



# ANALECTA

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ARCHAEOLOGICA RESSOVIENSIA

VOLUME **18** RZESZÓW 2023

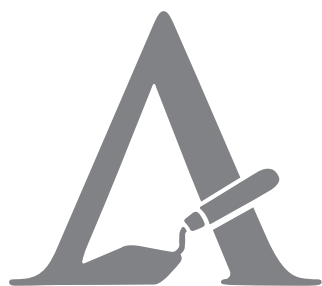


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Uniwersytet Rzeszowski  
Kolegium Nauk Humanistycznych  
Instytut Archeologii

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## Shipyard Archaeology in the Southern Baltic

### Abstract

Ossowski W. 2023. Shipyard Archaeology in the Southern Baltic. *Analecta Archaeologica Ressoiviensia* 18, 167–181

In the past two decades, the topic of archaeological studies of shipyard sites has regularly appeared in research devoted to maritime archaeology around the world. The closer attention of archaeologists to shipyard sites is due to the increased interest in studies of the maritime cultural landscape, ship graveyards, and coastal archaeology. The purpose of this paper is to review the problems of archaeological research of shipyard sites in the southern Baltic Sea and to compare these problems with previous research results from other regions. Seasonal or occasional sites for the building or repair of boats and ships have been created since the earliest times. Isolating such sites is often problematic since sleepers or simple wooden supports were sufficient for the construction of plank boats and the work was carried out in the open air. In the coastal cities of the southern Baltic, there is evidence for the existence of designated permanent shipbuilding yards, although without permanent shipbuilding structures, since the late Middle Ages. These were places in which a ship's carpenter received permission from the city authorities to use a particular section of the yard for shipbuilding in return for an appropriate fee. Structures used for construction were assembled each time to a specific order from the builder's materials and they could be dismantled after completion of the project. Archaeological research of the Gdansk Lastadia site remains the best recognized shipyard providing a more complete picture of the maritime cultural landscape of this southern Baltic city from the late Middle Ages to the 19<sup>th</sup> century.

**Keywords:** shipyard archaeology, maritime archaeology, logboats, slipway, launching method, Lastadia

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### Introduction

Over the past two decades, shipyard archaeology has become a frequent subject of maritime archaeology studies around the world. The numerous traces of these sites in archaeological material, both on land and underwater, typically include wharves, slipways, docks, warehouses, and the equipment and tools associated with the shipbuilding process. The increased interest of archaeologists in shipbuilding sites is due to a growing number of projects exploring the maritime cultural landscape, ship graveyards, and coastal sites. Consequently, shipyard archaeology has been discussed in both textbooks (Moser 2011) and in encyclopaedic studies of maritime archaeology (Harris 2014).

To date, research at these sites has produced a wide variety of data, making it difficult to contex-

tualise the results of most of the excavations (Moser 2011, 834). This is partly due to the fact that quay areas have undergone complete redevelopment and changes in function or urbanisation, as well as being exposed to the continuous dredging and widening of the channels to accommodate larger ships. Most of the shipyards explored by researchers are located close to ports in urban areas that are still in use.

Attempts to define shipyard archaeology have shown that there was great variation in the size of shipyards, the organisation of the boat- and shipbuilding process, and other ancillary functions performed by individual sites over the centuries. Some were located inland on rivers in smaller towns, while others served larger port cities and long-distance shipping. According to the definitions proposed in the archaeological literature to date, a shipyard, usually located



close to water and building resources, is an industrial site closely associated with labour history and contemporary socio-economic events. It is the vital link between the product – the ship – the manufacturer or shipbuilder, the community, and the environment in which the ship was designed to operate. There has been considerable variation in the sizes of shipyards, the services they provided, and the ways they carried out the primary functions of shipbuilding over time. Some were located inland on rivers in small towns, while others served larger cities and ports (Harris 2014, 6614). However, it is difficult to agree with the limited understanding that a shipyard was a place where ships were produced industrially. The dictionary definitions of the term “shipyard” suggests that it was a place where ships were built, rebuilt, repaired, or dismantled, whether this was done on an industrial scale or by skilled carpenters. A variety of factors resulted in the transformation of traditional building sites into permanent production yards.

Thus far, studies of historical shipbuilding in Poland have emphasised that, apart from the aquatic conditions, access to building materials, or technological advancements, other factors such as the organisation of shipping and transport needs significantly influenced the design of ships. The issue of boat- and shipbuilding, i.e. the construction centres and their location, the level and methods of production, has not been elaborated further.

The aim of this paper is to review archaeological research of shipbuilding sites in the southern Baltic Sea region and to compare it with the results of research in other regions. The choice of the geographical area is due to the fact that changes in boat- and shipbuilding and maritime exchange followed a similar pattern along the coast from the Bay of Lübeck to the Vistula Lagoon, and thus far there have been no attempts to conceptualise the archaeological research of shipyards.

### Logboat building sites

Among the oldest boat finds from this area are boats made from a single tree trunk – logboats. Although the importance of this type of boat in maritime transport since the earliest times, i.e. the formation of the Baltic Sea after the last glaciation, is widely recognised, there are few finds of this type dating from before the early centuries of the common era (Szymczak 1997; Lanting 1998; Ossowski 1999). A complete account of discoveries, published in the late 20<sup>th</sup> cen-

tury, has been supplemented by a few recent discoveries (Kontny 2021).

Nevertheless, some isolated sites have been identified as dugout building sites, allowing us to better understand how those vessels were made.

A stone axe-making site was discovered during excavations in the town of Rzucewo, Puck district on the shore of what used to be a lake and is now the Bay of Puck. The site consisted of a cobbled yard paved with medium-sized pebbles and large boulders used for grinding. Situated by the former shoreline, it was 70 metres long and 10 metres wide. The boulders bore traces of the grinding of pebbles into axes and hatchets. About 100 pre-processed stone axes and fragments of axes were found at the site. The accumulation of boulders and grinding stones and large quantities of wood chips suggest that the site was used to make dugout boats. Horizontal beams used to access the lake were uncovered next to the yard, as well as poles vertically installed in the ground, possibly for mooring boats closer to the settlement. <sup>14</sup>C dating suggests that site may have been used by the first fishermen and hunters to settle on the Rzucewo Cape in 3800–3700 BCE (Król 2016; 2018).

