsk, St Petersburg and Kaliningrad which allowed me to accumulate over sixty, mostly signed works of art. These are pieces by Maria and Paweł Fietkiewicz, Wojciech Jakubowski, Alexander Zhuravlev, Sviatoslav Ivanov and Ernest Lis. M. and P. Fietkiewicz are a unique artist couple, who had an individual exhibition to commemorate the fortieth anniversary of their work in 2009 at the Amber
Museum in Gdańsk. In their work, amber takes centre stage and its silver or gold setting is a deliberate complement. In my collection, their work is represented by clasps, brooches, buckles, rings and pins.

My collection contains 14 jewellery pieces by graphic artist W. Jakubowski, who has almost a thousand bookplates to his name and was the initiator and organiser of the bookplate biennial at Malbork Castle. These are: a necklace, pendant, four brooches, five rings and three pairs of earrings. The intricate setting of the amber in his brooches, rings and earrings is a kind of contemporary filigree, where amber or other natural gemstones are complemented with a fine twisted silver wire which is additionally enhanced with little balls of silver to form the definitive piece.

The work of A. Zhuravlev was distinguished by his mastery of modern amber–crafting techniques. My collection includes his Classicist two–layered amber cameo, set in a gold brooch by my husband Wiesław, a shell–on–amber cameo, amber gemstones sculptured intaglio with depictions of angels and women’s heads, square intaglio plates modelled after a great Gdańsk chessboard from the 17th century (currently on display at the Archaeology Museum and used as the lids to silver coffers) and a spoon. Furthermore, I have female heads painted by him on amber in collaboration with young painter Oleg Korshikov.

A sculpture of a dragon and an intaglio view of the Tyszkiewicz family palace in Palanga sculpted in transparent amber is the contribution from S. Ivanov, a sculptor who worked on the reconstruction of the decor of the Amber Room in the Palace of Catherine I in Tsarskoye Selo, Russia. The collection also has a cameo with the zodiac sign of Aries made in white amber by E. Lis, a very special, kind and trustworthy man, a graduate of the Mukhina Sculpture Academy and a long–standing (over 50 years) artistic director of the Kaliningrad Amber Factory. The cameo was set using the multiple bezel technique by P. Fietkiewicz.

Among its important non–jewellery items decorated with amber, the collection has three works by Russian artist L. Gradinarova, who is unfortunately no longer with us today: a brooch, a bracelet and an eyeglasses case. The items are made of leather and amber.

The collection also includes the artwork – a pendant and brooch – by Jerzy Głowacki, whose extensive knowledge about jewellery–making allows him to make masterly use of old jewellery–crafting techniques. The pendants by Viktor Parkhomenko of Kaliningrad are yet another paragon of beautiful form and precision.

The work of Andrey Kavetsky of Kaliningrad makes up part of the Sculpture and Sculptural Compositions Collection. His sculptures are made in natural amber from the Sambia deposit and represent all known varieties of amber. Most of his work in my collection is signed. The artist has won many awards in many amber competitions, knows the structure of amber well and uses it in a masterly way. He has an interesting way of using amber inclusions, where he builds on them to develop the shape of his pieces and their content permeated with a sense of humour and conical associations with real life situations. The 31 pieces by this artist in my collection represent all known varieties of natural amber, while four more are made of amber improved in an autoclave – owls, a bull, a cat and a saddened angel. Furthermore, the collection has seven insect figurines from the artist’s “amber orchestra.” A. Kavetsky’s work is light by nature, also in the literal sense: the lightest is The Kid weighing 2 grams, the heaviest is a figurine of a bull which weighs in at 95 grams and is a symbol of the Bursztynowa Hossa Publishing House.

The collection has a figurine of a Fox sculpted by Sergey Shmiruk of Rivne, Ukraine, in a single nugget of succinite from the Klesiv deposit (together with its pedestal it weighs 168 grams).

Small figurines of natural amber: an elephant, two hares, two ducks, a kitten and two others made of thermally improved amber: a squirrel and a kitten, come from the studio of Barbara Danuta Giergielewicz of Junoszyno, Poland. (7 small sculptures are currently undergoing identification).

The 1980s Jewellery Collection consists mainly of the work of Leszek Galecki, made with incredible technical precision, Anna Surajewska, who made her jewellery using a technique she herself developed, and Mariusz Gliwiński, whose work from this period has an interesting way of highlighting amber in the piece.

The Contemporary Jewellery Collection covers items decorated with both natural and improved amber by artists including Marek Gutowski, who uses fine amber grains in myriad ways by combining them
with silver; and there are necklaces decorated with gilded silver from the studio of Leszek Krause. There are also many jewellery pieces from the Amber Factory in Kaliningrad: brooches, clasps, bracelets, necklaces, a powder compact, flasks, bottles and other items.

The Technical Equipment Collection consists of late 20th century tools and machines used to work amber. It includes two–speed grinders with dust removal, grinders with water–sprinkled wheels, grinder/polisher machines, a circular saw with milling cutters and diamond wheels, a dry amber mill, a wet amber mill, cylinders for grinding and polishing, amber drills, a regulated drill and an amber–roasting stove.

Furthermore, there is a jeweller’s bench, a set of burners, an electric stove for melting, a set of draw plates, electronic, laboratory and bench scales

A set of assay needles.

A stereo microscope and fibre–optic illuminator.

Part of the collection has been examined by Prof. Barbara Kosmowska–Ceranowicz (Polish Academy of Sciences Museum of the Earth, Warsaw), who was the Polish representative in the International Mineralogical Association’s Working Group on Organic Minerals (WGOM)(the group has since been discontinued). Individual items were examined by Dr. Ewa Wagner–Wysiecka (Gdańsk University of Technology, Chemical Faculty). Some exhibits served Dr. Aniela Matuszewska (University of Silesia in Katowice, Department of Geochemistry, Mineralogy and Petrography, Faculty of Earth Sciences), an astute researcher and amber enthusiast, in detailed amber research which resulted in new and intriguing information which enriched our knowledge about amber. Several items were examined with a Spectro–Lab ATR–IRS spectrometer by Dr. Dariusz Wysiecki eng.

For over a decade now and in various configurations, the Collection has been made available to the public at the international Amberif and Ambermart trade fairs and also at exhibitions, so it is constantly subject to expert valuation and assessment by amber jewellers, researchers, and amber experts from Poland and abroad.

The collection showcases the beauty of natural amber, the effects of its modification, the results of various methods used to obtain pressed amber and the items made from this material. It informs and it teaches, for example, how to correctly label marketed amber products in line with the findings and standards of the International Amber Association. Oftentimes, my collection makes the more and more surprised gallery owners aware how diverse amber can be and what hazards this diversity entails.

The items from the Collection’s departments serve to promote natural Baltic amber, while their photographs illustrate articles and books by many authors writing about amber. This includes brochures by myself such as The Beauty of Amber, Amber In Therapeutics and others.

The collection is still growing in terms of both volume and completeness.

The collection of literature

Gierłowska G. 2002: Bursztyn w lecznictwie/Amber In Therapeutics/Bernstein In Der Heilkunde. Bursztynowa Hossa Gdańsk


The Hoffeins Inclusion Collection

LECTURE

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The private amber and inclusion collection of C. & H. W. Hoffeins in Hamburg, Germany was established in the beginning of 1980. Like many other amber enthusiasts, in the first years of collecting we touched almost each field of the rich amber facets.

Baltic amber was picked up along the seaside of the North and Baltic Sea and in the Bitterfeld coal mine. After a period of severe amber hunting and when the first organic objects were discovered, our interest turned to the fascinating world of inclusions.

Since that very moment we got infected by the „Amber fever“ or so-called „Paranoia succinosa“.

The amber collection maintains 6 parts, all not catalogued except inclusions:

- objects of art, amber from worldwide deposits, accessory resins, natural forms, colour varieties.

Inclusion collection

The inclusion collection is maintaining plant and animal inclusions in Baltic and Bitterfeld amber including few samples of Dominican, Ukrainian, Canadian, Spanish and Lebanon amber. The inclusions are organized in cases with 36 plastic boxes numbered consecutively. Registering still is in progress, ordinary inclusions are kept in numbered bags sorted to family only, awaiting maintenance in the future.

For scientific studies the amber pieces with inclusions were prepared manually and embedded in polyester resin (Hoffeins 2001). For a protective purpose against weathering larger amber pieces are covered with varnish. About 80% of noted inclusions are embedded in artificial resin. The data are registered in field books and Excel. Filing in the database PALEOTAX/PALCOL will be a project for the next years.

The main part of the collection was picked—up by our own hands. This material formed the basis for a statistical research on the frequency of inclusions in unselected Baltic and Bitterfeld amber (Hoffeins & Hoffeins 2003).
Actually the Hoffeins collection (code: CCHH) is housing nearby 200 types, with further material under study. The insect collection will be deposited end of 2014 at the Senckenberg Deutsches Entomologisches Institut in Müncheberg (SDEI) as part of the institute's amber collection. Plant inclusions, Arachnida, Myriapoda, Gastropoda, Isopoda and Vertebrata are under negotiation for deposition in a public museum.

The collection with plant inclusions including fungi comprises about 1,530 pieces with leaves of conifers as pines, cypresses and deciduous trees, flowers and buds, isolated stamen, pollen and seeds, fragments of twigs, wood, bark, plant fibres, liverworts and mosses, ferns, fungi and hyphen, bacteria and un-identified objects. Outstanding samples are 3 unique pieces of wood impregnated and covered with resin, first records of orchid seeds (in prep) and the type of a sporing fungi Aspergillum collembolorum DÖRFELT & SCHMIDT, 2005. Plant inclusions partly are under study at the Courant Research Centre „Geobiology”, university Göttingen.

The collection with animal inclusions comprises more than 13,700 pieces mainly with arthropods such as insects, spiders and mites, millipeds and woodlice. Vertebrates are represented by fragments of lizards, birdfeathers and mammal hairs, Mollusca by snails and Vermes by Nematoda and annelid like organisms. Insect inclusions are documented with 90% of all animal inclusions. Arachnid inclusions comprise inclusions of webspiders (Araneae), harvestmen (Opilionida), false scorpions (Pseudoscorpionida) and mites (Acari). The arachnid collection mainly is focused on Acari, representing 52% of all arachnid inclusions. Mites are said to be „omnipresent“ in amber and are embedded as syninclusions in almost each second sample, therefore the exact number of mites in the collection is higher. The collection comprises one of the largest assemblages of multiple rare Acari inclusions along with common taxa and is comparative in volume and composition to the renowned museum collections of the world (E. Sidorchuk, unpubl.).

Outstanding samples are a fragment of lizard with bones (under study) and the type of Propupa hoffeinsorum STWORZEWICZ & POKRYSZKO, 2006 (Gastropoda).

Table 1. Composition of plant and animal inclusions

<table>
<thead>
<tr>
<th>Plant inclusions</th>
<th>Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leafs, needles</td>
<td>130</td>
</tr>
<tr>
<td>Flowers, fruits, stamen</td>
<td>90</td>
</tr>
<tr>
<td>Pollen</td>
<td>260</td>
</tr>
<tr>
<td>Seeds</td>
<td>23</td>
</tr>
<tr>
<td>Wood, plant fragments</td>
<td>538</td>
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<tr>
<td>Cupressaceae</td>
<td>57</td>
</tr>
<tr>
<td>Hepaticeae</td>
<td>45</td>
</tr>
<tr>
<td>Bryopsida</td>
<td>54</td>
</tr>
<tr>
<td>Lichen, Pteridophyta</td>
<td>90</td>
</tr>
<tr>
<td>Fungi, Hyphen, bacteria</td>
<td>243</td>
</tr>
<tr>
<td>total</td>
<td>1530</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Animal inclusions</th>
<th>Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arachnida</td>
<td>1207</td>
</tr>
<tr>
<td>Insecta</td>
<td>12558</td>
</tr>
<tr>
<td>Myriapoda</td>
<td>37</td>
</tr>
<tr>
<td>Crustacea</td>
<td>14</td>
</tr>
<tr>
<td>Gastropoda</td>
<td>6</td>
</tr>
<tr>
<td>Vertebrata</td>
<td>40</td>
</tr>
<tr>
<td>Vermes</td>
<td>13</td>
</tr>
<tr>
<td>total</td>
<td>13875</td>
</tr>
</tbody>
</table>

The insect collection comprises more than 12,500 pieces mainly with flies and midges (Diptera), beetles (Coleoptera), wasps (Hymenoptera), plant sucking insects (Hemiptera) and springtails (Collembola).

