

# THE EARLY MEDIEVAL BRIDGES AT OSTROW LEDNICKI IN THE LIGHT OF UNDERWATER ARCHAEOLOGICAL STUDIES

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## Abstract

Ostrow Lednicki, an island situated in Lake Lednica between Gniezno and Poznań, is an important archaeological site from the period of the beginnings of the Polish state. In the tenth and 11th centuries, apart from Gniezno, Poznań and Giecz, the town, which has been preserved together with the remains of a stone palace, was one of the main towns of the state of Mieszko I and Bolesław I the Brave. The significance of Ostrow Lednicki in the Early Middle Ages is also emphasised by two bridges leading to the island, the Gniezno bridge from the east, and, the Poznań bridge from the west, which mark an important communication route in that period between Poznań and Gniezno. With the exception of towns, bridges like this were the largest engineering constructions of the epoch in the Slavic world. Systematic underwater studies of the remains of the bridges were undertaken in 1982, and have been carried out with intervals until today. In 2000 and 2001, the exploration of the west bridge was supported financially by the Foundation for Polish Science. It was concerned in particular with building a special apparatus for the conservation of movable monuments after excavating them during underwater studies in the area of the bridge's location and found by means of metal detectors used in the close vicinity of the west bridge. These studies yielded a large number of artefacts, enriching our knowledge of the material culture of the Early Middle Ages. The military finds, consisting, so far, of over 150 axes and several dozen spearheads and javelins, are exceptionally important. This unique collection of military objects has no counterpart in European archaeology.

Key words: bridge, Early Middle Ages, underwater archaeology, Ostrow Lednicki, Poland.

Ostrow Lednicki, an island measuring a few hectares in Lake Lednica situated between Gniezno and Poznań, has been an object of archaeological interest for over 150 years. The island has revealed the well-preserved, clearly outlined Early Medieval earthen ramparts of a town, the ruins of the oldest stone-built construction in Poland, a palace with a residential function, combined with a chapel originating from the times of the first Piast dynasty of Poland of Mieszko I and Bolesław I the Brave. Our present state of knowledge regards Ostrow Lednicki, along with Gniezno, Poznań and Giecz, as one of the most significant Piast towns from the period of the formation of the state in the second half of the tenth and the beginning of the 11th century (Kurnatowska 2000, p.108ff). The Early Medieval settlement complex of Ostrow Lednicki also consisted of a settlement located on the island, a vast cemetery on the eastern shore of the lake, and two huge bridges connecting the island with the lake shores (Fig. 1).

Systematic studies on the Ostrow Lednicki settlement complex and its widespread supply base were undertaken at the beginning of the 1980s, within the framework of an interdisciplinary scientific programme, following the inspiration and coordination of historic, archaeological and geographical-environmental research supervised by the Museum of the First Piasts in Lednica. The museum also initiated underwater studies in Lake Lednica, which were a continuation, and

simultaneously a verification, of underwater work carried out in the lake in the vicinity of the island in the years 1959 to 1961. This was when the remains of two bridges were found in the lake on the east and west sides of Ostrow Lednicki. These bridges marked communication routes towards Poznań (the west one was called the Poznań bridge) and towards Gniezno (the Gniezno bridge). It was stated then that the length in the water of the west bridge amounted to 438 metres, and the east one 187 metres (Kola, Wilke 1977). During these three underwater excavation seasons, which were limited by time and their reconnaissance character, attention was focused solely on the west bridge's remains (Mikołajczyk 1961; Anderszowa *et al.*, 1963).

Since 1982, underwater research of Ostrow Lednicki has been carried out first by the Archaeology Department (at present the Institute of Archaeology) of Nicolaus Copernicus University in Toruń. The studies are an element of the longstanding research programme entitled 'West Slavic Water Communication Devices in the Middle Ages'. These studies have continued, with some intervals, until the present day. The first years of the excavations were devoted to the remains of the east bridge; and their results, apart from the current reports (Kola, Wilke 1985; 1991), were presented in a separate collective monograph (*Wczesnośredniowieczne mosty ...*, 2000). Since 1986 (Kola, Wilke 1989), the studies have concentrated, with some intervals, on the remains

