

Constructing Wooden Images



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The origin, assortments and transport of Baltic timber

Introduction

Intensive building and particularly shipbuilding activity in medieval Europe caused deforestation and timber shortage in many areas. Wrobel et al. (1993) report that, for example, in Lübeck in the late Middle Ages no primary forest vegetation was left close to the city. Similar problems occurred in England and the Netherlands. Rackham (1982) wrote that according to Domesday Book, woodland covered only about 15% of England in 1086. At that time England, was less forested than France in the 20th c. Consequently, the first regulations concerning forest protection were introduced, which created a need for large-scale wood importation.

The first cases of long-distance timber transportation in northern Europe, observed using dendrochronology, are from Dorestad in the Netherlands (Eckstein et al. 1975) and Wolin in Poland (Wazny 2001). Both settlements from the 9th century were located close to the mouth of large river systems. Some of the timber used at these sites was transported from distant inland areas, probably by floating the logs downstream.

The connection of inland and sea trade and traffic in northern Europe by the Hanseatic League increased the range and intensity of trade connections. Also important were the later medieval advances in shipbuilding. The cargo capacity of the Hanseatic cog is estimated to be 90–100 t, and the 15th-century hold could carry approximately 300 t of cargo at the west-route, whereas the hold of the caravel of the late 16th century could be loaded with over 1000 t. The advances in navigation and the organisation of sea transport enabled transport of goods at a massive scale. Increasing load capacity of ships was based on their deeper submersion that caused necessity to reload cargo in bigger harbors.



Fig. 1 – Baltic Sea catchment area showing the potential region of oak supply for Western Europe (A square indicates a custom post that registered the trade along the Vistula).

Timber became one of the most important commercial products. Buildings and ships were the most important end-uses of timber. In England for instance, the ceiling of a cathedral roof contained several hundred oak beams of about 10 m length and a typical 15th century Suffolk house was made of some 330 trees (Rackham 1982). When traditional sources of large and straight timbers suitable for construction purposes began to decline, Western-European countries turned to the forest of the Baltic countries. In particular, vast quantities of timber were transported from the ports of the eastern Baltic Sea to western Europe.

The material exported from the Baltic ports was generally:

- coming from more than 300 km inland;
- floated down the river system to the ports;
- reloaded to large seagoing ships as cargo;
- resold in the big trade centres in western and northern Europe.

Written sources, for example custom records, confirm the former timber trade, whereas contemporary research methods, mainly dendrochronology, reflects its scale. As one of the most important dating tools, dendrochronology has recently also provided information about timber origin (Bonde 1997). The present capabilities of dendrochronology and the common points it has with art history are presented by Eckstein [Eckstein, 2005, this volume].

Where was the timber exported from?

Baltic countries located on the south coast were the primary source of timbers. Regular trade routes connected towns and harbours belonging to the Hanseatic League. The export of forest products initially involved the catchment area of the Vistula. At the beginning, this applied to the lands of the former Teutonic Order – mainly the catchment of the lower Vistula. As the demand for timber was growing, the supply from Pomerania and Prussia proved to be insufficient and at the end of the 14th century the more distant parts of Poland were becoming more and more important sources of timber (fig. 1).

In the early 15th century the major suppliers of timber were the densely wooded Masovia and Podlasie regions. The Vistula river and its tributaries provided the necessary means of transportation. Three harbours have been qualified for timber export: Gdansk/Danzig, Elbing and Königsberg, but rapidly the dominant position of Gdansk became apparent. During the 15th c. the entire Kingdom of Poland, bound by the catchment of the Vistula into one geographic unit, became an exclusive source of supplies for Gdansk (Lauffer 1893).

In the period of 1389-1415, the State of the Teutonic Order bought 1,481,096 1/2 pieces of timber, almost all in Masovia (Böhnke 1962). At the same time, timber from the Great Lithuanian Duchy appeared on the Gdansk market. About 1400, the Teutonic Order built the canal Pregel - Kuron Bay, creating a waterway from Kaunas to Gdansk. Lithuanian wood was transported to Gdansk, and then exported to a number of European countries. Until 1450, timber from the wild borderland to Lithuania was not used for commercial purposes.