Another example is the Early Iron Age site in Luzino, district Wejherowo. During the archaeological excavations of a Pomeranian settlement from the 7<sup>th</sup>/6<sup>th</sup>–5<sup>th</sup> centuries BCE, archaeologists came across an oval object 6.28 m long and 0.64–1.08 m wide. It was identified as the remains of a dugout canoe with a slightly rounded, truncated stern and a narrow bow (Wiącek 1974). Next to it, there were hearths and pits, probably used for storing water, which was necessary to control the firing process. These finds suggest that heated water may have been applied to forcibly bend the sides of boats (Wiącek 1974, 270).

### The oldest plank boats

As well as log boats, plank boats similar to the Nydam boats and associated with the presence of Germanic tribes, were already in use on the southern Baltic coast in the early centuries of the common era. Frames discovered during a survey of the underwater archaeological site at Puck (Fig. 1) shed new light on the discussion about the oldest plank boats on the southern Baltic Sea (Stępień 1986, 82–83). The frames are two oak ribs with a worn, tattered outer edge, and a sharply-edged cross-section with hole marks. These items are probably fragments of ribs cut from curved branches and lashed to hewn plank cleats with withes. This technique was characteristic of Scandinavian

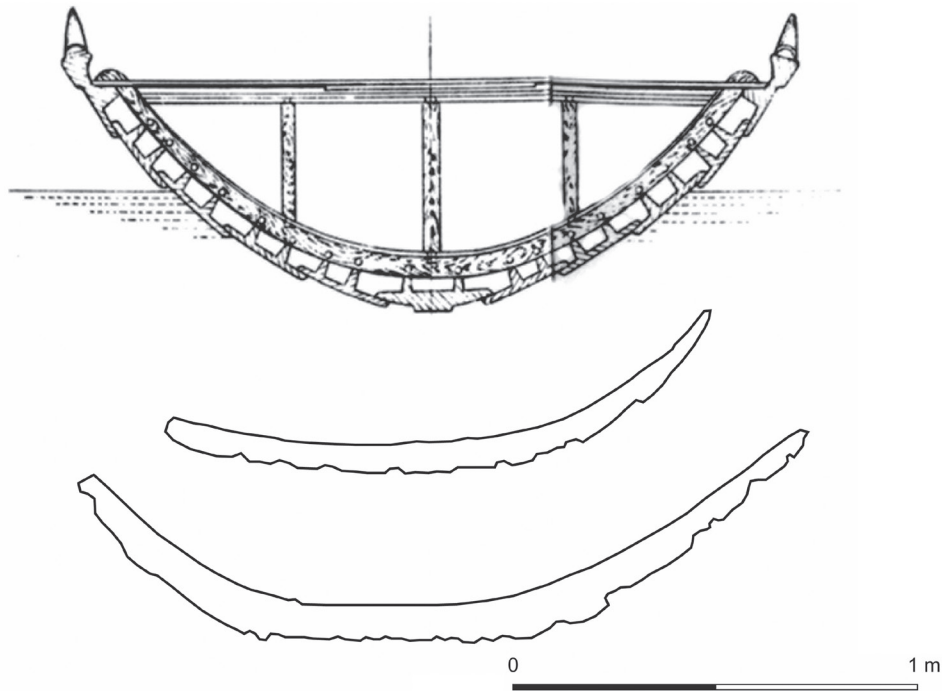


Fig. 1. Cross-section of a boat from Nydam from the 4<sup>th</sup> century BCE. (top) and outline of two Roman period frames discovered in the Bay of Puck (bottom) (drawn by W. Ossowski).

boatbuilding that originated in the 4<sup>th</sup> century BCE and continued to be applied until its gradual decline in late 8<sup>th</sup>/early 9<sup>th</sup> century CE (Kontny 2023). Radiocarbon dating indicates that the finds come from the Roman period (Ossowski 2010, 169).

It is currently difficult to say anything more about the context of these two isolated finds, whether they come from the wreck of a plank boat, a site where such boats were made or repaired, or, as at Nydam, they are a destroyed sacred deposit. Due to the progressive destruction of the underwater cultural layers of the Puck Bay site in recent decades, it is impossible to determine the context of the finds.

In connection with the discovery of frames, it cannot be ruled out that they are evidence of shipbuilding or ship repair on the coast. Studies from other regions of the Baltic Sea indicate that such shipbuilding and commercial activities were located in the same place during this period. Denmark's oldest trading centre at Lundeberg on Funen is worth mentioning in this respect. The small trading centre of Lundeberg was strategically placed on the coast of Funen, where the River Tange runs out into the Great Belt, around 3.5 km from the halls at Gudme. Traders could easily come directly to the site, then set up camp and trade. The trading place was only used in particular seasons (spring, summer, and early autumn). No traces of all-year-round habitation, such as post holes from dwell-

ings, have been found. It is assumed that instead the traders lived in tents during "the market period". The archaeological evidence indicates that various activities took place in and around the marketplace at Lundeberg in the 3<sup>rd</sup> and 4<sup>th</sup> centuries CE. In all, around 180 Roman coins were found at the trading centre, together with a number of gold and silver bars, silver fragments, and weights. These are all items that must have been used by the traders at Lundeberg. Presumably many traders sailed to the site and several thousand new and used ship rivets from clinker-built ships have been found at Lundeberg. It may be that the location included a shipyard for the repair and building of ships (Grimm and Pesch (eds.) 2011).

### The Early Middle Ages

In the early Middle Ages, Slavs developed boat- and shipbuilding on the coasts of the southern Baltic Sea. To date, more than a dozen wrecks of early medieval vessels, now identified as Slavic boats, have been discovered in Poland. These finds, as well as numerous similar boats excavated in the Baltic coastal areas of present-day Germany and Scandinavia, prove that shipping was important for Slavic people in that period. Their boats had low keels, flat bottoms, overlapping planks joined with wedged treenails and caulked with moss. This is different than Scandinavian boats

and ships, in which the planks were caulked with strips of animal hair and the planks were fastened together with iron rivets. The structural features of the wrecks suggest that they were used in both local shipping and military operations (Indruszewski 2004).