The composition of the Hoffeins Collection in general also reflects the composition of arthropod inclusions in Baltic and Bitterfeld amber.

The Diptera collection is comprising more than 6,300 amber pieces including 85 types (Febr. 2013).
Table 2. Composition of insect inclusions

<table>
<thead>
<tr>
<th>Insect inclusions</th>
<th>Items</th>
<th>Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diptera</td>
<td>6315</td>
<td>85</td>
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<tr>
<td>Coleoptera</td>
<td>855</td>
<td>25</td>
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<tr>
<td>Hymenoptera</td>
<td>721</td>
<td>10</td>
</tr>
<tr>
<td>Hemiptera</td>
<td>663</td>
<td>13</td>
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<tr>
<td>Collembola</td>
<td>253</td>
<td></td>
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<tr>
<td>Trichoptera</td>
<td>157</td>
<td></td>
</tr>
<tr>
<td>Microlepidoptera</td>
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<tr>
<td>Psocoptera</td>
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<td></td>
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<tr>
<td>Thysanoptera</td>
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<tr>
<td>others</td>
<td>3241</td>
<td>7</td>
</tr>
<tr>
<td><strong>total</strong></td>
<td><strong>12558</strong></td>
<td><strong>175</strong></td>
</tr>
</tbody>
</table>

Table 3. Composition of Diptera inclusions

<table>
<thead>
<tr>
<th>Nematocera</th>
<th>Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chironomidae</td>
<td>1464</td>
</tr>
<tr>
<td>Sciariidae</td>
<td>867</td>
</tr>
<tr>
<td>Ceratopogonidae</td>
<td>286</td>
</tr>
<tr>
<td>Mycetophilidae s. l.</td>
<td>786</td>
</tr>
<tr>
<td>Simuliidae</td>
<td>165</td>
</tr>
<tr>
<td>Cecidomyiiidae</td>
<td>133</td>
</tr>
<tr>
<td>Psychodidae</td>
<td>131</td>
</tr>
<tr>
<td>Limoniidae, Tipulida</td>
<td>135</td>
</tr>
<tr>
<td>Scatopsidae</td>
<td>64</td>
</tr>
<tr>
<td>Bibionidae, Hesperinidae</td>
<td>28</td>
</tr>
<tr>
<td>Dixidae, Chaoboridae</td>
<td>22</td>
</tr>
<tr>
<td>Anisopodidae</td>
<td>22</td>
</tr>
<tr>
<td>Culicidae, Corethrellidae</td>
<td>8</td>
</tr>
<tr>
<td>Tanyderidae</td>
<td>5</td>
</tr>
<tr>
<td>Trichoceridae</td>
<td>4</td>
</tr>
<tr>
<td>Nymphomyiidae</td>
<td>3</td>
</tr>
<tr>
<td><strong>total</strong></td>
<td><strong>4123</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Brachycera</th>
<th>Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dolichopodidae</td>
<td>720</td>
</tr>
<tr>
<td>Empididae</td>
<td>207</td>
</tr>
<tr>
<td>Phoridae</td>
<td>186</td>
</tr>
<tr>
<td>Hybotidae</td>
<td>126</td>
</tr>
<tr>
<td>Syrphidae</td>
<td>75</td>
</tr>
<tr>
<td>Rhagionidae, Athericida</td>
<td>65</td>
</tr>
<tr>
<td>Bombyliidae, Mythicomyiida</td>
<td>26</td>
</tr>
<tr>
<td>Therevidae, Apsilocephalida</td>
<td>21</td>
</tr>
<tr>
<td>Asilidae, Scenopinidae</td>
<td>18</td>
</tr>
<tr>
<td>Tabanidae</td>
<td>10</td>
</tr>
<tr>
<td>Pipunculidae</td>
<td>10</td>
</tr>
<tr>
<td>Platypetidae, Opetiida</td>
<td>5</td>
</tr>
<tr>
<td>Stratiomyiidae</td>
<td>4</td>
</tr>
<tr>
<td>Acalypratae</td>
<td>718</td>
</tr>
<tr>
<td>Calyptratae</td>
<td>1</td>
</tr>
<tr>
<td><strong>total</strong></td>
<td><strong>2192</strong></td>
</tr>
</tbody>
</table>

Despite the large number of midges in the collection, the main effort is focused on fungus gnats (Mycetophilidae, Keroplaptidae), dung midges (Scatopsidae), black flies (Simuliidae) and Limoniidae within the Nematocera and on long–legged flies (Dolichopodidae), dancing flies (Empididae, Hybotidae) and hump–backed flies (Phoridae).

But the most important part within Diptera inclusions is the assemblage of Acalypratae, representing the largest one worldwide with unique and outstanding specimens. The collection actually maintains more than 700 specimens in 34 families including numerous new and undescribed records on species, genus and family level (Tschirnhaus & Hoffeins 2009).
Fig. 1. Amber Fly *Lacrimyza lacrimosa* ROHACEK, 2012 (Diptera: Anthomyzidae), holotype; coll #829-4; size 2,2 mm. The species name is derived from the Latin word “lacrima” = tear because amber has been called “tears of the gods” by the ancient Greeks.

Outstanding samples are the types of Nymphomyiidae, *Nymphomyia succina* WAGNER, HOFFEINS & HOFFEINS, 2000 (Hoffeins 1995), an archaic family of midges firstly discovered and reported as fossils from the Hoffeins collection and the type of the unique record of a calyptrate fly of the family Anthomyiidae, *Protanthomyia minuta* MICHELS, 2000.

The Historical Oehlke Collection

A recently purchased collection from the hymenopterist Dr. Joachim Oehlke in Eberswalde, Germany is maintaining 200 samples of historical value with insect and plant inclusions. The amber pieces mostly are of reddish colour, partly of rectangular shape or glued on glass slides with handwritten labels. The main part of the collection was purchased by Dr. Oehlke from an elder German scientist and probably was established already before WW I. Registration is under progress.

References


Von Tschirnhaus M. & Hoffeins C. 2009. Fossil flies in Baltic amber - insights in the diversity of Tertiary Acalyptratae (Diptera, Schizophora), with new morphological characters and a key based on 1,000 collected inclusions. - Denisia 26: 171-212.

AMBER IN ART

Medici amber collection owned by Maria Maddalena of Austria (1589-1631) in the Pallazzo Pitti in Florence. State of the art objects and research perspectives

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The Italian amber collections are so far the least recognized ones in the literature concerning handicrafts of modern times. This article is aimed at pointing the problem out and specifying research postulates by analyzing the title collection as well as initial recognizing of the collection state. This subject shall be shown on the background of chosen issues, considering the present state of knowledge about modern amber craft.

At present, the collection of amber owned by Maria Maddalena of Austria, the wife of Cosimo II de Medici, is only a small part of large Medici art collection. It has been included in the current department of the craft works, however formerly it was housed in the Chapel of Relics, built at the times of the duchess, in the northern wing of the palace, in the part called ‘Quartiere del Volterrano’¹. From the year 1600 there was a private duchess’s sanctuary, where the rapidly growing collection of devotional and votive objects, collected by this devout duchess was kept. Therefore, the collection of amber objects became the integral part of the chapel’s furnishing which was aimed at religious services and where various items related to the modern form of worship were collected. It explains the confessional nature of these objects. We have information of the furnishing from the inventory dating back to 1616 that can be found in Archivio di Stato in Florence (ASF, GM 348). There is information of amber objects in the inventory, however any specified description of them cannot be found. Unfortunately, the issues connected with the origin as well as the relation of the persons ordering them are still to be researched. In this inventory you cannot find the answer for the question if the votives and its outer form were consulted with the middlemen within the scope of their form and content. If the programmes of home altars and reliquaries were subject to negotiations between the craftsmen and future owners of the object or their forms resulted from the standardization of this objects for private worship. These questions cannot be answered unambiguously. While the part of the mentioned inventory has already identified and compared to the existing object, the knowledge opens new challenges, which are to be determined thereinafter.

The researches are additionally hindered by the fact that all amber objects are included in one collection. Nowadays, it is presented in three baroque glass cabinet and one modern display showcase what causes the minimal lighting of the objects and making close overview of some objects impossible. They are stored in one, small room. One should also mention the institution what stores the collection as well as the way of its location in relation to other objects. The current presentation of the craft collection in the exhibition is set according to the type of material of which the objects are made. It means that the most of exhibits have been set anywhere in accordance with the principle of modern museum exhibition rules rather than their historical place of storing. Despite this fact, the amber objects stand out from the other objects in many ways. In fact the artistic objects of amber art in Palazzo Pitti constitute one of the most significant collections in Europe². This collection includes not only the objects owned by Maria Maddalena of Austria but also the pieces of art which arrived to Florence at various times, and their primary context as well as the

circumstances of acquiring them have not been recognized yet. The state applies also to the Medici collection described herein, and due to this collection many ancient works made of this material have been preserved. The remarks of deficiencies in researches refers not only to the older elaborations but also to the last one, extremely fragmentary but also very important presentation of craft collection placed in the publication of Marilena Mosco and Ornella Casazza³. The mentioned monograph was conceived as the first so broad presentation of handicraft works. The scope of this approach includes the whole collection of Medici. The elaboration has many values, the one is that the authors are trying to connect the amber objects with altering artistic taste and various personality of the subsequent collectors of the family. Marilena Mosco the curator of Museo degli Argenti in the Palazzo Pitti as well as the organizer of many exhibitions, wrote the separate chapter concerning the amber, taking the collections of Maria Maddalena of Austria into consideration⁴. One can learn from the article information about the origin of some objects as well as of the unique role played by the duchess in creating the collection. All objects, described in the elaboration, are stored in the one of the palace wings, neighbouring with seven other museums housed in this palace. As you know, the former palace of the Pitti family, owned once by the Medici family, is nowadays the museum which part of its left wing houses Museo degli Argenti. This is the museum where amber objects are finally kept. The name of this museum is misleading as next to the impressive collection of silverware, there are huge collections of other handicrafts. A careful observer would be astonished that the museum which houses the largest number of handicraft objects in Italy has not published the full catalogue of amber jewels. The publication mentioned above publishes only 14 objects made of Baltic gold. As a result, not only the position of individual objects among the ones gathered in the collection remains unrecognized, but also their number, what seem to be the basic issue when you try to describe the entire collection. The estimation cannot be changed by the precious catalogue notes made within former exhibition initiatives of Florentine museum⁵. Meanwhile, the initial study visit showed that the exposition alone contains 44 objects, from which more than half had not been mentioned in the subject literature⁶. The poor knowledge of the rest of the objects is also caused by the fact, that some of the objects, due to their state, are excluded from the exposition from time to time.