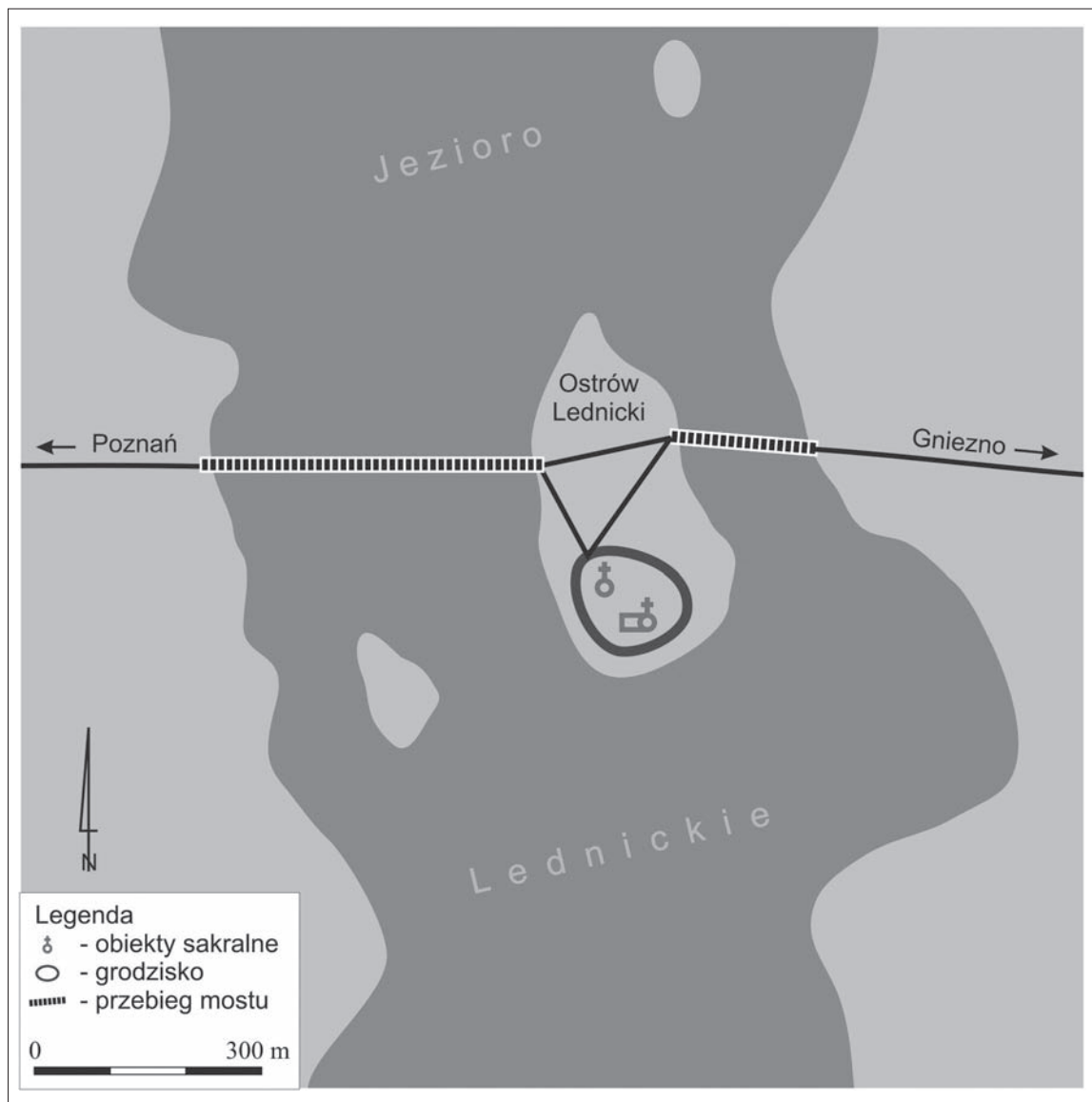


Fig.1. Ostrow Lednicki: a sketch showing the situation of the island and the bridges (after W. Szulta 2008, p.113).

of the west bridge and the lake zone situated in the western part of the island.

The remains of both bridges (Fig. 2) are manifested at present as sections of poles stuck into the bottom, slightly jutting out from the alluvion, being the remnants of supporting parts of the bridge, pillars (piers) and buttresses (Fig. 3, see Plate IV). Numerous remains of poles from the upper bridge construction, as well as other small wooden parts of this material from the period of building or repairing the bridge or the adjoining constructions, are scattered around them (Figs. 4, 5). The task of the underwater research was to retrieve from the bottom silt all the deposited wooden remnants, and all accompanying movable historical objects, to compile an underwater inventory of the excavated historic structures, and to take them from the water for a complete laboratory examination. To date, some wood samples from the bridge structures were

taken for dendrochronological analysis, which is indispensable for defining the dates of particular stages of the construction and repairs to the bridge within the framework of a planigraphical-chronological analysis. Movable artefacts, in turn, were subjected to conservation treatment, and after the conservation process they were delivered to the Museum of the First Piasts in Lednica; whereas underwater studies outside the zone of the remains of the bridge focused on searching for numerous movable artefacts appearing in the zone, particularly military objects deposited in the water as a result of human activity during the settlement's use.