Scientific evidence confirms the documentary evidence. The map presented in Figure 2 shows the origin of the 16th c. painted panels from

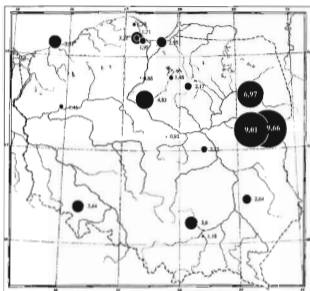


Fig. 2 – Map of Poland. Distribution of t-values showing similarity of the local Polish oak chronologies compared with art-historical chronology established by Crone (1998) for the painted ceiling of Guthrie Aisle/Scotland. T-value above 6.0 means very high similarity or tree-ring sequences.

the Scottish church Guthrie Aisles examined and dated by Crone (1998). Tree-ring analysis suggests that Eastern Poland – the Podlasic region – and most probably the Białowieża Forest or its vicinity was the timber-supplying region.

As a result of intensive tree felling for export and for local use, the natural woodlands of Masovia and central Poland were cleared to a large extent, so that in the early 16th century those regions were dominated by farmland. As early as the end of 15th c. the forested areas did not exceed 40% [Samsonowicz 2001]. Exporters of timber and forest products started to travel further east to the Great Lithuanian Duchy. The area from where wooden products were obtained expands from Gdansk-Pomerania

to a territory of thousands of square kilometres. The material could be easily floated down large rivers: Pregel, Nemunas and Daugava to the major Baltic ports: Gdansk, Königsberg, Memel and Riga. In 1565, 85% of wainscots exported from the Baltic ports were sent from Gdansk, but most of the material originated from the East. Consequently even art-historical objects of Gdansk masters from the same time contain mainly non-local wood [Wazny 2002].

The Polish-Swedish war from 1655-1660 almost completely destroyed the Polish infrastructure. After the decay of the Gdansk timber trade, the importance of Riga increased at the Baltic Sea [Zunde 1999]. The centre of the Baltic timber trade shifted to the north-east. Timber buyers also approached Scandinavia, and in particular Norway, the country which in the first half of 17th c. acquired the position of a great timber exporter [Bogucka 1982].

What was exported?

The timber trees in the Middle Ages were usually oak. Oak is highly durable and easily worked by cleaving. Many oaks in western Europe at that time were too knotty or crooked to be easily cleft.

Custom records from Wloclawek and Biala Gora [Weissberg] on the river Vistula [marked in Figure 1] provide the quantitative and qualitative evidence of goods transported down the river. They indicate that the floated timber was mostly composed of unfinished products and small-sized assortments. 'Thick' logs or beams were registered less often. For ease of transport it was advisable to make the boards close to where the tree had grown.

More than a dozen assortments were distinguished in the records. The shape, dimensions, use and price of some assortments was not mentioned, so we know only their names. Wainscots and staves (especially barrel-staves) were of primary importance in foreign trade. The records included also masts, oars, yew [for bow production] and many other wood sorts. From today's point of view the most important assortments are difficult to define or detail, because there are major differences between records devoted to them. The norms specifying the assortments, such as wainscot or staves evolved in the course of time. Changing units of measurement describing the quality and volume added to the confusion.

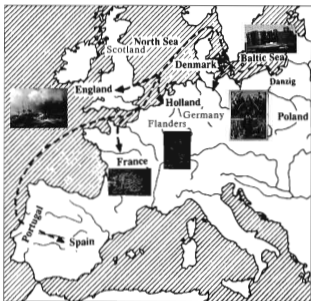


Fig. 3 – Occurrence of timber from South Baltic area in Western Europe.

Wainscot [wayneskot] means high quality oak boards. According Hirsch (1858) at the beginning of 15th c. they were 'produced from oak logs without knots, 10-18 ft. long and up to 30 in. in diameter. Logs were cut into 2-4 pith-free pieces and cleft into boards 10 in. wide'. In 1572 wainscot means 'boards of 10 ft. and more length and 1.5 ft. wide' (Rybarski 1928).