Archaeological discoveries also confirm permanent Scandinavian settlement in the southern Baltic Sea – excavations of trade and harbour settlements in Truso and Wolin uncovered numerous boat-building remains such as fragments of staves, frames, rivets or boat outlines in archaeological trenches (Jagodziński 2010, 115–126; Filipowiak 2022).

The largest number of artefacts confirming the existence of a permanent site for the repair and construction of plank boats were discovered during the excavation project of a trading emporium in Wolin. The coastal area of the main settlement on the Dziwna River is believed to be the location of the oldest shipyard on the Baltic Sea, dating back to the late 9<sup>th</sup> century (site no. 1, dig 4). This is evidenced by the discovery of unique items at the site such as: the base of the winch to haul vessel ashore, as well as fragments of planks, an anchor, and a thick layer of wood waste (Filipowiak 1994, 84–91). Boats may have been built at that location for generations, judging by the discovery of an unused mast step from the early 10<sup>th</sup> century, an unfinished stem from the early 11<sup>th</sup> century and a thick layer of wooden waste from the early 12<sup>th</sup> century (Filipowiak and Filipowiak 2014, 369). Admittedly, these finds seem to be strong evidence that there was a shipyard at this site, despite the dense development in the centre of the emporium.

More recent studies indicate that the inhabitants of Wolin built plank boats as early as in late 9<sup>th</sup> century, somewhere in the area of digs 4 and 8, whereas the main construction yard was probably closer to the riverbank. It is likely that two types of storage methods were used in Wolin: pre-processed elements were kept in the water and, after processing, they were stored in the space between the huts (Filipowiak 2022, 216–220).

An extremely interesting discovery was made on the Danish island of Falster in 1981. In the town Fribrødre Å, known in the 17<sup>th</sup> century as Pribrod, meaning ‘by the ford’, traces of a Slavic settlement and remains of a permanent ship-repair yard dating back to the 11<sup>th</sup> century have been found. To date, only a section of the shipyard closest to the river – right by the ford – has been uncovered. Various construction elements and tools have been found there, as well as cuttings, wood chips, etc. The site may have been used to repair ships in Scandinavian fleets before a naval

invasion of the southern Baltic. Rather than serving as a permanent site for the production of ships, it was used now and again to prepare naval fleets (Skamby Madsen and Klassen 2010).

Although not many sites are identified as permanent shipyards, numerous finds related to the production of boats and ships have been found in coastal pre-urban settlements of the 10<sup>th</sup> to 12<sup>th</sup> centuries, located at the estuaries in the Baltic Sea, such as Szczecin, Kołobrzeg, and Gdańsk. Large quantities of detached planks, frames, keels, treenails, caulking material, or ceramic vessels with traces of tar found near the houses suggest that their inhabitants engaged in boat building. Most of them probably just repaired their vessels, but it is likely that the more experienced among them knew how to construct larger boats, which were not only used for fishing but also for inland and sea transport. The clinker boats of the time, made of overlapping planks, could also have been used for a variety of purposes.

Apart from boat fragments, various boat-making tools serve as additional evidence for shipyard activity. Most of the tools discovered there, such as axes of various types and sizes, hatchets, skewers, carpentry clubs, wedges, augers, or knives, can be classified as general-purpose carpentry tools. However, during archaeological excavations in Gdańsk in the 1950s, three specialist boatbuilding utensils were discovered, namely wooden clamps that supported the planks as they were fastened together with wooden pegs or iron rivets during the hull formation stage using the shell method (Fig. 2). The boatbuilders’ work, due to its nature, was done outside the town, although some things, such as cutting the wooden pegs needed in large quantities for boat building, could be done within (Ossowski 2010, 149–150).

The same was the case in Szczecin, where a considerable number of remains of plank boats, fastened with wooden pegs and sealed with moss, were excavated. Because of the substantial volume of the finds of this type, researchers believe that boatbuilding was one of the production areas that developed on the outskirts of the early urban centre of Szczecin. According to E. Cnotliwy, recent discoveries suggest that at least some of the inhabitants of the riverside district were hired as boatbuilding labourers or manufactured some of the components necessary for the construction of vessels. This can be inferred from the discovery of piles of wooden treenails used to fasten vessel planks in two adjacent buildings exposed in settlement levels dating from 1170–1189. In one of them, there were 170 such treenails. Cnotliwy assumes that