A suitable method for the exploration and underwater documentation was specially prepared in order to fulfil the study programme while excavating the remains of both bridges (Kola 2000). The area of the poles, that is, the remains of the bridge, was divided into two strips four metres wide, in a transverse composition towards

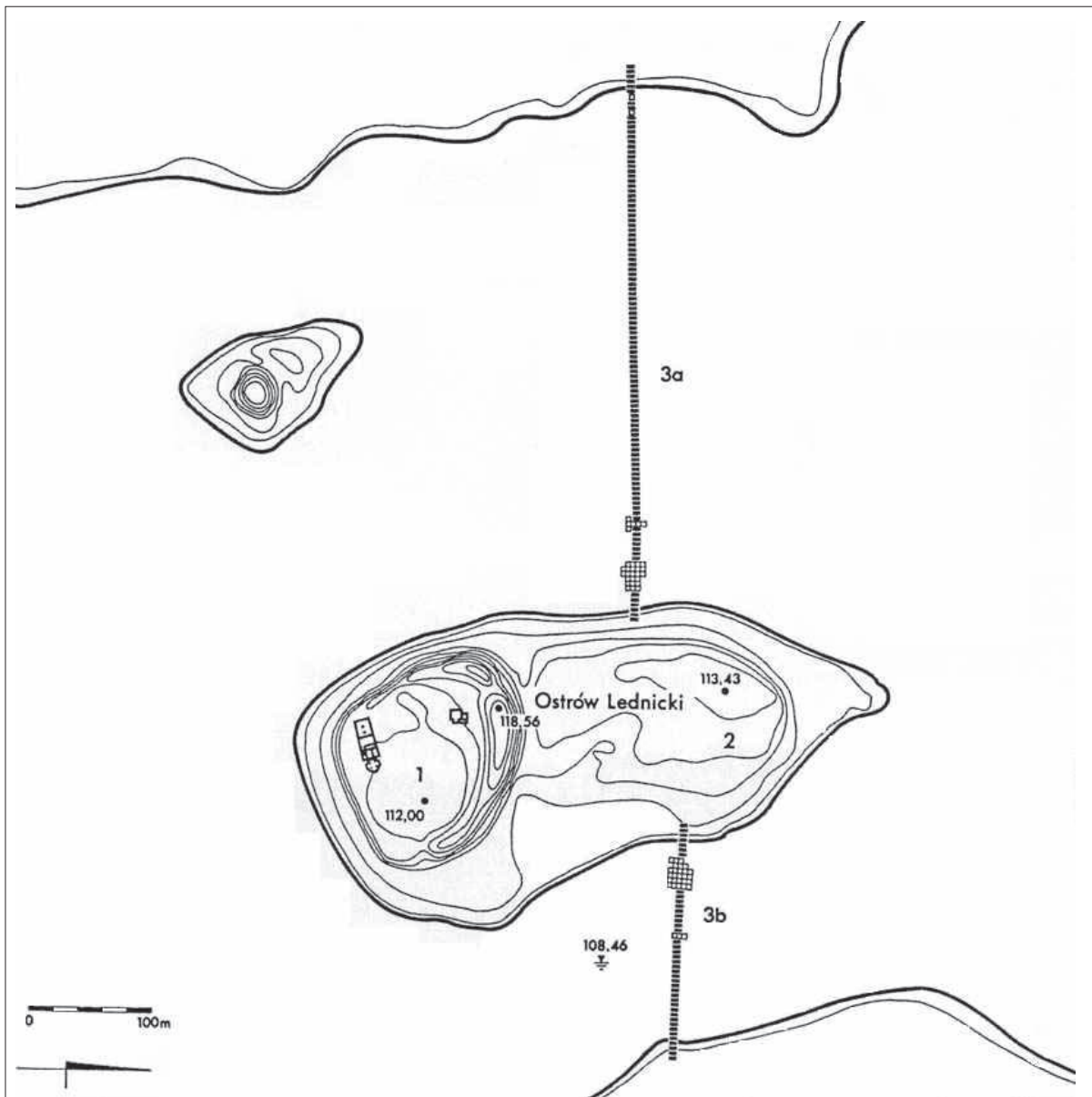


Fig. 2. Ostrow Lednicki: the Early Medieval bridges. The situation of the remains of the west bridge (3a) and the east bridge (3b), together with the exploration sectors (in accordance with the research from 2000) (after A. Kola, G. Wilke 2000, p.13).