Clapboards [staves] were at the beginning of the 15th c. 'boards of at least 5 ft. long and 5-9 ft. wide' (Hirsch 1858), whereas in 1572 boards were '3 ft. long, 1 hand [ca. 4 in.] wide and 3 finger [ca. 3 in.] thick' (Rybarski 1928).

Timber as cargo has been found on board of a shipwreck discovered at the bottom of the Gulf of Gdansk. The ship has been named the 'Copper

Wreck', but apart from a large cargo of copper ingots, it transported also barrel staves and planks, probably for shipbuilding (up to 2.5 m long).

The wooden cargo of the 'Copper Woeck', dendrochronologically dated to AD 1405-1408, consist of:

- 79 boards – 236-252 cm long, 24-30 cm wide, 1.5-3 x 4-6 cm thick (trapezoid cross-section - *wainscot*)
- 200 staves – 79-85 cm long, 14.5- 16 cm wide, 1.2-2.5 cm thick.

To give an idea of the quantity of timber being transported, it is worth mentioning that in the years 1389-1415 the Teutonic Order bought in Masovia 1,005,388 pieces of wainscot [Böhnke 1962].

The wood assortments referred to above were usually made in the areas from which they were floated or transported on boats down the river to the Baltic ports. There is no dendrochronological evidence of large cross-section beams imported from Baltic ports to western Europe in objects dating from the 14th century and after mid 17th century [Bonde et al. 1997]. The first case was confirmed by Tyers [personal communication] as repairs of the Peterborough Cathedral from the end of 19th c.

When the significance of Gdansk in the Baltic timber trade was diminishing, new timber assortments appeared on Western European markets: Righolt (Riga Holz – timber from Riga) and Estrich boards (boards from the Estreich/ Estonia).

Where was the timber exported to?

Baltic timber was exported to all countries of Western Europe: from Denmark and Germany to Spain and Portugal (fig. 3). Major destinations and the intensity of export to particular countries was related to the political climate, as well as the evolution and organization of the Hanseatic trade system.

At the beginning of 13th c. Gdansk had close trading contacts with Lübeck, what is confirmed by the trading freedoms given to the merchants of Lübeck. Polish oak can be found in altarpieces of Lübeck churches [Eckstein, this volume]. In the 15th c. timber was exported principally to Holland, Scotland and England, and in small quantities to the islands of Gotland, Oeland, Bornholm, as well as to Denmark and almost all Hanseatic cities on the coast of the Baltic Sea and the North

Sea [Lauffer 1893]. The largest consumer of high quality timbers were the shipyards and the shipbuilding industry. Baltic oak wood was the most sought-after, especially for the building of fleets by the main European sea powers. Today it can be found in shipwrecks in probably all seas of the world.

In the 17th c. about 4,000 well-grown oak trees were needed to build a medium size merchant ship [Olechnowicz 1960]. The durability of the ship and its ability to navigate in difficult, stormy conditions required timber of particularly high quality. The secure life of such a ship was limited because of wars, storms, catastrophes or simple wood deterioration in an extremely wet environment. Portuguese ships for example could only survive four expeditions to Africa [Malowist 1968].

Dendrochronology enabled unquestionable identification of imported timber in numerous groups of objects: paintings, altar pieces, furniture, carpentry, room panelling, ships, etc. A very special category were barrels – medieval containers for different types of goods – produced in hundreds of thousands. Barrels made of Baltic oak are found in Western Europe, and alternatively barrels originating from the South or West of Germany were found in Gdansk.

How much did it costs?

Timber trade in the period discussed here was exceptionally profitable. The acquisition of the material costed almost nothing, the felling and transport costs were very low, on condition that waterway was chosen for transport.

To give a better impression of the costs of transporting depending on the means, Rackham's [1982] calculations for the passage of oak can be quoted:

- 50 miles by road
- 200 miles by inland waterway
- 500 miles by sea

for about the same cost (price relations valid in the period 1250-1450 for non-urgent loads).