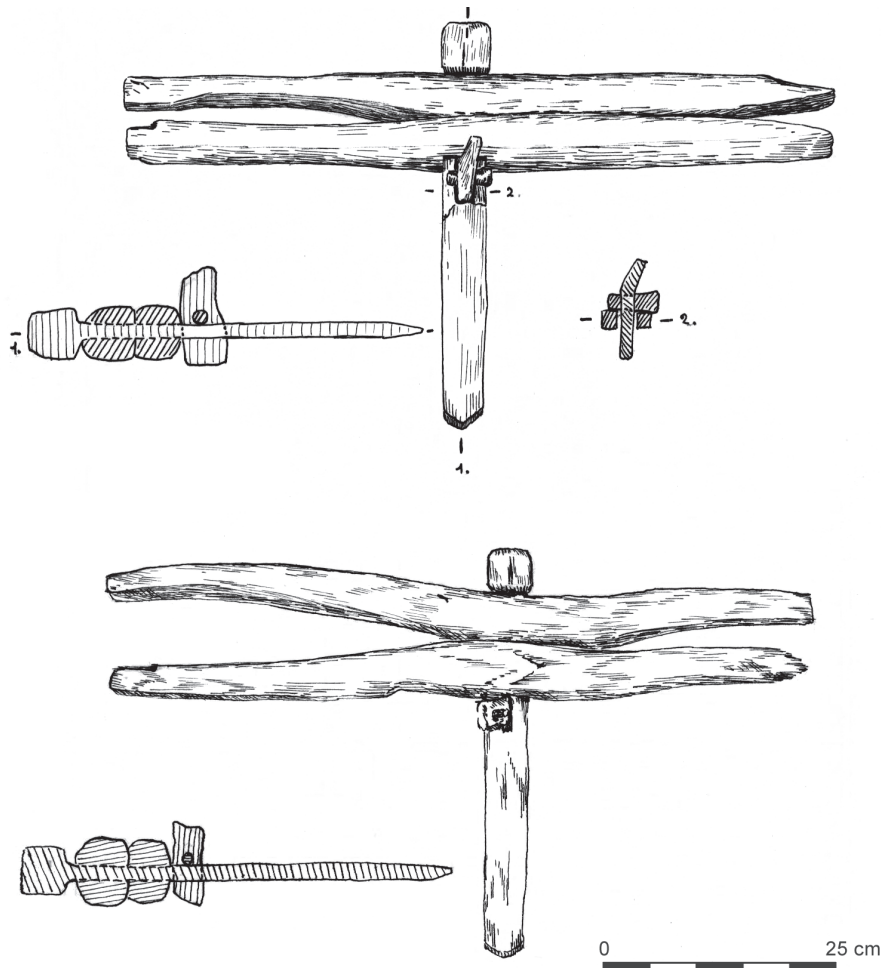


Fig. 2. Boat-building clamps from the 12<sup>th</sup> century discovered in Gdańsk stronghold.  
1 – inv. no. 2928/50, 2 – inv. no. 3738/50 (from the collections of the Archaeological Museum of Gdańsk).

during low season boatbuilders stocked up on pegs for their own use, but they may also have been ordered by someone else (Cnotliwy 1996, 18–19). Ethnographic analogies attest to the fact that pegs, which continued to be used until recently, were carved with a knife, and this work was very often done by men in the household in wintertime when there were fewer chores to attend to (Christensen 1996, 20).

In the 12<sup>th</sup> and 13<sup>th</sup> centuries, the *ius ducale* system developed, in which men were assigned to perform specific manufacturing and service roles. The system came with a number of burdens, such as tributes and monopolies, which also applied to the builders and users of plank boats. Since the duke was the sovereign of all watercourses and there was no mass trade, boats at that time were probably built and used to serve the master or his deputies.

It should be emphasised that during this period boats were not built by professional craftsmen but rather by villagers or town dwellers as part of their addi-

tional servile work. Archaeological research shows that people of the period were skilled in all kinds of occupations. Therefore, plank boats were built using similar techniques as those applied in carpentry of the time, i.e. caulked with moss and fastened with treenails.

There are records of servile boatbuilders, so-called *korabnicy*, who constructed larger river vessels outside of Pomerania in central Poland, namely in medieval Płock and Włocławek. Three Polish villages are called Korabniki to this day, which is another reference to that particular group of labourers (Buczek 1958, 61).

In the 10<sup>th</sup> to 12<sup>th</sup> centuries, boats were mostly built on the banks of rivers, near forests. It is possible that certain places, convenient for the production of boats, may have become more or less permanent building sites. The fact that several villages were called Korabniki supports this suggestion – although they could also have been occupied by professional boatbuilders rather than servile labourers.



## First ships

An important moment in shipping history was the appearance of the first merchant ships and maritime merchant vessels in the western Baltic coast in the late 10<sup>th</sup> century and early 11<sup>th</sup> century. According to the available data, the first ships were between 14 and 20 metres long, or even longer, and could carry about 60 tonnes of cargo. The oldest ships discovered so far in northern Europe are: the Klåstad wreck – discovered off the south-east coast of Norway, built around 990 (Christensen and Leiro 1976; Hylleberg 1993) and the wreck of Åskekärr 1 found in the Gota River in Sweden, made of local timber in around 1000 (Borg *et al.* 2000). This type of vessel appeared in the Baltic soon after, with one of them being the wreck from Hedeby (Crumlin-Pedersen 1997).

Merchant ships started to be used with the development of Atlantic shipping and the socio-economic changes that took place in the emerging early feudal Scandinavian states. At that time, rulers extended control over the shipping routes, gaining profits in return for a guarantee of safety. Another factor that stimulated the development of cargo shipping was the growth of urban centres with access to shipping routes. To date, 16 Scandinavian shipwrecks have been discovered, suggesting an intensification of maritime trade in the Baltic in the 11<sup>th</sup> and 12<sup>th</sup> centuries. Partnerships of owners and users of merchant ships, who probably joined together because of the high costs of their construction and operation, already existed but the process of the formation of a group of independent sea merchants living exclusively off maritime trade had not yet been completed. The development of monetary exchange, the emergence of specific tax regulations, and the codification of maritime law were necessary for this social group to fully form. In the Baltic region, sea merchants continued to engage in other occupations besides shipping. According to written sources, groups of professional sea merchants whose only source of profit was maritime trade became active in the entire Baltic region in late 12<sup>th</sup> century. This was when larger sized cargo vessels began to be constructed in local boatbuilding workshops on the southern Baltic coasts. At the same time, new types of ships were designed, one of them being the cog ship, which became popular in the Baltic (Englert 2015). To launch those vessels was often a major problem for their builders. While medieval vessels with hull lengths of up to 30 metres could be launched using the simplest solutions, such as pulling along wooden rollers or pushing over greased

planks, chronicles from 1170–1175 describe a number of challenges encountered while pushing a larger ship into the water near Schleswig (Englert 2015, 13). The bigger and heavier the vessels became, weighing several hundred tonnes and measuring more than 30 metres in length, the more problematic it was to launch them.

## Urban shipyards

From the 13<sup>th</sup> century onwards, port towns belonging to the Hanseatic League began to develop on the southern Baltic coast. The citizens of these towns owned a wide variety of merchant ships used for the highly profitable maritime trade, and the scale of their operations led to the Hanseatic League's trade monopoly in the Baltic and North Seas in the 14<sup>th</sup> and 15<sup>th</sup> centuries.