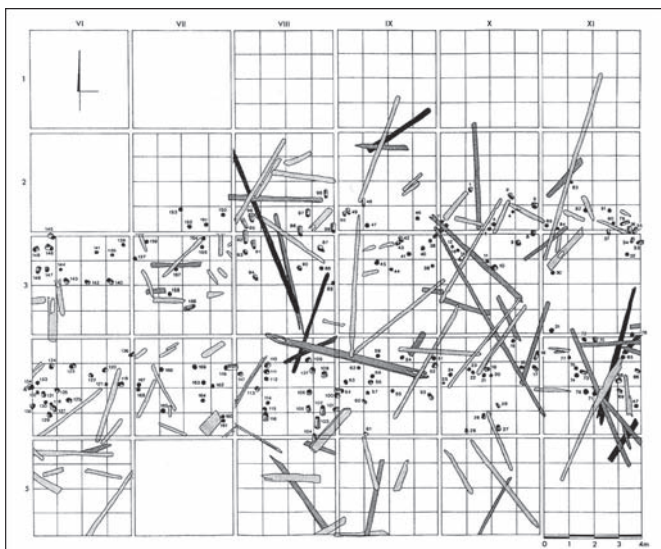


Fig. 4. Ostrow Lednicki: the east bridge. A projection of the remains of the bridge in sections of strips 6-9 (after A. Kola, G. Wilke 2000, p.40).

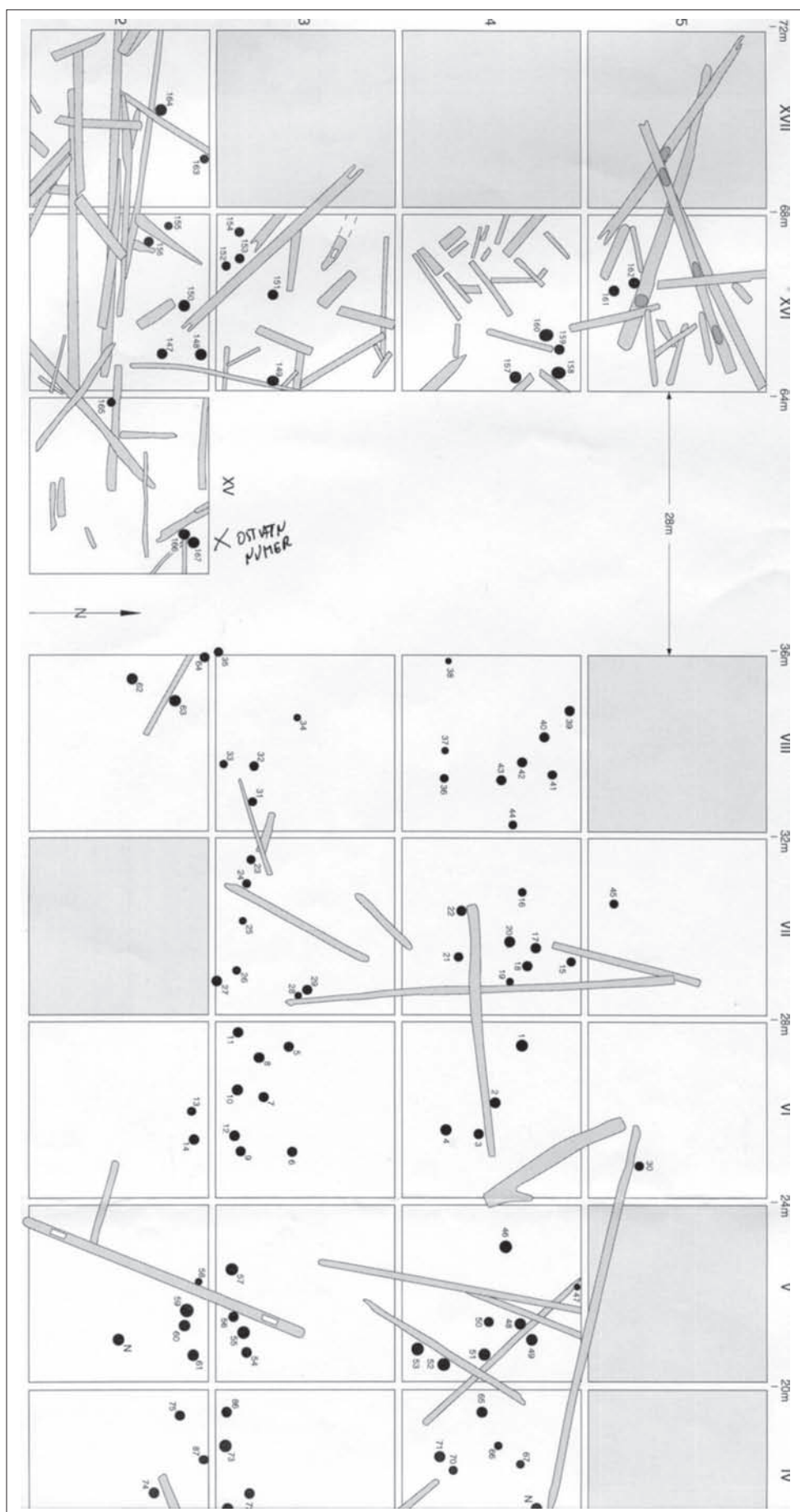


Fig. 5. Ostrow Lednicki: the west bridge. A projection of the remains of the bridge by the island (strips 4-8), and in the central part of the lake (strips 15-17) (after G. Wilke, archives of the Underwater Archaeology Department of the Institute of Archaeology of NCU).