The differences in prices for the wood were significant between Poland and Western Europe, as show in the Table 1, and susceptible to

rapid changes. Despite the efforts of Hanseatic cities to curb price rises, for example by introducing bans on the sales of ships or on the permission to built ships by foreigners, 'timber-famines was knocking at everybody's door' (Bernhardt 1872). Only in Poland a rapidly growing market for timber put the timber prices up twenty times in the course of 15th c. (Samsonowicz 2001).

Table 1 – Price of one 'greathundred' of wainscots and staves according to Hirsch (1858).

Assortment Region	Staves	Wainscots
Masovia	7-9 Mark	2-5 Mark
Lübeck	7-12 Mark	8-10 Mark
England	34 Mark	24 Mark

Time span – an attempt to calculate the difference between the date of tree felling and the date of wood application

Dendrochronological evidence confirms that Baltic oak was imported to western Europe until 1650-1670. Timber was floated down the Vistula mostly in two periods: March-May and September-December (Biskup 1952). In summer the intensity of river transport was low. The time needed for floating timber down the river was quite short – about three weeks – because the mean rate of water flow in the Vistula is about 3 km/h. When the water level is high, the rate of water flow can be even several times faster.

The historical documents of the Gdansk port show that navigation on the Baltic Sea usually started in March and reached a maximum in summer. An engraving from the 17th century illustrates the harbour of Gdansk (fig. 4). The navigation season ended in December or even in November. During mild winters the port was open nearly all the time. In 1403 the Hansetag introduced some limitations for safety reasons. Between St Martin's Day (11th November) and St Peter's Day (22nd February) navigation was banned, and any ship that did not respect this ban was confiscated with its cargo (Dollinger 1996).



Fig. 4 – Engraving showing the port on the river Motclau in Gdansk with inland-ships coming with cargo from Poland. Schuster and Lohrmann 1770.

It can be concluded that timber from trees felled in winter in the woodlands of Pomerania, Masovia and Podlasie could be found as wainscots and planks at the timber-yard in London, Antwerp or Amsterdam after several months.

Discussion

Dendrochronological identification of Baltic oak is in many cases the only evidence that has been found to confirm the massive timber trade. A growing number of very local master chronologies provides opportunities for studying both ends of the trade. For the western countries they enable us to identify imported timber, while for eastern Baltic countries they enable us to localize its origin.

The current possibilities may be illustrated by results obtained for panels from the already mentioned painted ceiling of Guthrie Aisle in Scotland. Dendrochronological evidence confirms the documentary and historic evidence and allows to precisely identify objects, particular construction elements, works of art or ships made of Baltic timber. Dendrochronology enables us to appreciate the massive scale and extent of timber trade in the past.

Currently the dendrochronological evidence of the former timber trade reflects mainly transportation of oak timber. Methods of den-

droprovenancing have also been applied for examination of imported conifer timber in England and trade connections with Scandinavian countries [Groves 1997]. High resolution chronologies are currently being developed in Poland, Lithuania, Latvia and Estonia. Chronologies for historic 'foreign' material have been constructed and refined in the UK, France, Holland, Belgium, Germany and Denmark. However, the grid of chronologies is still not dense enough and we can expect much more precise and in many cases surprising results in the coming years.

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Constructing Wooden Images

The symposium *Constructing Wooden Images. Organization of Labour and Working Process of Late Gothic carved altarpieces in the Low Countries* was organized in Brussels on October 25th and 26th 2002 by the Department of Art Sciences and Archaeology of the Free University of Brussels and the Laboratory of Wood Technology of the University of Ghent. The symposium was part of a methodological and interdisciplinary research project on the characteristics, evolution and socio-cultural significance of the carved altarpieces of Brabant (15th - 16th centuries) conducted by both universities from 2001 to 2004, in collaboration with the *Musées royaux d'Art et d'Histoire* in Brussels and the *Royal Museum for Central Africa* in Tervuren. The research of the project, and consequently also of the symposium, which had the intention of making public its provisional results, focussed on the socio-economic background of the considerable production of carved wooden altarpieces of the late Middle Ages and the early Renaissance in the Low Countries, especially in the old duchy of Brabant, and also on the actual construction of such works.

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