When new port cities were created, plots of land on the coastal areas of rivers, near their estuaries, were designated as permanent sites for the construction and repair of ships. In the southern Baltic, these sites were called Lastadia and they existed in: Lübeck, Wismar, Rostock, Stralsund, Szczecin, Gdańsk, Elbląg, Braniewo, Königsberg and Riga (Binerowski 1963, 49).

Initially, the name meant yards that were used for loading or unloading of cargo or ballast on and from ships (Löschin 1836, 47; Binerowski 1963, 49). Later, Lastadia were permanent sites for the production of new ships functioning with varying degrees of intensity until the 19<sup>th</sup> century.

In 2004, the Gdańsk Lastadia was excavated. It was the first and to date only systematically explored post-shipyard site in Poland. Excavations covered a total area of 3,000 m<sup>2</sup>, making it a major project of shipyard archaeology (Kocińska 2020). Compared to English shipyards, which ranged from 423 m<sup>2</sup> up to 24,280 m<sup>2</sup> in size (Stammers 1999), the Gdańsk Lastadia can be classified as medium-sized, with the area of the proper shipyard in the 17<sup>th</sup> century being 4,240 m<sup>2</sup> (Maciakowska 2020, 59).

The excavations mainly uncovered the remains of buildings of simple construction, made up of planked posts and serving as workshops or storage rooms. Among them, there was one different building from the 18<sup>th</sup> century, designed like residential buildings of the period, with a considerable usable area, belonging to the guild of Vistula carriers and used for guild activities, but also for rent. A number of small or very damaged tools were also found in the post-production layers. This should come as no surprise, since specialised tools were expensive and well cared for. The items

include measuring instruments, woodworking, metalworking, and textile tools as well as accessories for sealing and finishing work (Ignasiak 2020).

### A 16<sup>th</sup> century slipway

One of the most interesting discoveries at Lastadia are the remains of two wooden slipways (Fig. 3). The older one, poorly preserved, served as a substructure for the construction or repair of ships. It consisted of a row of several massive blocks up to 2.4 m long, 40 cm thick and 30 cm wide, positioned perpendicular to the shoreline. It is difficult to determine whether the beams constituted a substructure for the keel or for the chine. The beams could support a keel up to 16 metres long. Thus, the slipway could have been used to build medium-sized ships with a total length of more than 22–24 metres. On the basis of available records, it can be estimated that the slope angle was approximately 5.5%. The fact that there

indeed was a slipway at this place is also confirmed by a break in the quay and remains of a wall enclosing the slipway pit. Two samples taken from these elements are dated to 1536/37 and 1554, respectively (Ossowski 2020).

The slipway was constructed towards the end of the greatest development of shipbuilding in Gdańsk, lasting from the 15<sup>th</sup> to the middle of the 16<sup>th</sup> century (Bogucka 1962, 49, 53–54). In the late 15<sup>th</sup> century, ships constructed in Gdańsk could carry up to 200 lasts of cargo. Archival sources suggest that Gdańsk Lastadia must have been very busy in the 15<sup>th</sup> century (up to 12 hulls could be built there at the same time), because in another place – known as Brabank – an inclined platform was built to pull ships ashore for repairs. The keels of the largest vessels built in Gdańsk during this period reached up to 20 metres in length, if they had the traditional clinker planking (Overmeer 2017, 200), and up to 31 metres in length, if they had carvel planking.



Fig. 3. Location of the two slipways from the Gdańsk Lastadia site. Construction plan including outline of archaeological excavations (prepared by B. Kościński, K. Dyrda).

The slipway can be linked to the Dutch method of launching ships by means of lowering the hull with the bow towards the water on planks propped along the substructure. The technique, already described in 17<sup>th</sup> century Dutch texts (Witsen 1690; van Yk 1697) and represented in many engravings, was still used to launch smaller vessels in the 20<sup>th</sup> century. Given that wood has the tendency to push the grease out and tear into pieces, causing additional resistance, it can be assumed that, despite causing certain difficulties in the actual launching process, the technique had many advantages when it comes to the overall construction process. The ship would be launched half-finished, with only the lower section of the hull covered in planks for it to be able to float. The rest of the hull would be planked up when already on the water, and often the loading was done through the unfinished stern. In this way, it took much less time to finish the work before the launching stage. Another advantage of that technique was that a partially covered skeleton of the ship was much lighter, making it easier to slide it down the slipway skids without overloading the longitudinal reinforcements, and it did not require a deep shipyard basin or a more robust and longer slipway structure.

A number of iconographic sources relating to Lastadia and depicting ships under construction reinforces our belief that the Dutch launching system was used in Gdańsk in the 17<sup>th</sup> and 18<sup>th</sup> centuries. The main rationale behind this theory is the large influx of Dutch specialists to Gdańsk in the period. Obviously, Dutch shipbuilders, known for being the best in their craft at the time, would use the same building techniques in Gdańsk that were popular in their own country.

### Lastadia in the 17<sup>th</sup> and 18<sup>th</sup> centuries

At the beginning of the 17<sup>th</sup> century, there was a slowdown in production at the Gdańsk shipyard. During this period, an area of 3,429 m<sup>2</sup> in the southern part of the Gdańsk Lastadia, called *Kahn[en]feld*, was adapted for the construction and repair of river vessels and leased to the guild of Vistula carriers (Maciakowska 2020, 75–76). Around a thousand boatbuilding brackets associated with this activity were discovered on practically all usable levels of the shipyard. Such artefacts are found in large numbers in port centres, serving as evidence for the construction, use or repair of inland vessels. The brackets discovered at the Gdańsk Lastadia are of different types and have been preserved in varying conditions. The vast

majority of them are deformed, which suggests that they came from vessels that required the replacement of their sealing or were being taken apart.