Fig. A. Late baroque glass cabinet located in chambers of Palazzo Pitti which presents part of the most valuable Medici amber art collection. Museo degli Argenti, Florence.
B. One modern display showcase with another few pieces of the Palazzo Pitti amber art collection. Museo degli Argenti, Florence

⁴ M. Mosco, Maria Maddalena of Austria. Amber, Ibidem, p. 96-107.
⁶ The study visit mentioned above took place within the period 6th - 11th April 2011.
As far as the above mentioned catalogue is concerned, the most important issue in the article written by Marilena Mosco is the reference of existing objects to the unpublished inventory of 1616. It is the first document of these times which allows to connect the objects existing nowadays to the life and interest of the duchess Maria Maddalena. You can draw a conclusion that in the existing Florentine collection there are at least six objects of the style presented by George Schreiger from Königsberg, well known master artisan working with amber objects. Four of them can be considered as certainties as they are listed in the inventory (Inv. Bg 1917, no 75, no 18, no 74, no 31), but Mosco does not give information concerning the origin of the other two ones. One of these objects is attributed to Schreiber’s workshop tankard (Inv. Bg. 1917, no 73). The second one is signed by this master by his name and date – 1619 – the altar (Inv. Bg 1917 no 31). The date proves that the object could be found in the collection at least three years later than the inventory had been made. Presumably, it became the part of the collection during the life of the duchess and on her initiative. This would give a total number of six objects which in the first quarter of 17th century could be found, among the other objects of worship in Capella delle Reliquie. The identifications are listed due to the inventory, basing on the general description which should be compared with the correspondence between the owner and her Habsburg family, especially the exchange of letter with the court of Vienna. Apart from the valuable determines of Marilena Mosco who quotes the researches of Davide Grassi, which are unknown to me, many doubts causes her comments as well as some explanation of the interpretative character. All refers to very complex problem of amber handicrafts in the territory of both part of former Prussia. Unfortunately, there are some incorrect statements, even errors which should be corrected. As the example would be used the opinion that the erotic character of one of the objects (the jewelry box Inv. Bg 1917, no. 42) proves that it originated from Königsberg, what due to the author, resulted from the specificity of the city of Königsberg “which was more inclined than the Catholic (sic!) city of Danzig to select scenes inspired from mythology”. Danzig of modern times could not be considered as a catholic city in any cases. The similarly false key of interpretation seems to be the suggestion that Maria Maddalena of Austria, the wife of the Duke of Tuscany, Cosimo II Medici, collected the religious amber objects (especially crucifixes and reliquaries) because she was a bigot, whereas her eldest son – the Grand Duke Ferdinand – who was, as the opposite of his mother, the open minded person, preferred the secular amber objects. The serious deficiency of the elaboration is that the author did not indicate any other reasons, e.g. the importance of amber as the material in modern times, why the amber was demanded material for making luxury devotional objects. Although Mosco quotes also the later inventories of 17th and 18th century, which confirm continuous deliveries of amber for the Medici collection, does not connected it with the wider phenomenon of modern interest in the articles made of this material. It is partly justified by the form of the publication which is located – as Antonio Paolucci states in the introduction – between the catalogue and guide book. However it seems that the Author goes too far in simplifying the presentation if the origin of the collecting interests of the duchess.

In this perspective it is clear that a more comprehensive assessment of this collection will be possible after carrying out more deepened preliminary researches. This is what I want to focus on within my further considerations. One should pay special attention to the necessity of the lost objects or objects which are outside the exhibition showed in the Palazzo Pitti. Are there any other, unknown objects in storehouses which can be connected with the Habsburg duchess? Regardless these speculations, which so far remain unanswered questions, one should note that the one on the main needs of today’s researches is to clarify the mechanism of transferring the amber objects to the territory of Italy. Therefore, the decisive issue for the research of provenance would be the determination of orderers and checking the alleged Danzing or Königsberg origin of the objects exhibited in the Palazzo Pitti. Reaching the information of the orders and purchases would be possible only by viewing the other inventories and letters, kept in the large Medici archive. Other, wider scope of issues to be researched would be the matter of determining the place and

7 D. Grassi, Entry for Ogetti d’Arte (amber), Museo degli Argenti Archives, 2000
8 “It is certain that the objects such as this one must have been appreciated by an open and extroverted person such as the „Gran Principe” rather than the devout Maria Maddalena of Austria, whose role, in any case, must be acknowledged in allowing amber, a new and fascinating material, to be introduced into and appreciated by the Medici court”. Quotation comes from Marilena Mosco, op. cit., p. 106.
9 An interesting initiative has been taken by an international team of researchers gathered around the Medici Archive Project which within the scope of the activity of a small research institute, systematically provides archival documents concerning the Medici family. See: www.medici.org
significance of Italy as the one of markets. Certainly, the Italian Catholic elites created the demand for representative sacral objects (little altars, votive figures of saints, amber caskets with the presentations of Bible figures, apostles, saints, etc.), which participation among the secular object should be considered. Surely, the taste and needs of the recipients on the Italian market dictated somehow both the subject and iconography of these pieces of handicraft. Therefore there is a question how – in the sense of subject and iconography – these amber objects of the Medici collection stand out from the others. Is enough to explain the issue by frequent use of some religious motives in the preserved objects which were rejected by protestant countries? Maybe the subsequent researches confirm or falsify the thesis concerning the importance of this market in the process of creating iconography of amber objects made in protestant Danzig or Königsberg.

I am aware that this article does not cover the whole issue of the amber objects included by the collection of Maria Maddalena of Austria, not mentioning other collections stored on the large territory of Italy. I also think that so broad research cannot be carried out by a single researcher and demand large, international team which would like to deal with the problem. However, this article is to be only the basis justifying the need of exploring the unknown range of transferring the Baltic gold towards Italian territories.

Translated from Polish by Iwona Kienzler

Contemporary Reference to amber art and craft of the turn of the 17th and 18th cent.

LECTURE

WIESŁAW GIERŁOWSKI

Gdańsk, Poland:

At the turn of the 17th and 18th century Baltic amber was gathered from Baltic beaches and fished out from the sea. The raw amber from the sea was usually very fine, while larger nuggets would crack during their journey to the seashore. For this reason large pieces were relatively far more rare and expensive than in the 20th century. This, in turn, is why early modern amber works of art had such a high status.

The abundance of amber mined in the 2nd half of the 20th century, especially in the 1990s, made it commonplace. Massive amber works made today do not evoke the same interest and awe as they did three hundred years ago.

I. The role of large-scale amber artefacts from the turn of the 17th and 18th cent.

In the late 17th century, the custom to present expensive and unique gifts at important diplomatic visits became a rule in Europe. Gold and silver gifts, which became frequent due to the influx of precious metals from the recently discovered Americas, were still very highly prized but no longer very unique. Amber, just as highly valued but available in limited quantities, suited the exclusivity criterion for diplomatic gifts. Paradoxically, in the circumstances of a continuous shortage of raw amber, it served as a material for items on a grand scale, as if in spite of its persistent scarcity.

The large coffers, vases, reliquaries and portable altars typical of the final quarter of the 17th century took many kilograms of large fractions of amber to make a single item, even though large nuggets made up a scant part of the total raw amber collected at the time. And so, for instance, the Heidekamp Report states

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1 Janina Grabowska, Dyplomatyczne kariery szkatuł gdyńskich [The Diplomatic Careers of Gdańsk Coffers] (in) POLSKA 1971 No. 8
that in the winter of 1679/1680 the Prussian Customs House estimated the share of nuggets weighing several
dozens grams and over (called Sortimentstein) at 2%. This small percentage of Sortimentstein is relative to a
very small overall amount of amber collected in each year of the 1600s. In the mid–17th century, the annual
yield was as little as 50 barrels, or about four tonnes.2 Although the annual yield grew to ca. 150 barrels (12
tones) in the early 18th century,4 even then the two–percent share of large nuggets amounted to only 240 kg
a year. These numbers show how much of a rare and in-demand commodity large amber nuggets were at
the time.

The decisions taken by the German sovereigns of the time to fund enormous amber artefacts were
intended to manifest their economic potential and special place in the political arena.

This was the nature of the commission to build an amber throne for Holy Roman Emperor Leopold I
and a cabinet for Augustus the Strong, King of Saxony and Poland. Both of them were to occupy the most
prominent place in their respective palaces. The amber decoration of the cabinet used up almost 100 kg of
the highest quality amber and its size is truly impressive.5

But the grandest foundation of all, indeed one might call it bizarre given the scale of the states of
Brandenburg and Prussia where he reigned, was commissioned at the start of the 18th century by Frederic I
Hohenzollern to underscore his recently acquired title of “King in Prussia.” This was the amber decor of the
royal cabinet in the palace in Berlin, then under construction. Some of this decor was given to Russian Tsar
Peter I and later became the core component of the Amber Room in Tsarskoye Selo, Russia. The
reconstruction of the lost Amber Room, which the Russians completed in 2003, allows us to precisely
determine the weight of the finished amber components. They weigh 805 kg and the amount of raw amber
used up in the process of making the Room was estimated by Alexander Zhuravlev, the head of the
reconstruction team, at about 6 tonnes.6 Some 80% of the Amber Room’s decor came from the Berlin
cabinet, which means that some 4.8 tonnes had been used. This means that raw amber stocks accumulated
by the Prussian Customs House over several dozen years must have been used up to make the cabinet.

II. The Artists behind the early modern large-scale works of amber

In contrast to the overwhelming majority of historical amber artefacts, the artists behind grand works
of art, commissioned by sovereigns as future diplomatic gifts, are known by name. What is clear from this is
the special care to employ experienced artists and workshops, often from places far away from the employer,
craftsmen of Europe–wide renown. Surely the court officials were aware when selecting their contractors of
the risk of entrusting an extremely expensive and brittle material in the wrong hands.

The throne of Emperor Leopold I was a 1576/7 collaboration between esteemed masters: Christoph
Maucher, Gottfried Wolfram and Gottfried Turau (Turow) at Nikolaus Turau’s workshop in Gdańsk.7 All of
them were well known for both their creative talents and impeccable technique, as they had already carried
out prestigious commissions from royal courts in several European capitals. A quarter of a century later,

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2 I provide this information from Jacek Bielak’s doctoral dissertation “Bursztynictwwo gdańskie od II połowy XVI do
początku XVIII wieku” [Gdańsk Amber Craft from the Second Half of the 16th Century to the Beginning of the 18th
Century] University of Gdańsk, Gdańsk 2007. Table: The Quality breakdown of amber sold in the 1679/1680
autumn/winter season (116 barrels).
3 Jacek Bielak, ibid., table: Total data breakdown on the quantity of raw amber collected in 1568-1654 (in barrels)”
4 Jacek Bielak, ibid., table: Quantity of raw amber collected by the Prussian Customs House in 1655-1705
5 Augustus the Strong’s cabinet has the following dimensions: height - 210 cm, width - 108 cm, depth - 46 cm. Data from
conservation documents, Malbork 1968
6 Alexander Zhuravlev, The Amber Room - Beginnings of Reconstruction (in) Amber - Views/Opinions, Gdańsk/Warsaw
2005
7 Wiesław Gierłowski, Warsztat Nikolausa Turowa w Gdańsku - szkoła arcymistrzów: Christoph Mauchera, Gottfrieda
Wolfframa i Gottfrieda Turau (Turowa) [The Workshop of Nikolaus Turow in Gdańsk - the school of the Great
Masters: Christoph Maucher, Gottfried Wolffram and Gottfried Turau (Turow) (in) Polski Jubiler No. 22, Warsaw,
2004
Gottfrieds Wolfram and Turau became the chief makers of the amber cabinet of the King in Prussia at the Berlin palace.\(^8\)

From the beginning, the works which were hand–made by these distinguished artists from a highly prized material, which had long been considered precious (although not classified as a gemstone, the way it is today), gave amber an excellent reputation and thus brought about the need to maintain these artefacts for future generations; they also gained a prominent place in state treasuries and private kunstkameras. The heritage artefacts of early modern amber art still have very much to do with amber’s renown.

From the mid–1700s to the 1990s there was a long hiatus in large amber construction projects which lasted almost 250 years. There was an overall collapse in the amber art in the countries on the Baltic Sea, which used to be the world centre of this art form in the early modern period. The stagnation was not overcome even by the radically increased supply of raw amber thanks to the industrial–scale dredging of the Curonian Lagoon in the 19\(^{th}\) century and the production from strip mines in Sambia in the 20\(^{th}\) century. Industrially extracted raw amber would be sold to faraway markets, including China and Burma, where it superseded local fossil resins as a material for the characteristic local figurines and ornaments. Only occasionally did the Soviet Union, which gained control over the Sambia mines in 1945, undertake the construction of large amber artefacts.