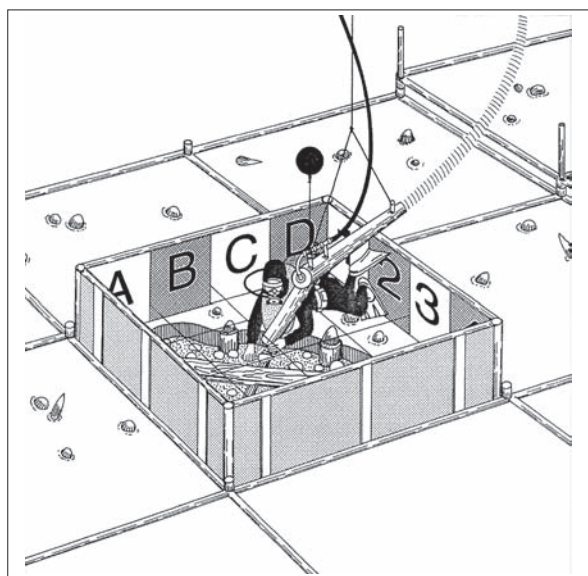


Fig. 6. Ostrow Lednicki: the remains of the Early Medieval bridges. A scheme of the exploration of the culture layers (after A. Kola, G. Wilke 2000, p.29).

the longitudinal axis of the bridge. These strips in turn were divided into four-by-four-metre sections, treating them as fundamental exploration and documentation units. The exploration of the bottom stratification was led by means of an accordingly constructed injector, a special appliance for cleaning archaeological structures of silt (Fig. 6). The exploration work was performed by divers, mainly students specialising in underwater archaeology at Toruń University. After completing the cleaning process, a drawing (scheme) was made under the water of all the wooden constructions revealed within the range of the section marked, and then transformed on the surface on to the collective scheme (Figs. 4, 5). The scheme was also equipped with places

marked where movable artefacts were excavated in the course of exploration.

The exploration of the west bridge, which is still not completed, concentrated primarily on studying the island side. Here, seven strips were explored, and a complete documentation of the remains of the bridge was drawn up (strips II–VIII, from four to 32 metres from the island) on a total of 35 study section surfaces. In this area, the remains of the bridge appeared at a depth of 1.5 metres to over six metres. Next, two strips inside five units were studied at a distance of 24 metres west of the former area (strips XVI and XVII), where the depth of the deposition of the remains amounted to over ten metres. The examined fields in the area of the last two strips did not include, however, all the range of the width of deposition of the remains of the bridge. This last area revealed a big sunken dugout boat over ten metres long, dated undoubtedly to the times of the use of the bridge. The boat is still awaiting lifting, which is connected with the technically and financially complicated process of its conservation. A dugout boat similar in size was excavated near the same bridge in 1960, which after being lifted found a place in the local Museum of the First Piasts (Mikołajczyk 1961a).

A crucial point in the attempt at reconstructing the west bridge is defining the number of subsequent stages of building or rebuilding (repairs). Analysing the planigraphy of pole relics of both the east and the west bridges, it can be noted that the remnants of bridge poles, being elements of pillars and buttresses in a horizontal projection in its construction, consist of two rows in the longitudinal composition of the bridge. Therefore, the imprecise rows outline the width of the bridge, where suitable poles in those rows joined by sway braces and

