

## Summary

### Karolina Kokora

#### Glass production in Wolin in the early Middle Ages.

Objects related to glass-making from the Early Middle Ages were found in Wolin on 9 sites out of 17 identified in the area. Most of them were found in settlement layers, and only a few - in cemeteries. The present work is the first monograph in which all objects (1117 items) related to glass-making, discovered so far in Wolin, are examined. The items included: vessels (9 fragments), rings (8 fragments), a circle (1 fragment), inserts (2 fragments), beads (886 fragments), a pin head (1 fragment), a spindle whorl (1 fragment), a game piece (1 fragment), a game pawn (1 fragment), a ball (1 specimen) and glass fragments (34 fragments), as well as glazed wares, such as clay vessels (3 vessels and 93 fragments) and a rattle Easter egg (1 specimen; Table 2.1). Production residues were also distinguished to which I included a stone mold (1 ex.), a glass mass (7 pieces), failed beads (43 ex.) and their other production waste (23 ex.), and semi-finished products (2 ex.; Table 2.1.). By observing the traces of technical procedures and defects in the glass mass, visible on the surface or in the glass, it was possible to determine the production and decoration technique of the individual objects discovered at Wolin. Among the glass beads, the following techniques were distinguished: drawing (337 items), winding (403 items), blowing (2 items), the so-called "drop" (5 items) and mosaic (6 items). It was not possible to determine how 132 beads, glass vessels and beads were made, mainly due to their poor state of preservation. The chemical composition of the glass from 122 objects discovered at Site 1 in Trenches 4, 6, and 8 was determined. Analysis of the concentration levels of the main glass-forming components made it possible to distinguish 3 types of glass in this collection: sodium, potassium, and lead. The first one was divided into two varieties: sodium "mineral" and sodium-potassium "ash", and these were further divided into 6 types; among potassium glasses, 2 varieties were distinguished: potassium-calcium and calcium-potassium, which were segregated into 5 types; among lead glasses, 2 varieties were distinguished: non-alkaline and alkaline, and 9 types, while mixed glasses had one variety - alkaline-lead and two types. In total, the Wolin collection included 55 sodium, 48 lead, 11 mixed, and 7 potassium glasses (Table 5.2). Soda glass, for which mineral soda was used, occurs in Wolin between the 2nd quarter of the 10th and the 12th or early 13th century (Table 5.2.). Glasses of the potassic type were recorded in layers dated to the 2nd half of the 9th-11th centuries, while those of the lead type were recorded from the 2nd half of the 9th to the end of the 11th-12th (?) centuries. (Table 5.2.).

There were 4 type B glassworks and 5 probable locations where this type of production could have taken place in Wolin. The oldest traces of glass production were registered in Wolin

in the 1st half of the 10th century. We can only assume that at that time there could have been the production of three types of glass beads in Wolin: 1. small beads made from a yellow glass

tube cut into straight sections (drawn-glass „bisier” beads) of the  $\text{PbO-Na}_2\text{O-K}_2\text{O-CaO-MgOSiO}_2$  and  $\text{Na}_2\text{O-K}_2\text{O-CaO-MgO-PbO-SiO}_2$  types, 2. segmented beads made of a single-layer tube of yellow wrapped glass (of unknown glass chemical composition), and 3. segmented beads made of a two-layer tube decorated with a metal foil of the  $\text{Na}_2\text{O-K}_2\text{O-CaO-MgOAl}_2\text{O}_3\text{-SiO}_2$  type of glass. These objects were most likely manufactured from semi-finished pieces, in type B.

Between the 2nd quarter of the 10th century and the 2nd half of the 10th century glass production in Wolin was already well developed. Three glass-making workshops were registered, which produced drawn-glass „bisier” beads from yellow container glass of the  $\text{PbONa}_2\text{O-K}_2\text{O-CaO-MgO-SiO}_2$  type, segmented beads of two types: 1. from a single-layer



tube of yellow packaged glass (of unknown chemical composition) and 2. from a double-layer tube decorated with metal foil from  $\text{Na}_2\text{O-K}_2\text{O-CaO-MgO-Al}_2\text{O}_3\text{-SiO}_2$  type glass. Most likely, these were processing workshops (type B) where beads were made from semi-finished products. Not far from the three workshops mentioned above, there may have been another workshop that produced bisiers from yellow, container glass (Fig. 6.15.), and to the east of them there was most likely another workshop that may have produced beads made by the winding technique of unknown shape, from  $\text{PbO-SiO}_2$  type glass. These items may have been produced from glass cullet melted on site.

In the 1st half of the 11th century the production of glass beads continued in Wolin, but on a much smaller scale. One type B glass workshop was registered, in which segmental beads of two types were most probably produced from semi-finished glass tubes made of  $\text{Na}_2\text{O-K}_2\text{O-CaO-MgO-Al}_2\text{O}_3\text{-SiO}_2$  type glass: 1. from a single-layer glass tube, made of yellow wrapped glass and 2. from a double-layer glass tube decorated with metal foil. It is also possible that two more glass workshops (type B) existed, producing drawn-glass „bisier” beads from yellow, wrapped glass of unknown chemical composition and the same type of glass beads of the  $\text{Na}_2\text{O-K}_2\text{O-CaO-MgO-Al}_2\text{O}_3\text{-PbO-SiO}_2$  type. The existence of a type A workshop in Wolin, where glass was supposed to be smelted, has not been confirmed. There are no sufficient premises to assume a local production of glass vessels, rings or glazed objects such as clay dishes or Easter eggs.

In the period between the end of the 8th century and the middle of the 9th century glass products could have come to Wolin from Frisia or Scandinavia and the drawn-glass „bisier” beads which was found in the layers from that period could have been produced in Staraya Ladoga or Haithabu. In archaeological assemblages dating from the 2nd half of the 9th century to the beginning of the 10th century, segmented beads made of a single-layer tube, of yellow and blue glass, and of a double-layer tube, decorated with metal foil, have been recorded in Wolin and are thought to have been imported from the East, but their manufacture in Staraya Ladoga and possibly Haithabu must also be considered. These ornaments were supposed to have been made in these centers on the basis of eastern technologies, from glass smelted on site or from imported semi-finished products, and from there they found their way to Wolin (Dekówna, Purowski 2012, p. 122). A bead (inv. no. 3328/76) made from two types of glass of the potassium-lime variety was also recorded at Wolin during this period; manufacturing waste of this type was revealed at Haithabu from the 9th to mid-11th century. (fig. 2.5c; Dekówna 1980, 148, 186, table 52:1, 2). Glassware made using the blowing technique may have flowed to Wolin from this center. Beads with ornaments in the form of "eyes" (type TW2/LK1/F3.2/group 2/subgroup 2/types 16 and 24/subtypes 2 and 6), as well as those made using the mosaic technique, may have arrived in Wolin from Near Eastern workshops. The above data indicate that craft and trade centers such as Staraya Ladoga and Haithabu, as well as Middle Eastern centers, may have played a significant role in the genesis of Wolin glassmaking. Wolin in the 30s and 40s of the 10th century became an important transshipment point for oriental trade, from which silver was directed to Pomerania and the West Slavic lands (Adamczyk 2018, p. 195). It is not excluded that apart from silver, glass products or their semifinished products could have reached Wolin by the same route and it is in this phenomenon that the sources and directions of the inflow of glass technology and products made of this material should be sought.