**III. The Amber revolution of the 1990s**

Until the end of the 1980s, the Soviet Union not only had absolute power over amber mining from the Sambia deposits, but also had some control over the less productive sources of raw amber in East Germany (the Goitsche Mine near Bitterfeld) and Poland (rinsed from the Vistula River Delta). Trade in raw amber was severely restricted and stringently controlled by the Soviet police and customs forces. The dissolution of the Soviet Union in 1991 and the radical political and economic transformations in Russia and its dependent countries, just like the earlier changes in Poland and Germany, created the conditions in which amber could be subjected to the general principles of the market economy.

Amber extraction grew exponentially in Sambia after 1991 (although this was not reflected in the statistics of the state monopolist, the Kaliningrad Amber Factory;\(^9\) its output ended up being stolen away during the 1990s), because of new semi–legal strip mines and an untold number of “poor man’s shafts” dug into the shallow Sambian deposit. In Ukraine’s Volyn Region, where two state–owned strip mines have operated since 1993, there was a clear predominance of illegal private mining with an uncommonly large share of very large amber nuggets found. In the 1990s there was a clear surplus of raw amber, including large nuggets, over the processing capabilities of the time. As a result Polish, Lithuanian and even Japanese companies were able to accumulate considerable raw amber reserves at a comparatively low price. These conditions made it possible to return to the early modern tradition of building large–scale works of amber.

The first to take advantage of this availability of raw amber was the team of the Tsarskoye Selo Amber Workshop, which had been preparing for the reconstruction of the Amber Room in the Palace of Catherine I for over a dozen years. Russian government subsidies, but most of all several million dollars of support from the chief importer of Russian natural gas, the German RUHRGAS company, were the determining factor in the successful and meticulously faithful reconstruction of this work from 300 years ago, which mysteriously vanished during World War II. The reconstruction of the Amber Room required the knowledge and perfect mastery of many difficult amber working techniques and methods for joining brittle components into a durable structure. The acquiring of such skills by the almost 100–strong team of artists and technologists made it possible to establish St Petersburg as a centre of amber craft from scratch and today in many ways it is a leader in the global amber industry.

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\(^8\) Michail Voronov and Anatoliy Kuchumov, Yantarnaya Komnata [The Amber Room], Khudozhnik RFSRR Leningrad, 1989

\(^9\) Zoya Kostiashova, История Калининградского Янтарного Комбината, Калининград [The History of the Kaliningrad Amber Factory, Kaliningrad] 2007
IV. Contemporary works inspired by the traditions from the turn of the 17th and 18th cent.

St. Petersbourg and vicinity

A large group of amber artists are still employed by the Tsarskoye Selo Amber Workshop limited liability company where they continue to use early modern design and techniques. The group enjoys considerably preferential treatment: it is the first to obtain commissions from the state and uses tried–and–tested amber colouring technologies. The Workshop made a set of amber icons for the chapel of the President of the Russian Federation at the Moscow Kremlin. This was one of the earliest commissions of a sacred work in the new Russia, completed as early as in 1995 – eight years before the reconstructed Amber Room was opened. In the 1990s, the Workshop made many decorative pieces modelled after early modern artefacts from Prussia and Pomerania (vases, coffers, chess sets, writing sets, dressing cases), but has now specialised in the amber copies of historical icons. The icons made at Tsarskoye Selo faithfully maintain the composition of the painted images but enhance them with sculptural techniques: relief, engraving, intaglio and églomisé. However, they do not introduce any new artistic vision or any contemporary motifs.

Until recently St. Petersburg was where Alexander Zhuravlev (1943–2009), the most famous amber artist of our times and the founder of the team that reconstructed the Amber Room, worked independently. He was one of the co–originators of patents for amber colouring methods using organic pigments and a committed supporter of their widespread use. Just like the entire Tsarskoye Selo team, after a period of drawing inspiration from early modern amber art, he focused on the painterly use of coloured amber. His topics were secular. In 1997–1999 he worked in Japan for the authorities of the city of Kuji (where Japanese amber is extracted and worked), creating several large pictures and wall compositions made of Baltic amber there (including: The Golden Konjikido Flowers sized 195 x 277 cm). After his return to St. Petersburg he made RUS’, a 300 x 150 cm allegorical panneau and an entire series of portraits of important figures from Russian history. The day before he died he completed a portrait of his namesake, Tsar Alexander II.

Alexander Krylov, the long–standing artistic director of the team which reconstructed the Amber Room, still creates original pieces inspired by the achievements of early modern amber art. His work combines tradition and innovation, mastery of execution and the ease with which he uses the possibilities of this unique material, but most of all his ingenuity when it comes to the subjects of his depictions and the functions of the objects he makes. Over the last two years, Krylov has succumbed to the fashion for making amber icons as well. He does not, however, make copies of earlier works, but gives a new expression to the old themes by making use of amber’s unique beauty.

St. Petersburg has many more artists who work in amber and are inspired by the traditions of early modern Europe. However, it would be impossible to introduce them in such a short article.

The Russian Federation’s Kaliningrad Oblast’

The Kaliningrad Amber Factory is currently the global monopolist in amber mining and therefore has the greatest potential capabilities in terms of selecting material for large–scale projects, but still uses standard designs developed back in the Soviet times. JUVIELIRPROM, the amber–processing part of the factory, seems to treat any reference to old Königsberg in line with the Soviet slogan to “chase out the Prussian spirit” from today’s Kaliningrad.

A number of private Kaliningrad companies have managed to master early modern amber sculpting techniques and know how to join many disparate components into various kinds of ornamental items. Style–wise, however, they are either traditionally Russian (e.g. the SUVENIRY BALTIKI company), or contemporary, highlighting amber’s natural beauty (for instance, the studio of the DAVYDOV family). It even proved impossible to produce a dozen or so reconstructions of historical amber artefact (kept in local collections between the World Wars) for the Amber Museum in Kaliningrad.
Gdańsk and vicinity

The need to continue or to re-establish the traditions of Gdańsk amber art from the times when the city belonged to the Polish–Lithuanian Commonwealth was raised from the first post–World War II years, both by the authorities and the public at large. However, there were no specialists and the historical artefacts from pre–World War II museums, churches and private collections were all either destroyed, removed or looted. The large fractions of raw amber imported from the Soviet Union were rationed by the state which required that they be made into standard products to be exported for hard currency.

The first attempts to make large–scale objects modelled after the works of old took place only 50 years after World War II upon the initiative of the owners of private amber jewellery companies which were successful in the international market. With the remarkably high revenue gained in the 1990s, over a dozen companies decided to treat amber as something more than just a gemstone and made it a point to raise their profile by mastering forgotten amber sculpting techniques and methods of constructing large–scale objects by joining many amber–only components. These projects were not made to order, but to showcase valuable and technically difficult objects in the companies’ design studios. The forms of these objects and the methods of their construction were most often inspired by the heritage items exhibited at the Castle Museum in Malbork, but also by artefacts from many other European museums, which Polish amber jewellery makers visited during their business trips. Other important factors included the news about how the world at large was interested in the progress in the reconstruction of the Amber Room and Polish jewellers’ personal contacts with the Russians who carried out this project.

One of the first owners of private amber jewellery companies in Gdańsk to undertake the construction of large–scale amber objects at his own expense was Jacek Leśniak of the VENUS company. He employed sculptor Alicja Pluta, a graduate of the Gdańsk Academy of Fine Arts, who made a 4–litre mug with a scene of the March of Bacchus. The mug was made using an early construction technique which employs double amber walls, without any frame or metal reinforcement. Alicja Pluta also made several large figures and ensembles from natural amber, including The Birth of Venus, which is a reference to the company’s name. The same subject was taken up by another sculptor, Agnieszka Puchacz, who made an amber copy of the Venus de Milo from the Paris Louvre with a record height of 82 cm and weighing over 14 kg. VENUS’ entire collection was exhibited at the Amber Museum in Gdańsk in 2006.

Alicja Pluta also made amber–only figural sculptures, reliefs and vases for Lucjan Myrta and collaborated on the white amber gown for the icon of the Blessed Virgin Mary at St Bridget’s Basilica in Gdańsk, made in the studio of Mariusz Drapikowski. Other important and beautiful sacred works from Mariusz Drapikowski’s studio are contemporary in style and technique and do not refer to the early modern tradition.

Following his work for the Castle Museum in Malbork on the conservation of a coffer by Christoph Maucher, Lucjan Myrta, owner of several successive and successful amber jewellery companies made it his life’s ambition to master the techniques and recreate the grand scale of amber objects from the turn of the 17th and 18th cent. In the process, he came to work in a technique from a somewhat earlier period when large amber objects were constructed with multiple layers of amber without a frame or wooden walls. Lucjan Myrta’s first amber coffers was a copy of the work by Maucher, where Myrta remained faithful not only to the original’s form and the techniques used to make it, but also copied its dimensions which, at 41 x 27 x 41 cm, are very large for an object made without wood or metal, but not larger than those made in the early modern period.

The coffers from Myrta’s studio kept getting bigger and bigger. Completed in 1999, Adrianna has dimensions of 46 x 60 x 41 cm, while the 2009 Gdańsk coffers is 66 x 69 x 44 cm. This growth tendency

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10 Stanisław Bernatt, I znowu trzeba gromadzić bursztyny [We have to Collect Amber Nuggets Again] (in) Problemy R. 12 No. 9 Warszawa 1956
applies to everything else made in his studio. The range of functions and subjects of his works also grew. He made furniture, clocks, candelabras, dishes, figural sculptures and sculptures in relief, with pictures becoming predominant after the year 2000. In contrast to the Russian icons discussed above, the colour layer of the amber pictures from Myrta’s studio is applied not on plywood, but on a support made of dark pressed amber. He does not colour the amber components of his painterly compositions, which is commonplace in Russia, but forms the picture by selecting the appropriate varieties of natural amber. The pictures, over a hundred of which were made to date, appealed not only to the studio’s owner but also to over a dozen customers who were ready to pay the high price for purchasing them. The initial architectural subjects of the pictures first gave way to flower compositions, next to a period of portraits of the members of the Myrta family and other people and finally to religious depictions. There are a number of versions of the scene of the SERMON ON THE MOUNT and the series of religious works concluded with an enormous 365 x 280 cm triptych called THE TREE OF LIFE.

Amber tureens, vases and mugs from Myrta’s studio are similar to their predecessors from 300 years ago, but usually 2–3 times larger. The several–litre RUBENS mug and an equally large vase can be seen at the Amber Museum in Gdańsk, which has 17 exhibits from Myrta’s studio in its collection.

Two ebony amber–incrusted cabinets: SOPOT and the FISHES are the largest works of them all. They are over 4 metres tall, making them twice as high as Augustus the Strong’s cabinet in Grünes Gewölbe.

However, Myrta’s most valuable and most extraordinary work in his AMBER TREASURY. It is a five–storey 203 x 210 x 60 cm closet made exclusive from amber components standing on eight bronze legs. Some of the closet’s walls are triple–layered, which is necessary because of its size and weight. The closet’s thousands of components were made using all the exquisite techniques from the turn of the 17th and 18th centuries, and the selection of extraordinary varieties of amber is a marvel to behold. The Treasury is dedicated to Christ and is a profession of the artist’s faith.

The overwhelming majority of the works produced by his studio over the last few decades remains undispersed in Myrta’s collection. It is exhibited in specially fitted rooms at the Lucjan Myrta’s studio in Sopot. During the Polish presidency in the European Union it was visited by MPs and government members from EU Member States.

V. In Conclusion

Today, amber is used almost exclusively as a gemstone, and used in jewellery which is not especially expensive, usually silver, not gold, and has a much lower social standing than 300 years ago. The fact that amber’s role is narrowed down to just that of a jewellery material renders investment in industrial extraction, especially of Polish deposits, which are deeper–lying, impractical. An economically viable mine would have to produce at least 1000 tonnes of amber each year and the jewellery industry just does not generate such demand.

Without at least two equal mines which would compete with each other in the raw amber market, amber commerce will always be disrupted by the irrational decisions of the monopolist. Detrimental fluctuation of supply, jacking up prices, protectionism in sales and the incessant corruption it produces – would all be well worth eliminating someday.