No testimony has survived concerning the organisation, construction methods, or launching technique of the Vistula vessels built in Gdańsk. On the other hand, information available on similar sites located elsewhere in Poland suggests that small inland ports did not have specifically designated areas for the construction or repair of river vessels, nor any fixed structures to launch or pull them ashore. Larger ships were assembled wherever there was timber available or launching was convenient. Ships would be built in winter and then high spring waters would lift them from the shore (Burszta 1955, 762). Based on this, we can assume that in this part of the Gdańsk shipyard, after the *Kahn[en]feld* had been designated in early 17<sup>th</sup> century, there was no need to build special facilities to support the building or launching of river vessels. Earlier, seagoing ships were built on the same yard in the 16<sup>th</sup> century, as evidenced by the remains of the second slipway discovered on that site.

Later, in the 18<sup>th</sup> century, the so-called *Bordingsfeld* was designated in the northern part of Lastadia (Maciakowska 2020, 67–75). Bordings were lighters that were used to transport cargo between the port, waterway and harbour and they played an important role in Gdańsk ports until the 19<sup>th</sup> century. The waterways constantly changed their course, which made it difficult to enter the shallow port on the Motława River. Because of that, larger ships did not enter the inner harbour and cargo was transhipped onto lighters at the harbour.

During the long period when river ships and lighters were built at the local shipyard, the craftsmanship was passed down from generation to generation orally rather than through written technical records. In such system, the secrets of the trade were carefully preserved, turning shipbuilding into a kind of secret art (Olechnowicz 1960, 21). To build a ship was very costly and no one could afford to experiment with it, as a result of which the technology was slow to develop and the same building methods were used for a long time.

### A 19<sup>th</sup> century slipway

In the 19<sup>th</sup> century, judging by the second slipway discovered at the local Lastadia, the shipbuilding industry in Gdańsk was completely different. Also uncovered in 2004, the structure had considerable dimensions: it was at least 48 m long and 11 m wide (Fig. 4, 5). The





**Fig. 4.** Archaeological excavation of the remains of a slipway from the 19<sup>th</sup> century (photo by B. Kościński, K. Dyrda).

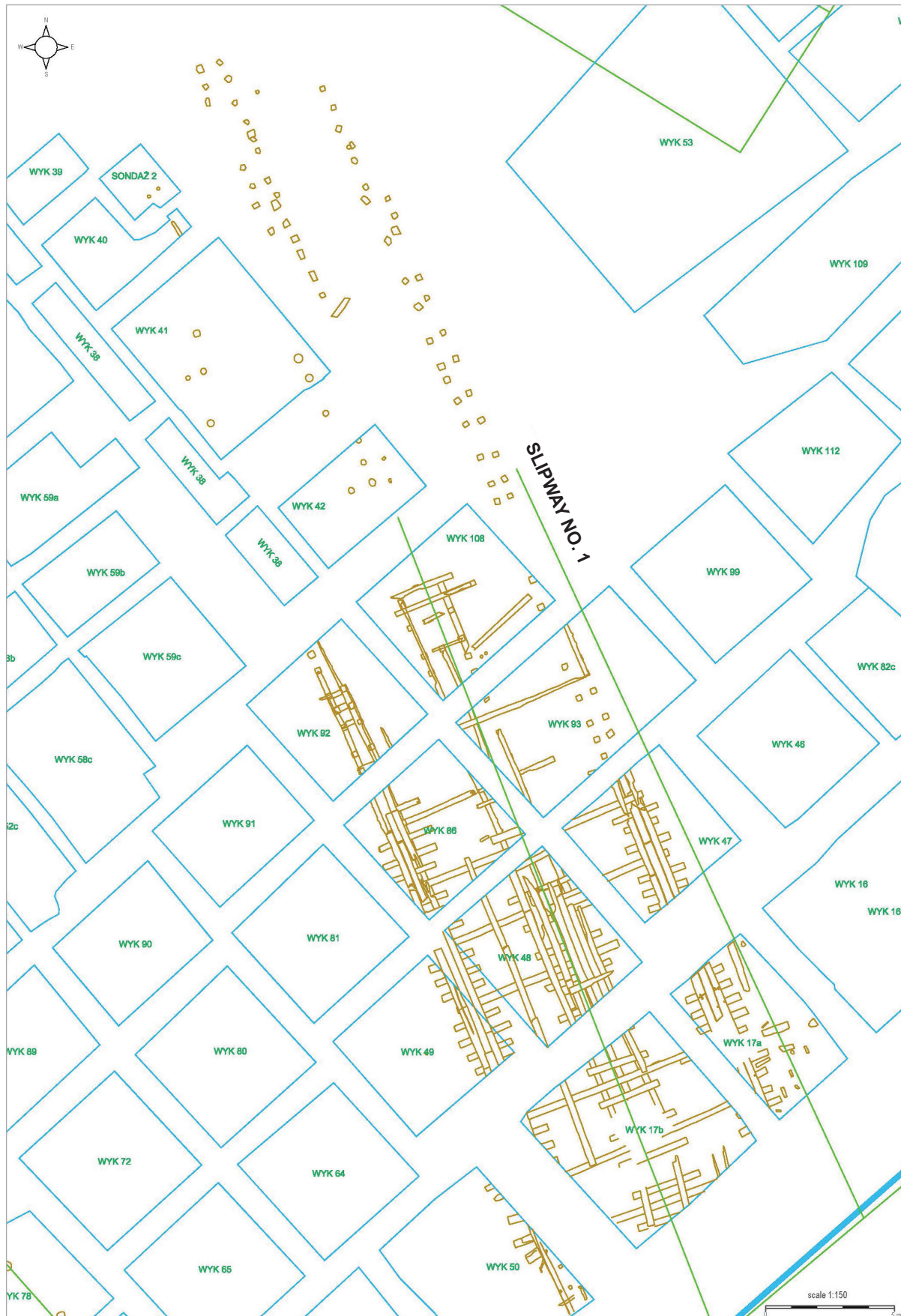
structure sloped towards the Motława River at an angle of approximately 6%, according to the records. Ten digs with a total surface area of more than 290 m<sup>2</sup> uncovered quite well preserved remains of the eastern part of the working slipway, where the hull was drawn up, and part of the run-up slipway that plunged into the water. The wooden structures found in the digs were elements of the foundations for the placement of the fixed substructure and keel support, as well as the tracks along which the hull was launched (Fig. 6). No other items were discovered, such as poppets, cradles, or sleds that were made before launching and mounted directly to the hull.

