

A semi-precious stone proves very precious to science

Treasure of the North



Prof. Wiesław Krzemiński,
Director of the Museum
of Natural History,
an amber enthusiast
and exhibitions organizer,
studies the fauna
found fossilized
in amber specimens,
especially insects

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Over thousands of years, amber has been used for decoration and as a kind of currency, magical substance, and medical cure. Coveted to this very day, amber has now become more than just a pretty stone – it holds sensational secrets for biologists



Krystyna Nykiel,
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of amber exhibitions,
and the conservator
of a collection
of amber specimens
and fossilized insects

The Ice-Age glaciers receding from Poland, leaving behind vast quantities of sand and erratic boulders, also peppered the country with deposits of amber, the greatest treasure of the north. This fossilized resin, a product of the subtropical forests that covered what is now Scandinavia 40 million years ago, became a commodity much in

demand in ancient times – for thousands of years it was the main export product stimulating trade and development in North and Central Europe.

Amber is fascinating for its mysterious origin, for the fossilized animal and plant “inclusions” found inside it, and for the pine-resin scent it produces when rubbed intensively. Coming in a wide variety of shades, easy to work and relatively widely available, amber became a choice material for producing luxury goods. Yet for modern paleontologists, the millions of plant and animal specimens magnificently preserved in amber samples represent a unique opportunity to study the ancient forest ecosystem and climate.

Amber-adorned mammoth-hunters

When modern humans (*Homo sapiens sapiens*) reached the vast, as-yet unforested expanses of what is now Poland 40,000 years ago, they would from time to time discover bits of amber washed out of the glacial sands. The specimens that have been found amidst the camps of mammoth-

Depictions
of the goddess of fertility
(from the left):
a stone figurine
from the Paleolithic,
an amber figurine
most likely from
the Neolithic,
and a stylized
anthropomorphic amber
pendant from
the Neolithic



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hunters already show signs of primitive working. The oldest amber ornaments known from some 12,000 years ago are mainly poorly-worked amber chunks, most likely worn as amulets. Further climate warming led the main amber deposits along the northern Baltic coast to become exposed. Zoomorphic figures known from the Mesolithic (7,000–4,500 BC) represent true works of art.

This short article can do little to expound on amber's vast significance in the development of European trade and civilization, yet it is worth noting that amber was visibly present in all the cultures inhabiting this part of Europe for nearly 7,000 years.

In bronze and iron

Nearly all the cultures in successive epochs, i.e. the Neolithic (4,500–2,300 BC), Bronze Age (in Poland about 2,300–700 BC), and Iron Age (from about 800 BC), evidence a true fascination with amber. Amber-bearing artifacts, demonstrating extraordinary beauty, were the object of a brisk trade.

From the Neolithic, archeologists have discovered imaginative pendants, necklaces, human-shaped figures (called idols) and animal shapes, as well as entire amber-processing workshops (e.g. in the vicinity of Żuławy) containing large stocks of raw and partially-processed material.

In the Bronze Age, amber ornaments appear as far afield as in Greece, Egypt, and Mesopotamia. Trade routes stretched across Europe, running from Jutland along the Elbe and Rhine and from the eastern Baltic coast along the Oder and Vistula, all the way to the Mediterranean and Black Seas. Characteristic shapes include necklaces comprised of circular and hatchet-shaped pendants, and round beads mixed with bronze spirals. The Lusatian culture (from 1300 to 800 BC) produced numerous graves with urns containing the remains of amber-bearing bronze ornaments.

The Hallstatt culture (800–450 BC) of the Iron Age has in its western portion been identified with the Celts, who quickly took over most of the amber trade, spreading it through the west and south of Europe. Beautiful pins, clasps, bracelets, and lavish necklaces have been found from the period. The amber route running along the Vistula



A termite (*Isoptera*) preserved in Baltic amber. The occurrence of such insects signifies that a tropical and subtropical climate prevailed in Northern Europe in the Upper Eocene

valley, through the passes of the Western Beskids, and through the Orava and Spiš to the south of Europe revived considerably at that time.