11 As of January 1, 2013, the number of catalogued items at Lucjan Myrta’s studio collection was 296. The amber items and purely amber components in mixed structures have an aggregate weight of 3,954,620 grams, i.e. almost 4 tonnes.
Amber and wood in contemporary art

LECTURE

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Every material, which amber is combined with in jewellery and works of art, gives it a new expression and tone. Gold gives it a shade of luxury, silver – cool elegance, leather – a sense of warmth and comfort. Wood has a special place in this unlimited number of components.

The combination of wood and amber is a very old tradition in the handicraft and folk art of the countries on the Baltic Sea. Such a combination was used to make coffers and furniture or even entire interior decoration ensembles (including the famous Amber Room). Wood always played an auxiliary role in such works: it served as a base, a structural frame or as a support in mosaics. Carved wooden components, usually gilded, often provided a frame or complemented the amber decor (amber was universally thought to look best against a gold background).

As a material, wood has a number of properties which are hazardous to amber. Wood absorbs humidity from the ambient air, it is liable to swelling and deformation; it dries unevenly to become warped or covered with cracks; it is threatened by fungi and insects. On the other hand, as a soft and pliable material, wood is very similar to amber, not only because it originates from the same plant kingdom. Wood, just like succinite, contains the energy of the sun and a record of our planet’s past.

Just like Baltic amber, wood has thousands of varieties which differ in their durability, density, colour and grain patterns. All kinds of wood varieties are used in combination with amber, from quite common (oak, cherry, beech, pear, ash, white maple, great maple, walnut etc.) to relatively rare and expensive ones (rosewood, mahogany, ebony, padauk, African rosewood (wenge), boxwood etc.).

Almost every contemporary artist who works in amber has combined it with wood at least from time to time. Examples include works or art and jewellery by such artists as: Lonny Fechner (Denmark), Jan Materek, (Poland), Manuel Vilhena (Portugal), Silke Trekel (Germany), Ludmila Sakharova (Russia), Sigitas Virpilaitis (Lithuania) and many others.

One can find most intriguing result in the work of the masters who specialise in “amber and wood” compositions. A good example is the work of Marta Włodarska (Poland), who combines raw or lightly cut natural amber with driftwood – splinters of wood washed up on the Baltic shore by the sea waves. Each time she manages to select the wood’s colour and grain pattern in such a way that its proximity to amber highlights the amber’s natural beauty.

In her innovative necklaces and bracelets, Elżbieta Szupienko (Poland) also combines bits of amber with splinters of branches and fragments of wood found washed up on the Baltic beaches. She usually leaves them uncrafted, only sometimes does she gild the fragments.

Łukasz Ircha (Poland) takes a different approach. His pieces have perfect amber gemstones with regular forms, which are outstandingly displayed in highly polished geometrically-shaped (round and rectangular) settings made in rare and expensive woods such as wenge, amazaque and bubinga. Glowing with its sunny light and vital strength, the amber clearly contrasts with the ascetic background of the dark wood. As a result, perhaps because he uses a third component – silver connectors – his jewellery is extraordinarily harmonious, ornamental and truly elegant.

Dorota Kos (Poland) is an artist who has her own style of creating mosaic arrangements by interweaving bits of amber and wood which she uses to make her brooches, rings and pendants. Her style is reminiscent of the abstract paintings of Piet Mondrian and Theo van Doesburg, the founders of De Stijl.
Giennadiy Losets (Russia), maker of elegant smoking accessories, most frequently combines wood with amber. Wood (boxwood and walnut) is the primary material for the stems of his pipes and the bodies of his snuffboxes, while he uses amber to make the mouthpieces and the inlaid and appliquéd ornamental details. The wood and amber are always a perfect match in terms of colour. They have a common golden–yellow or brown–claret tint. Their appeal is heightened by Losets’ tasteful amber and metal incrustations.

Turned on a lathe, wood is an important part of popular interior decor items, such as writing items, clocks, lamps and chess–sets, which are the speciality of the Kaliningrad–based amber masters Boris Serov and Yuri and Vadim Lopatkin. The same method of wood crafting is used to make designer vases from valuable woods decorated with amber and other ornamental materials (mother–of–pearl, silver, gold foil etc.) by master Vitaly Papst of Germany.

In the souvenirs made by Alexander Yuritsin (Russia), a wooden structure made as a support for amber figures is transformed from a simple pedestal into an important element of the content and form of the entire composition (The Dragon, The Golden Fleece, A Bunch of Gnomes).

A separate place in the world of wood and amber belongs to the abstract compositions of Igor Zalaldinov (Russia), in which the combination of the two materials is so natural that sometimes the border between amber and wood gets blurred.

The most striking expression in amber and wood art has been achieved in “paintings” and sculptures, with the innovative object collages by Paulina Binek (Poland), which are full of deep philosophical meaning. The assemblage technique allows her to use bits of amber, scales, snatches of rope, paper, fabric and fossil to create expressive images that make one think about the futility of life, the flow of time, the mysteries of nature and the challenges of modernity (the triptych Sign Off, the picture–necklace A Leaf from the Calendar etc.).

Andrey Kavetsky (Russia) is perhaps the most inventive artist to integrate wood and amber. In his “dualist” sculptures, amber and wood not only complement each other, but also often contrast with one another. And although the majority of his sculptures are made of wood, it is the comparatively small sculpted amber components that determine the sculptures’ form and content. In his work, the artist shows interactions between humankind and the world of nature – the way they are and the way he would like them to be (Girl with Cat, A Man and a Bird, The Kiss of a Fish). In others, human passions are the leading subject (The Pilot, The Entomologist). In other works still, he shares his thoughts on Life and Death, the richness of Love, the brevity of Inspiration and the torments of Creativity, about human types and the human comedy (Defiance, Pegasus, The Protégé).

Considering the reasons why wood is used by many talented amber jewellery masters, it would be fitting to say that they realised that the artistic possibilities provided by Baltic amber were not enough to express their message. Amber’s bright decorativeness most likely turned out to be insufficient for them to create ambiguous, philosophical images which would convey the artists’ reflections about “eternal” existential issues. And then it is wood, with its shared ancestry, that comes to amber’s rescue.

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Amber + Design – Then, Now and in the Coming Future

LECTURE

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1) Again! (...how many times can one go on about the same thing?). I have been asked to write yet another article on “design + amber.” This is a suicide mission because all one has to do is take a walk around Gdańsk’s Old Town to become convinced that the two are antonyms, two opposite notions that are permanently and irrevocably mutually exclusive; a semantic obverse / reverse, fire / water, sweet / bitter, amber / design. Given such an experience would anyone still be willing to believe that French fries are exclusive if one can buy them together with a paper tray, ketchup and toothpick set on every street corner? As if that wasn’t enough, all the expensive promotional strategies have been sabotaged by a seemingly innocent geopolitical circumstance – photos of Angela Merkel at every press conference with an amber bead necklace, indirectly promulgating amber’s image as a relic from the times of The Flintstones in the process. Sooo vintage.

2) Let’s start at the beginning (“...In the beginning, there was Chaos.” Has anything changed?). Like any other tourist resort, Gdańsk – The World Capital of Amber offers local folklore, supposedly local, but at the end of the day the tour as conceived part of the transglobal trinket business for the statistical target of the undiscriminating consumer. Beads, rings, a souvenir from the Baltic coast, a better Goldwasser. A cliche no better or worse than: ham from Parma, chocolates from Brussels, Murano glass from Venice, port wine from Porto, etc. We in Poland like to refer to tradition. The Amber Routes, a medium of the Greco-Roman civilisation, then the Amber Room – “the Nth Wonder of the World” and, of course, inclusions: yet another sequel to Jurassic Park. All these real and made-up legends fill us with pride and make us drop our guard. Even though we strive to look to the future, historical prejudices prevent us from casting off a provincial scale of reference. Meanwhile – in spite of the folk legends – amber really isn’t anything special to us, certainly no more than the emerald to Colombians or pearls to the Japanese and no more exotic than emeralds or pearls are to Poles. It is time to finally give up the infantile myth about the shaman’s amulet that heals, hypnotises, electrifies [Greek: elektronos] and, in the end, prevents us from building effective development strategies. Today, no one falls for “added value” anymore, especially ourselves. All we need is to professionally design a high quality product.

3) nEUROmarketing (...Ferrari, Campari, Bulgari). Ideas to “build the Amber Brand” are self-defeating from the start. There is no advertising budget that couldn’t be blown without any noticeable result. “Innovative Economy” is really innovative only if it has an innovative product made using innovative technology; and that’s just the beginning, with no guarantee of success. Economic history is full of examples of truly innovative products which became a marketing and image success as well as a spectacular market failure (see: the Segway, which, according to its designers and design theoreticians, was to revolutionise the way we move; whereas in practice the market proved it no more than an acrobatic version of the pallet truck). Let us assume, however, that what contemporary amber jewellery has to offer fits the notion of “innovation” and that it is worth investing in promoting it. Perhaps, then, instead of organising one-off, celebrity-driven events which by tomorrow will have the currency of yesterday’s papers, it is worth investing in systematic education? First designers, then (or, better still, at the same time) – opinion makers, journalists,
exhibition curators, competent critics and design managers, who can activate existing or better yet, create new channels for the exchange of information, new institutions and in time an entire promotion system which would not be just a provisionally set up makeshift operation called “Brand Building.” It’s no use wasting money on such a hoopla, it is not worth the dashed hopes, but most of all, it’s a waste of time. We will never get any “evaluation” from it.

4) However, this is not an academic article (...even though an academic conference was the reason for its being written). The reason is simple: no one who is emotionally involved in the subject at hand can ever write a scientific, objective and impartial analysis on it. As a witness to the clueless “brand building” efforts made so far, it would be difficult for me to maintain the detachment which is necessary for research. However, in order to somehow wriggle my way out, I shall quote my own writing from five years ago in the final chapter of A History of Polish Jewellery. Although, for reasons beyond my control, the book never got published (though it certainly should), it turns out that my text has lost little of its relevance, which additionally confirms the pointlessness of any promotional programmes which were to promote a non-existing product based on a fairy tale script made in Mariacka or Sesame Street.