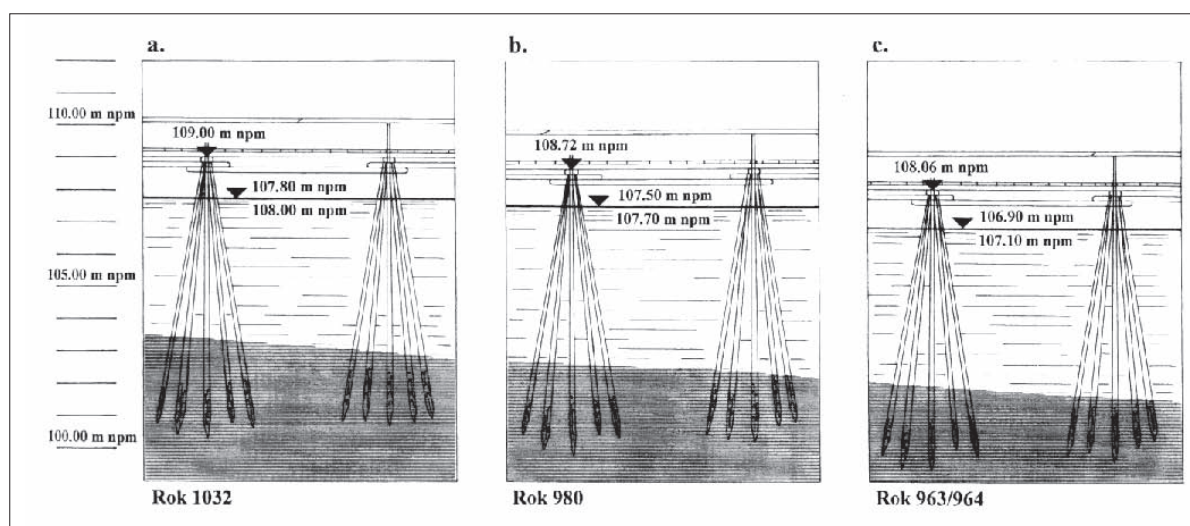


Fig. 7. Ostrow Lednicki: the exploration of the east bridge. A reconstruction of the deck levels of the bridge in subsequent stages, on the basis of planigraphy of the remains of pillars and dendrochronological studies (after G. Wilke, archives of the Underwater Archaeology Department of the Institute of Archaeology of NCU).

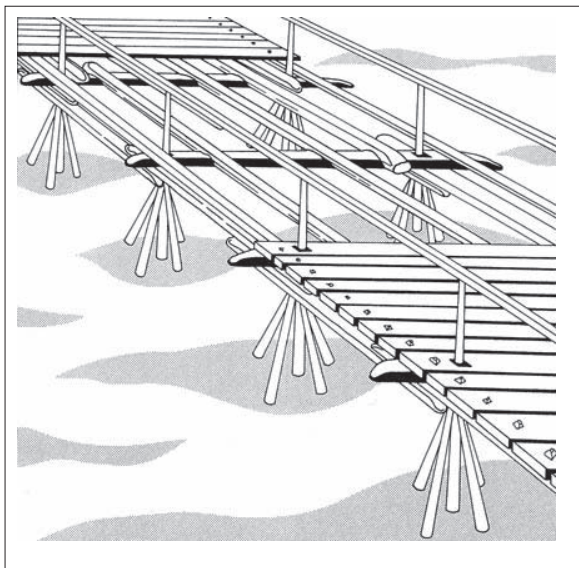


Fig. 8. Ostrow Lednicki: an attempt at the reconstruction of the east bridge (after A. Kola, G. Wilke 2000, p.46).



Fig. 10. Ostrow Lednicki: the east bridge. Axes 'in situ' from the bridge area (photograph by W. Szulta).

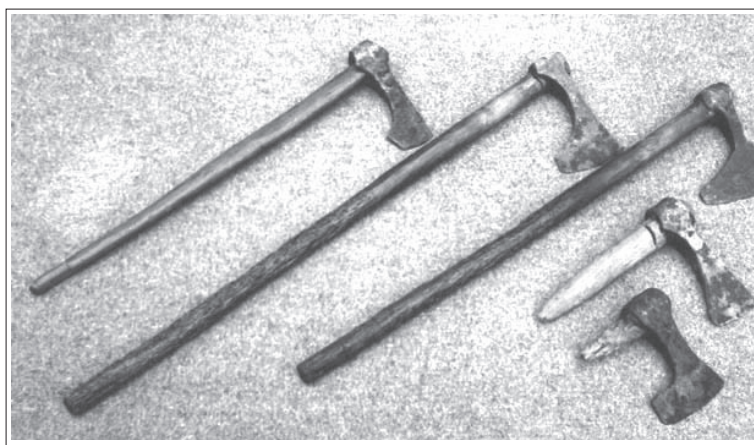


Fig. 11. Ostrow Lednicki: the east bridge. A selection of axes found in the area of the bridge (photograph by W. Szulta).

strengthened by buttresses from outside created the bridge pillar. Such bracing with joggle holes for inserting poles was excavated among the studied remains in the zones of both the east and the west bridge. In the case of the east bridge, the span between the joggle holes in the bracing was about 4.2 metres, appointing at the same time the width of the bridge's deck (Fig. 7). Based on the results of dendrochronological pole analysis, and using them for a chronological-planigraphy analysis (Fig. 8), it was established that the bridge was erected in the years 963–964, and its subsequent rebuilding or repair took place as late as the 1030s (Wilke 2000). The west bridge could have functioned at a similar time; analyses of selected dendrochronological samples are in progress.