The Goths, who for several hundred years occupied areas ranging from the lower Visula valley to Ukraine, gradually came to control the amber routes and also produced their own beautiful ornaments of bronze, iron, silver, and large quantities of amber. The amber trade presumably laid the foundation for their rising military power.

A particular predilection for amber was shown by the Romans. In their vanity they believed themselves to be the first to appreciate its beauty and value, and in the period of 25–375 AD they mounted numerous expeditions to obtain it. For example, preserved records mention an amber-seeking expedition and games organized by Nero in 63 AD.

The onset of the Middle Ages (6th–15th centuries AD) brought great shifts in European populations. Trade with Rome ceased, and the traditional amber routes slowly died away.

Window on the past

Nowadays, amber's value and interest no longer lies solely in its use for decorative purposes. Baltic amber is now highly prized by natural history museums and private collectors, amassing vast collections of amber inclusions. Yet fossilized resin still guards many secrets.

The incredible concentration of amber deposited along the southeastern Baltic coast is a truly phenomenal natural occurrence. In the former USSR, up to a thousand tons of amber were mined each year! The accumulation of such quantities was made



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The presence of this oak inflorescence in Baltic amber (left) confirms that oak trees were a frequent component of the Eocene "amber forest." Adult specimens of the stone fly (*Plecoptera*) are rarely found fossilized in Baltic amber (right)

possible by the vast production of resin in Eocene forests. Most of the amber currently available is about 40–45 million years old.

Amber offers us a true "window on the past": millions of excellently preserved inclusions, mainly delicate invertebrates (insects, arachnids, myriapods, crustaceans, and others), plants, and more rarely traces of vertebrates (hair, feathers) or even whole organisms (e.g. lizards).

The first true scientific descriptions of the flora and fauna preserved in Baltic amber appeared in the early 19th century. It came as a great surprise for the first researchers to find relatively numerous groups of animals in Baltic amber whose modern-day representatives now live in tropical and subtropical climates. Of course, this fact considerably complicates such research, yet at the same time it makes Baltic amber fauna all the more intriguing, showing us a world of European nature entirely different from what we know today. Many groups of animals have turned out to have a completely different range of occurrence in the Tertiary than previously thought, and certain ones considered to be endemic to particular zoogeographic regions were in fact widespread in the world in the past.

Amber continues to surprise and amaze us. Some higher taxons of insects were first described from Baltic amber fossils, and only later discovered to be alive in

the modern natural world. This was the case with *Tanyderidae*, a primitive family of dipteran flies. A true scientific sensation was caused in 2002 by the discovery of an entire new taxonomic order of insects, dubbed *Mantophasmatodea*. Entomologists were additionally shocked to discover that representatives of this order have indeed survived into modern times, such as in the dry regions of southern Africa.

But a fraction

Unfortunately, of the millions of preserved inclusions, only a microscopic fraction of them ever reach museum collections. Suffice it to note that all the museums in Poland hold only about 40,000 specimens, including some 7,000 held by the Museum of Natural History of Polish Academy of Sciences in Kraków. For a country that takes pride in being at the center of amber trade and production this is a less than modest showing. Moreover, these collections have been put together mainly thanks to such collectors and enthusiasts as Jacek Serafin, Mariusz Gliwiński and the late Henryk Kulik, who despite the great commercial value of inclusion specimens donated part of their own collections without any financial reward. Unfortunately, the financial problems of research institutions in Poland and the underappreciated import of museum collections do significantly complicate the

development of serious amber collections, This is all the sadder in that many times more specimens are now in private hands than in all the museum collections combined, and are unfortunately mostly inaccessible to researchers.