5) A long time ago (...and, unfortunately, still true). The peak of the bull market for amber jewellery manufacturers and exporters came in 2003, when exports were estimated at UDS 320 million. In the years that followed, the profitability of amber jewellery consistently declined for many reasons that were independent of each other. These were chiefly: a decline in the availability of raw amber and the ensuing increased prices caused by the restricted supply from Russia (which had not always been legal), the unsolved issue of amber extracting in Poland, significant fluctuations in currency exchange rates, growing prices of silver and gold, strong internal and external (Lithuania, China) competition, the appearance of amber imitations made of other natural or synthetic resins and the resulting growing unease among consumers concerned about the authenticity of the raw material, but most of all the lack of co-operation between stakeholders or the development of an effective lobby, a long-term marketing strategy and finally the fragmentation of the amber industry, its anachronistic manufacturing structure and inefficient management methods. As a result of all these circumstances combined, in 2008 amber jewellery manufacturers felt the global economic recession very acutely. Since at the time when this chapter is being written it is still difficult to foresee whether the crisis in the amber industry is just a temporary slowdown or an absolute end to the amber bull market, it is worth pondering – at least as a supposition – on the reasons for amber’s still-low popularity in Poland and the relatively strong interest throughout almost the entire world. In Poland, the contemporary image of amber constantly clashes with an entire store of stereotypes loaded with a long-standing tradition with amber jewellery usually perceived as a folk art phenomenon. In spite of the fact that many companies and designer studios have long offered above-average contemporary design, amber’s overall image still remains stuck in the same chain of associations with: wicker furniture, Polish flax, breadcrumb soup (żurek) and bison vodka (żubrówka). In the opinion of Polish female customers, amber is both out-of-fashion and out-of-date. Paradoxically, however, what we might feel to be a symptom of provincialism, to many non-Polish nationals is an element of genuine and intriguing exoticism. And so amber in itself does not have to have only negative connotations, even in Poland; these are usually the result of its incredibly shoddy “packaging,” which to the majority of the opinion-forming consumers and observers invariably remains a synonym of “cheapies” (even though amber hasn’t been cheap for a long time now). Assuming that the potential “Baltic Amber” brand should be associated with a high-quality Polish speciality, then certainly the areas where the level of historical neglect is the deepest include design and styling. The prestigious “red dot” awarded by the German Red Dot Institute for Advanced Design Studies may serve as a point of departure for further analysis. So far, the only Polish winner of the award was the MOHO-design group for its collection of carpets inspired by cut-outs from the Łowicz region in 2008. This impression is complemented with excellent execution with the highest quality wool, finished with a specially designed and patented technology. Relating the above example to the amber business and the likely reason why it has so far failed to develop a style
which would be clearly associated with a high-quality product made in Poland, perhaps it is because the exporters from the Tri-City of Gdansk, Gdynia and Sopot have made the erroneous presumption that in order to make it in a foreign market, one has to mimic it. In spite of all external appearances, the overall picture is that amber jewellery manufacturers from the Tri-City hardly make anything original! They are but contractors for wholesalers, agents and distributors from all over Europe, the USA, Japan, Russia, etc. It is these customers who are the collective “trend-setter” for Polish amber jewellery design, while the Tri-City companies still remain only an outsourcing centre, albeit an increasingly expensive one. Therefore, it is small wonder that we have never arrived at a “Polish Amber” brand if the style of amber jewellery is a reflective of the rather unsophisticated expectations of those who make money on short-term agency, on top of which the pressure to keep prices low leads to a correspondingly low quality of the product, which is still made with a disproportionately high amount of handicraft labour. Even though the role of the agents and, by the same token, of trade exhibitions is diminishing year by year (this concerns not only the jewellery industry), the manufacturers make no attempt to develop their own distribution channels but passively base their business on the shrinking and increasingly less profitable supply to export orders instead. In the current market situation this is tantamount to suicide and the businesses who fail to comprehend this are sentencing themselves to become anonymous subcontractors, resigning to a ceaseless scramble at the lowest price- and quality-end and a never ending struggle to survive in an increasingly competitive market – not only domestically, but also in competition with similar subcontractors from China, Thailand, Indonesia, Pakistan, India, Mexico and many other countries where there are no labour codes, and the notion of “social justice,” which is so overused by European politicians, remains rather unknown. Another serious problem is the lack of even the most fundamental respect for intellectual property rights, while designs copied with impunity thrive in secondary circulation with the active participation of the wholesalers themselves, as they buy product samples from respectable companies who invest in design and quality and then send them to their contractors to make cheaper knock-offs. However, the “civilising” of the amber business must begin with an elementary matter: education, which must be modern and adapted to free market conditions. The existing spontaneous development model based exclusively on the manual skills of craftspeople is unable to maintain a lasting prevalence of Polish amber products on the global market. However, there are also many promising examples which allow us to look into the future with some guarded optimism. Considerable credit for developing a modern image for the Gold of the North belongs to several Tri-City-based companies including S&A of Gdynia, New Amber Collection and Art-7, who managed to develop their own recognisable styles. What they offer is complemented by collections from individual designers, the most celebrated of whom include: Mariusz Gliwiński, Dorota Kos, Paulina Binek and Dariusz Zarański. It is also worth mentioning a few names of Polish and European designers and artists who use amber in their work, even though it is not their primary material of choice: Marcin Zaremski, Jacek Byczewski, Wilhelm Tasso Mattar, Manuel Vilhena, Michael Zobel, Philip Sajet and Gisbert Stach. The quite numerous examples of creative amber jewellery-making presented above – both in terms of unique and batch-made products – allow us to hope that the new development directions for design begun by these pioneers will lead to an irreversible process where a contemporary image of amber will develop, in Poland as well. The sad alternative could only mean a return to folk amber craft as a regional souvenir product whose unchanging archetype is the “medium-cognac” coloured cabochon with “sparkles” wrapped in “little monster flowers” of oxidised silver. Perhaps the bear market which inevitably awaits the amber business in the immediate future will make it possible to put many things in order and systematise many issues that resulted from the amber industry’s dynamic growth in the 2nd half of the 1990s. Certainly the effort that needs to be put in the development of a contemporary style and – based upon it – of a well-received Polish Amber Brand is much too much for individual companies or business associations to afford and carry out. This is a task which requires the co-ordination and long-term cost-intensive promotion by several institutions and governmental agencies.
[My prophecy has just come true and what I called for in 2008 has materialised four years later and this publication, published as part of the Innovative Economy Operational Programme, is part of the evidence. Time will tell whether the promotional efforts underway will yield the desired results and whether the amber business will finally recognise the merit of “innovation”.]

6) The End (...and at the same time a new beginning because it is certain to be continued soon). Every good storyline should have its moral – best if it’s optimistic. And so it will be this time. Paradoxically, what makes the new generation of designers smile is what drives the traditional amber craftspeople to despair. The shortage of raw amber and the rise in its prices mean that today, every piece of amber has to be carefully analysed in terms of how to use it most effectively – before it gets barbarously drilled and threaded. Today’s speculation-driven prices of precious metals also force both buyers and sellers to look for new materials which would be more in sync with our contemporary ideas of “nobleness.” Silver, and certainly gold, have ceased to evoke exclusively good connotations, and sometimes have even become a synonym for nouveau riche aspirations to flaunt one’s material status which, at a time of economic uncertainty, cannot be socially accepted. This process makes us witnesses to the re-evaluation of many notions. “Quality” does not always have to mean high price today and is increasingly associated with uniqueness, which is most credibly confirmed when the piece can be recognised as the work of a distinct artist. The other end of the jewellery market, with the pressure of low price as its only point of reference, is also irreversibly losing its significance. The age of one-off products distributed along the archaic chain of: manufacturer > wholesaler > retailer > buyer is irrevocably becoming a thing of the past. All this means that we have to work out a credible language of communication which is devoid of false advertising propaganda in the relationship between the maker and the user (I have consciously avoided the corporate terminology of “producer – consumer”). All this still lies ahead of us. The promising, albeit still quite spontaneous, beginnings of a process to develop innovative style in amber jewellery and to build new ways of selling it, i.e. concept store / show room / internet, allow us to predict in which direction this evolution will go. We will have to wait a few more years to see the commercial and image-driven results of this evolution. In any event, good times for designers are approaching and given that this will go together with a somewhat deeper awareness of the cultural aspects of design, we can be sure that this also means better times for Baltic amber.

7) The Postscript. I would like to thank all my former, current and future students for the opportunity to study the difficult art of forgetting (and learning anew time and again) together. I would also like to invite all those who want to systematically build an innovative economy based on the creative potential of Polish designers to work with us! The illustrations to this article have been selected from the end-of-term projects of the students of the Jewellery Design Studio at the Academy of Fine Arts in Gdańsk.
Modern amber jewellery design

POSTER

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The economic crisis has brought an end to the amber souvenir industry, with just any items sold by weight. A new era has arrived – a time of collaboration with professional designers and of modern design. This is the new face of amber jewellery.

Design and quality – these two factors have currently the greatest influence on the changing image of amber jewellery. It is precisely in them that the amber industry, experiencing the effects of the economic downturn, is looking for ways to keep developing and succeed commercially. Slowly but surely our way of thinking about amber is changing: it is no longer just a magic stone found on a beach, a holiday memento full of memories, but a unique product of high quality and modern, attractive design.

A significant role in creating the new "amber mindset" has been played by a new group of qualified designers in the market (related mainly to the Gdańsk Academy of Fine Arts but also to the Łódź–based
Academy of Fine Arts and College of Art and Design) whose ambition is to change the image of amber, to look for new solutions, get off the beaten track and break stereotypes in the process. The global economic turbulence and a significant increase in the prices of raw amber in recent years have accelerated the process of designers and manufacturers getting together in the so far rather change-resistant amber industry.

This emerging new "amber mindset" is not only reflected in the amber companies’ products range – oftentimes even resulting in a complete change of image – but also, as proven by many well-known cases, brings commercial success within a short period of time. This is equally true for businesses which have been promoting attractive design for many years, by working with designers and developing their own design studios, and for those who have only recently begun revamping their brand through original design.

Fine artists are an important community which has always aimed at "revolutionising" the perception of amber. By creating fresh and ambitious jewellery, they have consciously placed themselves at the polar opposite to "mass production" which they hold in such little regard. Their studios have produced art projects which are unique and captivating in their artistic approach to amber.

The trend for breaking amber–related stereotypes continues, while designers try to outdo one another in devising ever bolder jewellery productions. Owing to new and often unconventional ideas and fashionable settings, this stone has assumed a modern character and a lightness of expression. No longer is it combined only with "traditional" silver but also with gold, diamonds, other precious materials and a whole array of non–precious materials. What counts most is an attractive composition with an interesting visual effect at the fore. In order to give their designs a unique character, designers follow current global fashion trends on the one hand and local traditions and folk handicraft on the other.
The Design of jewellery with amber - forecasts for design development

LECTURE

ANDRZEJ SZADKOWSKI

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Jewellery is an art form which reflects the personality of both the designer and the wearer. Harmoniously matched, it emphasises the wearer’s appeal. It is an intentional sign as its purpose is to evoke a pleasantly aesthetic feeling and to provide information. Therefore, jewellery can be classic in form, presented discreetly to create an atmosphere of calm and dignified stability, complementing the general mood, or provocative and aggressively avant-garde, possibly aimed at distraction.

The expression of a jewellery display can also reflect personality. New means of expression, new materials, new structures, out-of-the-ordinary applications consequently become a conscious choice to emphasise characteristic features, advantages for example, and to hide faults by distracting attention.

Therefore, jewellery is information about taste. A run-of-the-mill use of ugly jewellery tells us about an uninteresting person of no sensitivity. Unless it is clearly done to provoke and then it takes on a completely different meaning.

Jewellery pieces contain in this way yet another – psychological – effect. The one that may prove the most important. It determines the choice, the purchase, the gift and the application. So jewellery is not just pointless decoration. Its meaning is multilayered, complex both in its artistic and aesthetic dimension and in its informative and psychological aspect.

It should be played with meaningfully, with an awareness of intent, a purpose and consistency. That’s because JEWELLERY STARTS A CONVERSATION.

Its beauty is about focusing on detail.

Contemporary communication uses complex messages but also short and specific ones, which also applies to art, design art in particular. The essence of expression is an innovative and apt statement delivered through properly selected materials.

The Americans claim that apparently the first 30 seconds are enough to form an opinion about another person. Such an impression is the sum of harmonised details and positive associations. An amber detail may be a significant aspect of this psychological game.

Jewellery, located at eye level in the central part of the human figure, focuses attention with its beauty, evokes positive associations and becomes an image of the soul and the carrier of its good message. A play on the first impression, based on perfect accentuation, immediately establishes class in many positive aspects. The complexity and richness of the content and visual message establish the level of judgement and respect.

Such is the energy brought by amber, a mineral that remarkably inspires the artist and the viewer.

A designer’s respect for amber begins with the first observation. The idea of how to use it in a work of art is revealed immediately (intuitively) or by analysing the features which make up the essence of this impression and the amber nugget’s nature – after an extended synthesis of perception, knowledge and skill. The most important part of this stage is the purpose, the application, the function and dedication (to whom, what, what for?).

The uniqueness of amber nuggets due to their one-of-a-kind form, size, mass, texture, colour, combination of effects, interior projections, inclusions – all create an endless world of inspiration for artistic improvisation.

The fascination with amber’s diversity and attractiveness helps to expand the ranks of amber artists. “I feel it is amber in its primal and raw form that is the most inspiring. Amber that has not been dramatically
processed, through its singularity is a perfect material for exclusive and unique jewellery," says Monika Oczkowska confidentially.

Amber – a phenomenon with character. Like no other jewellery component it requires special care and intimacy. It inspires. A contemporary designer’s task is to bring out its most crucial properties, the nature of this one and only unique amber nugget. Like no other gemstone, amber contains the greatest number of elements of artistic importance and other encoded features which influence our senses: the senses of sight, touch, taste and smell; it dazzles us with its colour, shape, texture, internal light – transparency or internal landscape, inclusions, smell, generally speaking: its amber energy.