When viewed from above, the exposed structure is visibly made up of three parallel rows of tracks: the central track, which we will also refer to as the keel track, and the two side tracks, which we will also call the chine tracks. The outer tracks were narrower than the central – keel – track.

The structure of the slipway was made of coniferous wood, mostly Baltic pine. On the basis of

dendrochronological studies, we can distinguish two phases in the functioning of the wooden structure of the slipway. The first phase is the period after the winter of 1806/1807, when the trees used for the foundation piles were felled. The second phase is the winters of 1851/1852 and 1853/1854, when the trees used to make the structural beams were felled. On this basis, we can assume that the slipway was built after 1807. Most of the surviving foundation piles come from that phase. After 1854, the structure was renovated and the foundation beams were replaced. At around the same time, the plot was bought by the Gdansk merchant and shipowner Friedrich Heyna, who ran the shipyard between 1855 and 1874. Archaeological analogies indicate that the technologies used in the 19<sup>th</sup> century Gdańsk slipway were transferred from other countries that were more advanced in shipbuilding (Ossowski 2020). A well-known representative of this process is one of the pioneers of modern shipbuilding in Gdańsk, Johann Wilhelm Klawitter, who, having spent a number of years in England after 1814, became proficient





**Fig. 5.** Plan of the slipway's structure from the 19<sup>th</sup> century from the Gdańsk Lastadia site, including the outlines of the excavations (prepared by B. Kościński, K. Dyrda).

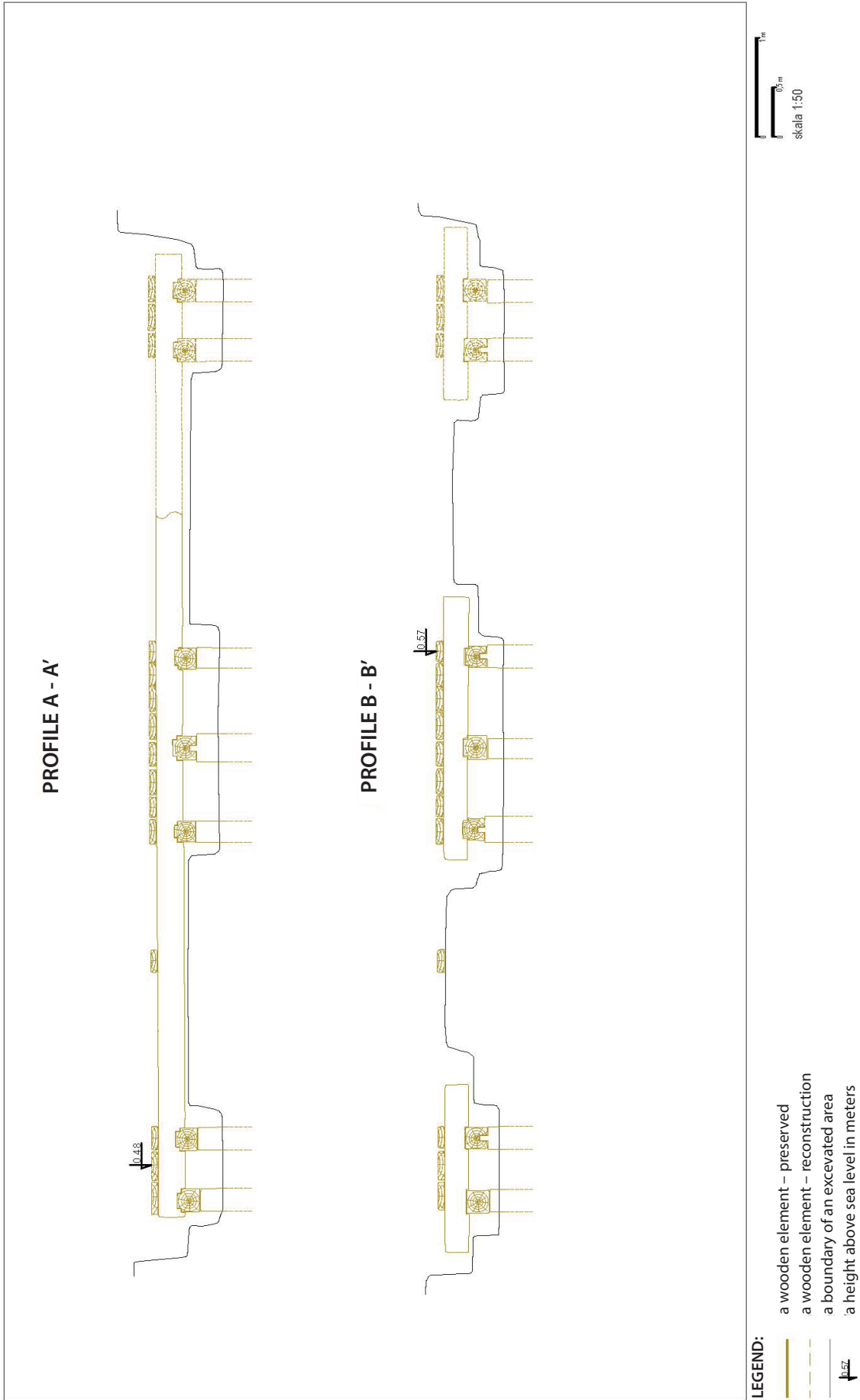


Fig. 6. Cross-sections of the 19<sup>th</sup> launching way from the Gdańsk Lastadia site (prepared by B. Kościński, K. Dyrda).



**Fig. 7.** Engraving from 1846 showing the *Bordingfeld* – a part of the Gdańsk Lastadia presenting the moment of construction of a wooden ship being prepared for launch with the bow towards the water (from the collections of the National Museum of Gdańsk).

in modern shipbuilding technologies. On his return to the Gdańsk Lastadia, he took charge of the construction of the wooden rowing and sailing gunboat “Thorn”, with a length of just over 16 metres, which was ordered Prussian navy in 1819 and launched in 1823. In 1827, he established a modern shipyard at Brabank, where iron and steam-powered ships were built from 1840 onwards. The first iron and steam-powered ships made in Gdańsk were largely fitted out with equipment imported from England, and they were built by English specialists hired by J. W. Klawitter (Ruhnau 1983).