The Museum of Natural History in Kraków, run by the PAN Institute of the Systematics and Evolution of Animals, has for more than 15 years been collecting amber inclusions, raw chunks, shading variations, and ancient and contemporary amber-bearing artwork. These collections are used to organize exhibitions extensively addressing amber's origin, explaining the importance of inclusions for scientific researchers, and showing how amber was ever-present for thousands of years in the cultures of the people who inhabited the Polish lands. The collections likewise serve as the object of paleontological research – as the basis for dozens of published scientific papers containing description of new taxons of fossil insects within the taxonomic orders of coleopterans, neuropterans, mecopterans, and especially dipterans. Work is currently underway on a comprehensive (monographic) description of fossilized flies from such families as *Tanyderidae*, *Trichoceridae*, *Limoniidae* and *Anisopodidae*, pooling together our knowledge of fossil species from the moment of their appearance on Earth until the present day, and demonstrating how the evolution of these groups of insects proceeded and how their distribution on the Earth has varied.

That such research is recognized and esteemed in the world is shown by our involvement in international programs. Currently, the first author of the present article is the coordinator of a Polish group of paleontologists taking part in researching fossil insects as part of a project entitled “The terrestrial fauna and flora of the Insect Bed, Isle of Wight: interpreting the climate near the Eocene/Oligocene boundary” and the coordinator of an international dipterological group working under this program, led by Dr. Andrew Ross from the Natural History Museum in London (INTAS Project 03-51-4367).

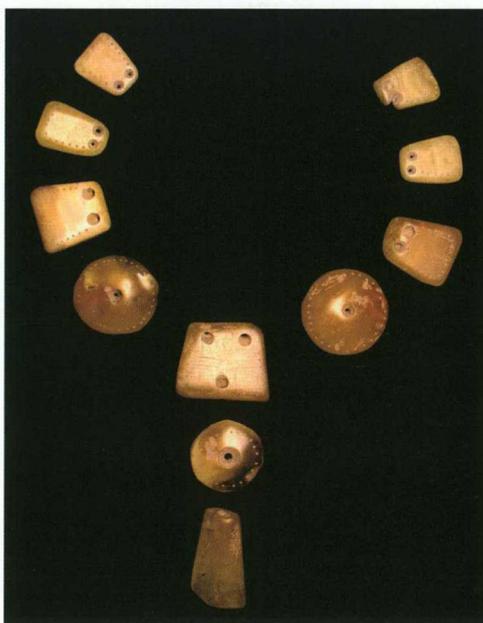
Baltic amber truly is a storehouse of secrets, and should be studied intensively – especially in Poland. This magnificent gift of nature has accompanied mankind

throughout the development of European civilization. For thousands of years, it motivated the trade routes that ran mainly across Polish territory, stimulating wide-ranging cultural and technological exchange. Even the small percentage of plant and animal inclusions that do reach scientists, in turn, are opening up an ever wider window on the Eocene world – showing the organisms and ecological relations that existed in the forests of the epoch and highlighting the ties between the fauna of 40 million years ago and the fauna of today. Amber will definitely continue to offer us many more new fascinating riddles to solve. ■

Further reading:

- Kosmowska-Ceranowicz B., Gierłowski W. (eds.) (2005). *Bursztyn – poglądy, opinie. Materiały z seminariów Amberif 1994-2004* [Amber: Views and Opinions – Materials from the Amberif Seminars 1994-2004]. Gdańsk-Warsaw: International Amber Association, PAN Museum of the Earth, Międzynarodowe Targi Gdańskie SA.
- Kaczanowski P., Kozłowski J. K. (1998). Najdawniejsze dzieje ziem polskich (do VII w.) [Earliest History of Polish Lands (Until the 7th Century)] in *Wielka Historia Polski* [Great History of Poland] (t. 1, pp. 1-382). Kraków: FOGRA Oficyna Wydawnicza
- Kosmowska-Ceranowicz B., Choińska-Bochdan E. (2003). *Z bursztynem przez tysiąclecia* [With Amber Through the Millennia] Gdańsk: Archeological Museum.
- Krzemińska E., Krzemiński W. (1993). *W bursztynowej pułapce*. Kraków: PAN Institute of the Systematics and Evolution of Animals.

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Nearly all the cultures in successive epochs evidence a true fascination with amber. Amber-bearing artifacts, demonstrating extraordinary beauty, were the object of a brisk trade. Here a necklace from the late Neolithic