Any other mineral can be used to produce an idea of any given jewellery form. With amber, it’s a mistake to underestimate these remarkable distinguishing features which evoke positive associations. The very beauty of natural amber forms in itself encourages respect and inspires. Supplemented by the designer’s creative vision, it will produce some maybe as yet unnoticed visual effects – a piece that is phenomenal, unrepeatable, artistic.

The primal beauty of nature must not be destroyed by unprofessional and insensible action. That is why the remarkable beauty of a bite of amber can often be daunting and paralysing to the extent that we cannot determine how it should be used. Oftentimes it is only the underlying subconscious that, having been fascinated and contemplating a revelation, will show the solution.

I am describing this irrational approach to amber (emotions, empathy) because the material as such is unpredictable in itself. This pertains to the part of art creation which requires focus, sensitivity, revelation, inspiration, knowledge and refinement in using the tools of one’s trade. In a way, it can be compared to painting a holy icon, which involves a specific canon of procedures and which most of all is preceded by a moment of concentration on the work, almost a prayer.

Being with amber on similar terms of respect, in an appropriate scope, ensures the same impressions. This applies to individual and unique artistic creativity.

Colour

Amber’s colour and diversity are the primarily significant visual elements which make amber attractive. The symbolic nature of the colour of amber transmits the positive energy of the sun’s warmth – the light of optimism. Given the idea that colours shape our lives, the colours yellow, orange and transparent “cognac” bring about a consummate optimism in human beings rooted in their folk consciousness.

Like through the music of Beethoven, who defined the essence of music and claimed that with it people could be better (The Große Fuge, Op. 133) – with amber people should become happier. The pleasure from contemplating the beautiful art of jewellery enriches us and gives us a sense of its possession.

Gene Davis, a painter associated with the Washington Color School, claimed that materials influence form. This can be related to amber whose uniqueness is an inspiration for purposeful, pertinent and consummate applications.

Coming back to the psychological nature of the colour of amber and the positive associations it evokes, one may state here that amber in its natural form is accepted for these very reasons even at the first stage of intimacy. It is the artists’ imperative to cause as little damage to its primeval nature as possible, to preserve as much as they can and present its fundamental nature, highlight the uniqueness of the amber nugget, bring out and underscore the value of the final piece with additional artistic elements. Unconventional forms of expression are expected but within the limits of the harmonised sound of new beauty being created.

The emotional influence of colour as a visual element in the human space.

Colour has psychological importance in designing an image. Yellow – stands for the highest values and knowledge; it’s a symbol of joy, the symbol of the sun; it brings back the memories of good times, holidays for example, evokes good vibrations, cheerfulness, warmth in the mood of-happiness. Orange symbolises energy and, with its ability to bring out creative ideas, it is the colour most frequently used for advertising. Colour is the first thing that our brain records. That is why meticulousness is expected in using it effectively in amber jewellery. Its effective use can indeed start a conversation but also determine how we are seen upon first impression and most of all leave a noble and positive image in people’s memory. The colour of amber enhanced with its internal or external light makes up its very essence. Illuminated pieces of amber can be found in fine and applied arts, such as in Alina Szapocznikow’s Lampe–bouche illuminated lip sculptures.
Searching for light in amber.

The light which appears inside transparent pieces of amber gives it a special character. Some forms which have transparent internal spaces enhance the value of the mineral. In such a shape, nature already contains elements of art and can be confronted with contemporary sculpture by Hans Arp, Henry Moore, Barbara Hepworth or Constantine Brâncuși. The organic sculptures are also turned inwards. Reaching inside is a specific way of looking for the truth. The above statements can be put under the motto: “Who does not include nature in art will make a mere decoration of it.”

The fascinating secrets of amber’s nature are as if a thought–out expression of visual elements which inspires creative thinking and para–sculptural projects. History shows that the observation of nature is the proper support for development, including art. Organic abstraction is a form of the biological world. It creates styles based on nature and is the artistic equivalent of natural concepts, for example Hans Arp’s sculptures illustrate such a bond with nature. His sculptures were created as analogies to nature and express the same harmony and simplicity.

Amber’s uniqueness compels individual artistic decisions that highlight amber’s beauty and its essence. Such impressions are a direct inspiration for design work. By selecting important values they improve nature towards artistic perfection. An ideal transposition of nature, including amber, can be seen in the 1930s sculpture by Arp and its title: Sculpture to be Lost in the Forest. Which in our case should entail such an understanding of amber as to create its new nature rather than some foreign creation. Henry Moore expressed it in a similar way: “The observation of nature is part of an artist’s life, it enlarges his form and knowledge, keeps him fresh and from working only by formula, and feeds inspiration.”

Next to what has been described above, the interior of an amber nugget contains inclusions: animals and plants. Bringing them out in jewellery is yet another design challenge. A purposeful use of all the elements in the right proportion: background, the direction in which the inclusion in displayed, the nugget’s inner light, special setting – has to produce a perfect functional form: a ring, brooch, necklace, bracelet etc.

Smell is the only element that is exceptional among both minerals and gemstones and typical only of amber; when rubbed, an amber nuggets produces the resinous smell of the forest together with the related associations and visions. The memory of these impressions evokes more elements: sounds, images, emotions. Newly formed impressions become an added value of this celebrated wonder of nature.

Development forecasts for amber jewellery and designer art.

The professionalism of designers resulting from the knowledge of physical, chemical and aesthetic properties and their creative application in designing unique jewellery may be a basis for making use of know–how, skills and artistic sensitivity in design studies. Serial production cannot allow for the essence and exceptionality of amber. Amber components (plates, cabochons, balls) will not create an innovative entity if they can be replaced by any other material. The uniformisation of modular forms together with the uniformisation of colour to fit industrial production rules is a departure from nature, acting directly against nature and losing the essence of amber. A departure from these rules and a return to the uniqueness of raw amber in specific proportions will make it possible to develop design that is really based on nature. I can see greater and faster opportunities for amber art development in unique designs that are not very producible. Automated serial production is clearly at odds with the idea of natural amber’s beauty. New incarnations of amber must result in exceptional design. When looking at the art market and when reviewing art at art tradeshows and international exhibitions, one can predict a direction in amber art development which would be parallel to the trends in fine arts and fashion in general. The new styles have to be open to the contemporary taste for combining even unusual materials in sentimental, maybe even antiquated styles. Specialists see the current standing of Polish design and Poland’s “style corps” as good in terms of development prospects and in comparison to international competition. Novel design based on creative methodology and state–of–the–art technologies will be the trademark feature of Polish amber jewellery. At the promotion stage, the complimentary marketing activities will be important to create the entire amber package.

Colours shape our lives, and colours mean amber, amber means emotions.

The dynamic and proper development of Polish amber jewellery design which is underway shows that amber should become a Polish export brand. The promotion of new design will place amber in fashion trends as Poland’s flagship product. The contemporary amber brand should continue its traditions and sustain the cultural continuity related to it.
THE AMBER MARKET

RAW AMBER OUTPUT

Comprehensive study of geological setting and mineral potential of Górka Lubartowska amber-bearing deposit (district Lublin)

LECTURE

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Examinations conducted up till now in the field of prospecting researches of amber accumulations are quite classical and delimited to widely applied for many years analytical methods. That is why, one of the major issue of presented case study was to work out the modern methodology, which allows to integrate important geological information layers, that determine mineral potential and mining availability on the needs of rational deposit management. Presented outcome determines the most profitable area of "Górka Lubartowska" amber deposit.

3D geological models represent the highest level of data integration and therefore provide a knowledge synthesis of geological setting of studied area. Interoperable environment of geological modeling software enabled to combine several sources of both surface and subsurface geological data to construct comprehensive 3D model of stratigraphic framework and facies architecture of Upper Eocene Górka Lubartowska amber–bearing deposits.

The latest advancements in geostatistical modeling techniques of complex reservoirs were combined in hierarchical order to reconstruct facies relations and spatial distribution of amber–grade of Paleogene deposits. Additionally, several 1D statistical (such as variogram and vertical trend curve) and stochastic (Markov chain) approaches were applied to develop a conceptual model that describes architecture of amber distribution. Several strucutes of amber occurrences were distinguished, such as lenses. Model examinations revealed that distribution of grain size and grades of amber are conditioned by facies spatial architecture.

General overview of depositional trends of Paleogene basin of Polish Lowlands were investigated using vertical proportion curves determined on the basis on large basin–scale modeling and lithological profiles gathered from diverse geological databases of Polish Geological Institute. Sequence stratigraphy interpretation based on diagram of vertical depositional trends revealed that amber bearings in the vicinity of Górka Lubartowska were deposited during the period of relative maximal sea–level when the land–derived terrigenous sediment transport was limited.

The three–dimensional stochastic models of facies architecture revealed the presence of elongated and gutter–shape sandy lithofacies in the transverse cross–section, shaped as glauconite silty and fine–grained sands, developed within glauconite sandy silts. The above mentioned isochronal facies are covered by discontinuous beds of silts clays sporadically intercalated with organic matter. The presence of this erosion event was also noticed at basin–scale diagram of vertical depositional trends. Similar facial architecture but in smaller observation scale was presented by K. Jaworowski who proved the presence of elongated zones characterized by the presence of thick sandy sediment sequences elongated perpendicularly to hypothetical Eocene shore in Pomeranian area.

Applitaction of two scenarios that assume different chronostratigraphy correlation and geostatistical algorithms based on Monte Carlo Simulation allowed to conduct the uncertainty assessment. In general, observation scale constrained by distance between wells was sufficient to determine facies relations and sedimentary environment in contrast to reconstruct the spatial distribution of amber grade.

In the presented case study, the attention was paid to add the geological conceptions as much as it was possible by application of secondary data such, as 3D probability cubes in order to make model consistent with sedimentological interpretations and expectations of geologist.
ECONOMY, TRADE

The market requires promotion measures. The “Not Only by the Baltic Sea” exhibition at the 2012 Gold Silver Time trade exhibition, Warsaw

POSTER

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The exhibition and publication entitled Amber. Not only by the Baltic Sea are part of Poland’s amber promotion programme and are complementary to the amber promotion measures taken by the City of Gdańsk and the Amber – Treasure of Poland Consortium, which is carrying out a three-year promotion programme for the jewellery and amber industry at the behest of Poland’s Ministry of Economy.

Promoting the “Gold of the Baltic” is one of the more important objectives of the MCT International Fair Centre which organises the GOLD SILVER TIME trade show. Based in Warsaw, which perpetually remains Poland’s cultural and business centre, the GST trade show has a lot of opportunity in this regard. Amber has been invariably present in Poland’s capital city for 13 years now, while our exhibitor numbers – manufacturers, fine artists and designers – are growing systematically.

The exhibition on Amber. Not only by the Baltic Sea is the pinnacle of the collaboration with the PAS Museum of the Earth in Warsaw, which has continued since 2001, and was inspired by Prof. Barbara Kosmowska-Ceranowicz. A unique project entitled Museums at the Fair was developed, under which a series of focused exhibitions were presented as miniature museum displays which were available to the public of several thousand during the three days of the GST show (see the list of events). The aim of the project is to further the knowledge about amber. We show the most interesting specimens and present the latest research, raw amber production issues, archaeological artefacts, 19th and 20th cent. heritage items and contemporary amber art.

Amber. Not only by the Baltic Sea is a retrospective exhibition which presents the achievements of amber artists from southern and central Poland. As a background to contemporary artists, jewellery manufacturers, schools, museums and galleries, we present amber traditions with prehistoric workshops, the history of raw amber exploration and extraction in Poland’s region of Kurpie and in the River Narew basin. It is a fascinating example of the most important achievements in amber art created across the centuries, which makes the public aware of our historical heritage.

GOLD SILVER TIME endorses a consistent strategy for amber promotion in Poland, where amber still has some untapped potential. It enjoys sentimental attachment and prestige, there is the awareness that it is a Polish brand but amber products are bought mainly by people from abroad. Amber jewellery does not rank high as jewellery of choice with Polish women. We hope that this will change. GOLD SILVER TIME is the key moment when to meet the best of the market, trade customers and especially to meet women from the world of culture, politics and show business whose opinion matters. Amber still requires promotion measures in the Polish market.