Underwater studies performed in 2000 and 2001 in the zone of the west bridge by Ostrow Lednicki were supported financially by a grant from the Foundation for Polish Science, Archeo II, as a continuation of the work undertaken in the 1980s. The study method corresponded with the experience previously gathered at the same site. The idea was to explore underwater stratification from the bottom, using special equipment (injector of water type) and free penetration by means of underwater metal detector. The research using these methods was performed both within the area of the remains of the bridge, and in the vicinity of the lake from the western shore of the island.

In 2000, the exploration concentrated on shore strips II and III near the island. In strip III, the exploration of field 2 of the previous year was continued, where the remains of four poles marked in the general scheme of the remnants of the bridge with numbers from 89 to 92 were found. They constituted a piece of the pillar beam of the bridge. In strip II, the exploration was focused on the area of field 3 (only about four to eight metres from the present shoreline), which was completely overgrown with reeds. Under a thick reed root layer of about 80 to 100 centimetres, a greyish-yellow sand layer with grey gyttja under it contained nine further poles stuck into the lake bed, marked on the map by the numbers 102 to 110. Moreover, the three next trenches were set in strips IV, V and VI (marked in those strips as section 0), within a dis-

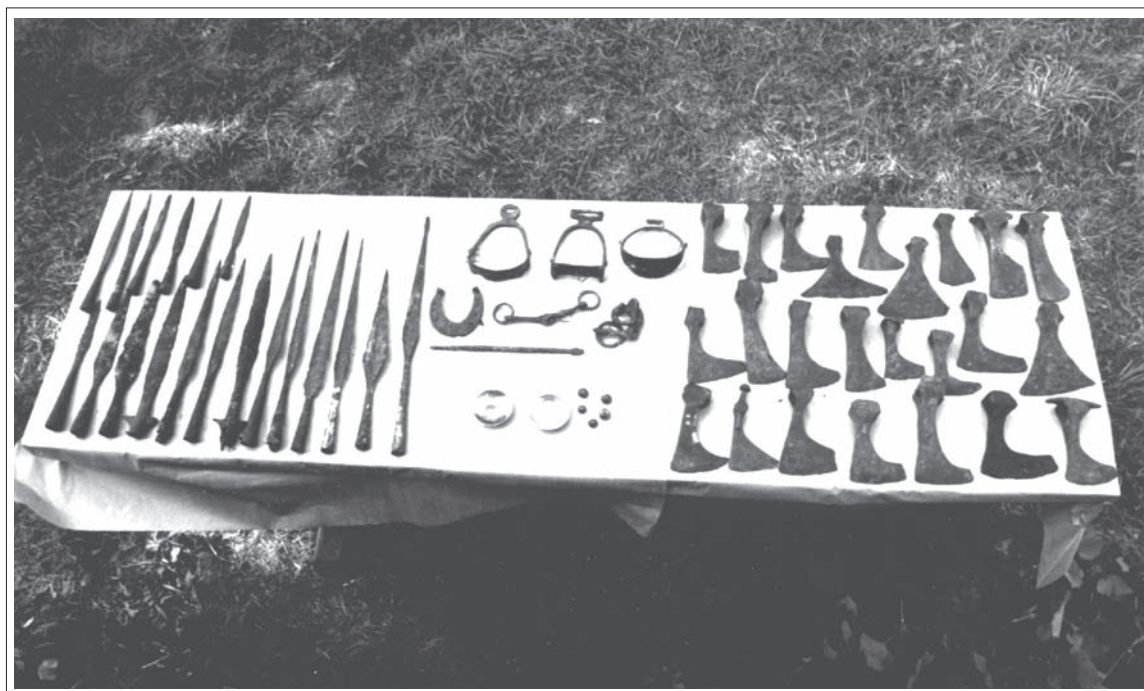


Fig. 12. Ostrow Lednicki: the east bridge. Military and riding accoutrements from the 1999 studies (photograph by W. Szulta).

tance of about eight to ten metres south of the place where the remains had already been spotted in previous years. Their purpose was to indicate the presence of wooden constructions and historic artefacts related to the use of the bridge under a layer of semi-fluid silt. The verification turned out to be successful, because the fields explored in strips V and VI contained oak laths 540 centimetres long, 38 centimetres wide, and ten centimetres thick, which had probably been part of the bridge's deck. The trench in field 0 (strip IV) revealed a completely preserved wooden sledge runner, and nearby two complete Early Medieval axes entangled with each other. As a result of underwater exploration in the year 2000, except for the items listed above, several other wooden and metal artefacts were excavated, including an iron axe and wooden nogs and pegs for fixing parts of the bridge construction. The mass of artefacts consisted of fragments of Early Medieval ceramic vessels (a total of 632 fragments).