Johann Wilhelm’s younger and prematurely deceased brother, Gustav David Klawitter (1805–1837), master shipwright and teacher at the Royal Shipyard School in Szczecin, wrote a book on shipbuilding in which, among various other aspects, he also discussed ship launching methods that were used at the time (Klawitter 1835). Among other things, the book describes a slipway, the lower part of which – the actual slipway – was permanent. It consisted of massive oak piles driven 4 to 6 feet deep into the ground at specific intervals. On those piles were laid thicker oak beams in such a way that they formed a platform sloping towards the water. The slope was  $\frac{1}{2}$  inch per foot, which

is ca. 4% (Klawitter 1835, 1). According to the book, there were three main methods of ship launching in the first decades of the 19<sup>th</sup> century: the French, the Danish and the English. Their choice in any particular case depended largely on the size of the vessel being built. While the French method, of relatively simple design, was used for smaller vessels, the other two were applied to the largest ships. The first method, according to the author, was the best for launching vessels with sharply shaped hulls.

The 19<sup>th</sup> century slipway discovered at Lastadia most closely resembles the construction described in the textbook as the French launching method (Ossowski 2020). We can see the resemblance not only in the construction of the fixed lower section but also in the fact that the hull was supported at three points: under the keel and under the sides. For launching, a cradle was mounted to the hull of the ship, the skids of which moved along the three launching tracks.

On the basis of the surviving elements, we can attempt to estimate the size of ships that were built on the slipway (Fig. 7). Of course, such attempt is only an approximation, as we are not able to determine the exact width of the hull without knowing the spacing of the tracks or the construction and size of the



launching cradles or poppets. Nevertheless, the width between the axes of the outer tracks was about 9 metres and, assuming that the outer tracks indeed served as support for the chine where the launching cradles were attached, we can estimate that the width of the hulls of the ships under construction was the same or larger. Considering the sizes and proportions of merchant ships from late 18<sup>th</sup> century, we can estimate that the largest hulls built on the slipway were 32 metres long or more. According to historical data, F. Heyna's shipyard built three-masted ships of up to 650 tonnes of carrying capacity. Since ship types at that time were determined by the type of sails, we can conclude that the largest barges and fuller-rigged ships were constructed at the shipyard, counting among the biggest types of ships built in the period.

### Conclusion

From the earliest to the modern times, there were seasonal or occasional sites on the southern Baltic for the construction or repair of boats and ships. Identifying such sites is difficult, because the construction of plank boats required nothing more than sleepers or simple wooden supports and the work was done in the open air. What remained were piles of shavings, small pieces of wood, traces of hull sealing, tarring residue, and fasteners in the form of wooden treenails, pegs, iron rivets, or nails. Also, such sites were located at some distance from dwellings, where timber was available, and where there was a convenient shoreline to launch new or repaired hulls of vessels.

In the pre-industrial period, beginning with the late Middle Ages, there existed designated, permanent shipbuilding yards within the coastal cities of the southern Baltic which did not have any fixed shipbuilding facilities. These areas, called *Lastadia*, were divided into yards where, in addition to the shipbuilding workshops, there were storage yards for construction timber, and wooden sheds at the back for storing the equipment and tools needed during construction. Shipbuilders would pay a fee to the city authorities for permission to use a specific section of the yard to build a vessel. The builders would set up the facilities used for the construction of ships on a job-by-job-basis, using their own materials and dismantled them upon completion. The launching of smaller vessels using the "forward bow" method was not technically complicated and the structures required for launching were easy to dismantle. Although the Gdańsk *Lastadia* remains the best explored shipbuilding site today, in all probability other

maritime cities from Lübeck to Braniewo had similar sites, creating a uniform picture of the maritime cultural landscape of the region.

The material collected makes it possible to respond to the attempts made in archaeological publications to classify archaeological sites associated with shipyard production.

Moser (2011) proposed a typology dividing shipyards into five broad categories: (1) large state-owned shipyards like the British naval shipyards of the 18<sup>th</sup> and early 19<sup>th</sup> century, (2) well-organised private shipyards with a substantial workforce, such as the Dutch East India Company in Amsterdam, (3) private shipyards with a large number of labourers that could build many ships at the same time, (4) smaller private shipyards with single slipways that could build only one ship at a time, and (5) shipyards with limited fixed infrastructure, which built or repaired only a few ships and were often in financial difficulties.

With regard to the southern Baltic, this classification is only exhaustive for the modern period and can be linked to industrial development. From the perspective of changes in shipping and shipbuilding methods, these types of shipyards first appeared in the area in early 19<sup>th</sup> century. At that time guild regulations were abolished, and large and small private shipyards began to emerge in major Baltic cities as well as large state-owned facilities serving the growing needs of the Prussian fleet and large shipping companies. These shipyards were usually established outside urban ramparts and fortifications and were built from scratch.

The findings so far, mainly from Poland, allow the following types of archaeological sites associated with shipbuilding activities to be identified: (1) occasional/temporary sites of boatbuilding activity from the Stone Age onwards, (2) permanent shipbuilding sites in maritime towns, without developed infrastructure operating from the late Middle Ages to the 19<sup>th</sup> century, (3) small, private shipyards operating in the 19<sup>th</sup>/20<sup>th</sup> century and (4) large industrial shipyards developing from the 2<sup>nd</sup> half of the 19<sup>th</sup> century onwards.

Shipyards are of little interest to archaeologists. If necessary, pre-development archaeological excavations are done at such sites, but their results usually go unpublished. This is not only the case in the southern Baltic region and many authors point to the lack of training of cultural resource managers in identifying or documenting shipyard sites in other locations across the world (Stammers 1999; Ford 2006; Richards 2008; Harris 2010). Shipbuilding archaeology offers

the opportunity to develop a more comprehensive and accurate model of changes in economy, trade, and technology in the southern Baltic region.

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