List of amber promoting events, organised in 2001–2012

2001
- Exhibition: *Men’s Amber Jewellery from 4000 Years Ago in light of the Ząbie Discovery*, by Katarzyna Kwiatkowska, PAS Museum of the Earth, from the collection of the Warsaw University Department of Archaeology

2002
- Original artwork display by Mariusz Drapikowski: *The Millennium Monstrance*

2003
- Exhibition: *The Amber Drop*, by Barbara Kosmowska–Ceranowicz, from the collection of the PAS Museum of the Earth, Warsaw
- Exhibition: *Amber in Poland’s region of Kurpie*, by Jerzy Jastrzębski, from the collection of the Northern Mazovia Museum, Łomża
- Photography exhibition: *The Amber Altar at St Bridget’s Basilica, Gdańsk* (photographs from M. Drapikowski’s archive)

2004
- Exhibition: *The colours of amber*, by Krystyna Leciejewicz, from the collection of the PAS Museum of the Earth, Warsaw

2005
- Exhibition: *Amber plants*, by Alicja Pielińska, from the collection of the PAS Museum of the Earth, Warsaw
- Original artwork exhibition by Maryna Lewicka–Wala: *Amber Jewellery Collections*, from the author’s collection

2006
- Exhibition: *Baltic Amber versus the World’s other fossil resins*, by Barbara Kosmowska–Ceranowicz, from the collection of the PAS Museum of the Earth, Warsaw

2007
- Exhibition: *Animal Amber Inclusions in Jewellery*, by Janusz Kupryjanowicz, from the collection of the PAS Museum of the Earth, Warsaw
- Presentation: *The amber forest and how inclusions came to be*, by Elżbieta Sontag, from the collection of the Gdańsk University Museum of Amber Inclusions

2008
- Exhibition: *The amber nugget*, by Barbara Kosmowska–Ceranowicz, from the collection of the PAS Museum of the Earth, Warsaw
- Original artwork display by Mariusz Drapikowski: *The Heavenly Jerusalem Triptych*

2009
- Exhibition: *Amber. What We Wore and What We Wear*, by Katarzyna Kwiatkowska, from the collection of the PAS Museum of the Earth, Warsaw

2010
- Exhibition: Gdańsk – The World Capital of Amber, Gdańsk City Hall
- Exhibition: *Amber’s Oldest Travels*, by Barbara Kosmowska–Ceranowicz, from the PAS Museum of the Earth Warsaw Amber Collection

2011
- Exhibition: *Amber in Poland’s Prehistory*, by Katarzyna Kwiatkowska, from the PAS Museum of the Earth Warsaw Amber Collection

2012
- Publication: *Amber. Not only by the Baltic Sea*, by Prof. Barbara Kosmowska–Ceranowicz and Wanda Gontarska (Eds.)
Ever since the dawn of settlement on the Baltic coast, Baltic amber was recognised by the local tribes as medication, an ornament or an amulet that sculpted easily into ritual figurines.

In Etruscan times, and later in the Greek and Roman era, it became an object of desire in distant lands. It would be set in gold, intricate luxury items would be made of it, raw amber would be sought on expeditions into Europe’s far north, with the lands crossed along the way drawn into the orbit of trade exchange. Roads were built, experience was exchanged, people got rich – the legend of the Amber Route was born.

Amber is a fossil resin classified as an organic mineral, crafted by amber craftspeople into a gemstone, an object of desire for jewellery lovers and collectors alike, and today also for researchers who find traces of long gone nature in it.

From the 1950s, amber products were exported from Poland by means of very narrow and privileged channels, often by Poles, Russians, Ukrainians and Lithuanians who knew how to operate in strictly confidential relations with manufacturers.

Since the Amberif trade show was introduced in 1994, these contacts have become available to entirely new businesses and individuals; the amber industry began to develop very dynamically, or even exuberantly. Amber craftspeople, who had often worked cottage–industry style, were rapidly gaining independence and opening their own workshops.

Poland’s 2004 accession to the European Union broke down even more barriers by simplifying procedures of commercial exchange and by strengthening the sense of security among business people who today come to Amberif from more than 50 countries. Over the last three years, the most represented countries have included Canada, Hungary, Latvia, China, Czech Republic, USA, Italy, France, Russia, the UK
and Germany. Tradeshow statistics reflect the market trends – hence, the years of economic downturn in the USA have resulted in a drop in the number of visitors from that region, with a parallel increase in the number of trade visitors from China. Still, invariably, the greatest numbers of visitors come from EU Member States.

For years, any figures about the volume and value of amber product exports from Poland have only been estimates, as no statistical data is collected in this respect. Products are often taken out of Poland directly by the buyers who, due to the unique character of each piece of amber, personally select the jewellery they buy. Until recently, courier companies were reluctant to accept amber as jewellery shipments due to its high insurance value. Once the borders were opened in 2004, amber products have been in free circulation within the EU. The experts of the International Amber Association estimated the value of the 2000–2004 exports of Polish products made of silver and amber at about USD 300 million, but the years that followed brought repeated economic crises. At first, this was due to the Polish zloty’s very low exchange rate and in subsequent years – due to the shortage of raw amber, resulting from the decrease in raw amber production in Sambia (Kaliningrad Region, Russia) and the introduction of customs barriers between Russia and the European Union. The Lithuanians, who were able to establish better relations with Russia, took over a considerable share of the trade in both raw amber and amber products. The last three years were a time of downturn which began in the US, to soon reach the European markets. It was also experienced by several Polish jewellery manufacturers.

The current instability is sustained by the shortage of raw amber, especially its larger fractions (even those above 23 mm) which constitute only 18.1% of the Sambia deposit (according to Z. Kostyashova 2007). In the Kaliningrad Region there is an ongoing discussion about the ways to use amber to the greatest benefit of the region’s population. In Poland, licensing for amber exploration has stopped so the potential deposits in the Pomerania and Lublin regions are not mined. Ukraine’s output from the Rivne and Klesiv deposits, under private licences, is lower than expected; Ukraine is also trying to find efficient ways to develop its own manufacture of amber jewellery and objets d’art.

In this complex situation, Poland’s ambition is to maintain its leading position in the global amber market which, although somewhat of a niche, still has its followers in more than 50 countries worldwide. Polish manufacturers show a clear interest in introducing additional jewellery products in gold and silver decorated with gemstones other than amber. In 2008, Poland ranked 11th among global jewellery producers and 3rd in Europe, after Italy and Germany. It is estimated that within 8 years Poland may move up to the top 10 in global jewellery production (source: Gdańsk Institute for Market Economics 2008).

The International Amber Association estimated the 2010 value of Polish production of silver jewellery with amber and other gemstones at EUR 200 million per annum. Our most important business partner is the European Union where more than 42% of Polish jewellery with amber is sold; it is followed by the US and Canada – about 8%, China 5%, Russia 2% and other countries including the Middle East and Australia.

Poland has specialised in making silver jewellery based on the raw silver mined in Poland by KGHM Polska Miedź SA, which is currently the world’s largest copper supplier, with 1260 tonnes of silver output in 2011.

Basic share of Polish jewellery is made of this silver but Polish producers also buy silver abroad, mainly in Germany, Denmark and Austria. During the time of prosperity, many businesses made investments in machines – technologies imported from Japan, Germany and Italy – and Polish-made equipment or machines well-suited for finishing amber also readily bought by manufacturers from Poland’s neighbouring countries.

In the 1960s and 70s, faced with a total lack of access to gold and restricted access to silver, Polish artists and craftspeople developed interesting design and exquisite forms of silver settings for amber. They created a style and worked out the principles for combining warmly coloured amber with cold and metallic silver to break with the historical tradition. This way, Poland’s isolation under the Communist regime gave an interesting impulse, further developed in the post–Communist era of the bull market in the 1990s and early
2000s by the ever increasing number of amber companies and individual artists. Today, progress is measured by contemporary design, aided by crfts and a computer software.

The time of economic hardship is when businesses look for a new place in the market, for design that is price– and material–conscious and for ways to tap into the customers’ preferences and emotions. With their products, Polish manufacturers are aiming at the jewellery sector’s high end, having rightly assumed that a price battle with low labour cost countries cannot be won. Just as jewellers from Germany or Italy, they focus on quality, design and on building the national brand.

Building the brand involves certain necessary marketing activities which cannot be afforded by individual manufacturers. In 2011, following the International Amber Association’s application submitted as a response to a call for proposals announced by Poland’s Ministry of Economy, the jewellery and amber industry was qualified as one of 15 sectors to participate in an export promotion program which covers a number of projects developed together with the jewellery and amber community.

![Graph showing funded applications and remaining funding](http://www.mg.gov.pl/files/upload/10300/wykres.png)

**Source** http://www.mg.gov.pl/files/upload/10300/wykres.png

The objectives of the systemic project “Promotion of the Polish Economy on International Markets” carried out by Poland’s Ministry of Economy under the Innovative Economy Operational Programme (IE OP) include supporting export development in the industries covered by the project, with 12 mln zlotys net allocated to the amber and jewellery industry. The project was awarded to the *Amber – Treasure of Poland* Consortium established by the MCT International Fair Centre, Warsaw, the KIGB Polish Chamber of Amber Commerce, the S&A jewellery company and the MTG SA Gdańsk International Fair Co.

Up to 20 companies which have qualified for the programme will be refunded a significant part of the costs of participation in selected tradeshows worldwide, supported by an information and promotion campaign, although the programme’s benefits will be experienced by the whole sector.

New design trends, jewellery workshops with international designers, fashion shows, publications and the Symposium, in which we are now taking part, are all supported by the programme as well. Over a 3–year horizon, the programme should provide new development impulses and yield specific economic benefits, having taught us how to achieve synergies from well thought–out and future–oriented measures, such as, for example, the Amber Delta cluster initiatives.

There are many tasks which could support the international promotion of amber globally, most importantly the establishing of a quality control system for amber and the observance of clear terminology
required by international gemmology and jewellery organisations to provide customers with complete knowledge of the material used to make amber jewellery.

Only a natural amber stone, not subjected to any treatment other than cutting and polishing, should be referred to as natural; any thermal or chemical treatment qualifies a stone to being referred to as modified. In line with CIBJO recommendations, confusing names such as “genuine amber,” sometimes used to describe pressed amber, must not be used.

More and more often, gemmologists request the information on the deposits (geographical names of the place or country of origin) and on the methods used to obtain the raw materials which make up the marketed product, in order to be in line with the Fair Trade movement, which does not want to support illegal organisations, child labour, terrorism or other publically unaccepted social phenomena.

Since 2001, the Amber Laboratory has been operating during the Amberif and Ambermart trade fairs in an attempt to support the building of consumer trust when purchasing amber. The Gdańsk University of Technology Chemical Faculty, in turn, is an important research stronghold in confronting the ingenuity of those who try to compensate for the shortage of raw amber by using synthetic resins or forgeries made of mixtures of other subfossil resins.

Likewise, Amberif’s meetings of scientists whose opinions are based on reliable knowledge and research, the exchange of information and experience, the often heated discussions on the subject make it possible to analyse the state of the knowledge and confront it with the market’s needs and realities – to serve us all in furthering our knowledge and gaining a better understanding of the treasure which we deal with in our work – a fascinating drop of amber which encapsulates the whole world.
THE INTERNATIONAL AMBER RESEARCHER SYMPOSIUM.
“AMBER. DEPOSITS-COLLECTIONS-THE MARKET”.

Script Publisher:
Gdańsk International Fair Co.
Amberif 2013
SCIENTIFIC PARTNERS:

Polish Academy of Sciences Museum of the Earth, Warsaw

Castle Museum, Malbork

Museum of Amber Inclusions University of Gdańsk

Amber Museum Branch of the Gdańsk History Museum

The International Amber Association

Gdańsk University of Technology - Faculty of Chemistry

University of Gdańsk