The free exploration with the help of an underwater metal detector concentrated that year on studying the south side of the Poznań bridge, marked by two sections of 12 by 24 metres each, as well as along the western shore of the island towards the north of the remains of that bridge. As a result, several historical objects with ferromagnetic features were located and lifted from the lake, including two axes, two iron plates, an iron sickle and two half-scythes, a carpenter's hatchet with a preserved handle, the arrowhead of a bow, a belt clasp, a bucket arc, and a wooden tub with metal hoops.

In 2001, underwater research was continued in the area of the west bridge using a metal detector for underwater exploration, studying precisely by injector fields 2 and 3 in strip II. A total of 24 square metres was subjected to detailed study. The trench in unit 3 was a continuation of the work started the year before, and in the end ten poles marked with numbers from 102 to 111, being the part of the bridge pillar beam, were reported, while the exploration of field 2 of the same strip did not confirm the presence of any remains of wooden constructions related to the bridge. Other wooden objects that were found and brought up were the following: the stave of a small bowl, a piece of a lid, a wooden spade and a tub stave. The total number of objects considered to be parts of Early Medieval ceramic vessels was 282 pieces.

Underwater penetration with the use of a metal detector focused on the exploration of the south side of the remains of the bridge in the subsequent two sectors 12 by 24 metres each and the north side of the bridge. These systematic studies resulted in the localisation and excavation of the following historic objects with ferromagnetic features: two axes, a spearhead, an iron hook and a piece of iron wire. However, a wooden single-trunk dugout boat, a dugout with a preserved length of 4.5 metres, turned out to be an exceptional find. It was taken up from the bottom, and after completing its inventory, it was preserved for research and exhibition purposes.

The studies of Early Medieval bridges on the remains of Ostrow Lednicki, as far as the scale of work and the results obtained are concerned, can be regarded as unique in European archaeology. Regardless of all the knowledge gained so far on the subject of these monumental engineering achievements of the Early Middle Ages, the research produced many movable historic artefacts, enriching our knowledge of Medieval culture at the turn of the tenth century (Fig. 9, see Plate IV). The collection of military objects, nearly 150 military axes (Figs. 10, 11) and several dozen spearheads and javelins (Fig. 12), being the biggest collection of objects of this type obtained until now from one archaeological site, is particularly impressive. Therefore, the crucial problem now is the question of the proper conservation of the waterlogged objects excavated in such great quantity. The understanding on the part of the Foundation for Polish Science, which subsidised the research from the Archeo II programme and also met the expectations of these conservation problems, should also be stressed.

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## ANKSTYVŪJŪ VIDURAMŽIŪ OSTROW LEDNICKI TILTAI POVANDENINIŪ ARCHEOLOGINIŪ TYRIMŪ KONTEKSTE

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### Santrauka

Ostrow Lednicki – sala Lednica ežere, kuris yra tarp Gniezno ir Poznanės miestų. Šioje saloje yra reikšminga archeologinė gyvenvietė, menanti Lenkijos valstybės ištakos laikus. Šio X–XI a. miesto liekanos yra susijusios su akmenine pilimi, kaip ir Gniezno, Poznanės ir Gieczo miestuose. Ostrow Lednicki buvo vienas pagrindinių miestų valdant Mieszko I ir Boleslovui I Narsiajam. Šiam miestui ankstyvaisiais viduramžiais ypač svarbūs buvo du tiltai, jungiantys salą su strategiškai reikšmingais keliais. Gniezno vardu pavadintas tiltas iš rytų ir Poznanės tiltas iš vakarų jungė svarbius kelius iš Poznanės į Gniezną. Tiltų reikšmė ne mažesnė nei miesto, nes tai svarbūs inžineriniai įrenginiai slavų išplitimo areale. Sistemingi tiltų tyrimai prasidė-



jo 1982 m. ir su pertraukomis baigėsi tik pastaruju metu. 2000–2001 m. tiltų tyrimams buvo gauta Lenkijos mokslo fondo lėšų. Šiems tyrimams ir tiltų konservavimui buvo naudojami specialūs judantys aparatai ir metalo detektoriai. Tuo būdu šalia tiltų buvo aptikta daug radinių, susijusių su ankstyvaisiais viduramžiais. Dauguma radinių buvo kovinės paskirties: 150 kovos kirvių, strėlių ir iečių antgalių. Tyrinėti inžineriniai tilto įrenginiai ir šalia jų rasti radiniai neturi analogijų tarp Europos archeologinių paminklų.

Vertė Algirdas Girininkas

