Universiteit Leiden
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TOLLENSE VALLEY: A BRONZE AGE BATTLEFIELD.

The maritime archaeological fieldschool in the Tollense Valley 2023

Edited by Prof. Dr. M. Manders & R. Jonker

Maritime Archaeology Reports

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Tollense Valley: A Bronze Age Battlefield. The maritime archaeological fieldschool in the Tollense Valley 2023

Work has been executed at the Weltzin, MSE, Fpl. 35 in the Tollense Valley

The maritime archaeological fieldschool is a cooperation between the Landesamtes für Kultur und Denkmalpflege M-V, Rijksdienst Cultureel Erfgoed, Göttingen University, Rostock University, and Leiden University

Date: November, 2024

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Introduction

1.1 Background of the Study

The archaeological field school in the Tollense Valley 2023 took place from 17 July to July 27, under the direction of the Landesamt für Denkmahlpflege, Mecklenburg-Vorpommern (LAKD M-V). The project was conducted in collaboration with the universities of Rostock, Göttingen, and Leiden, combining both land-based and underwater archaeological components. Additionally, it was the second underwater archaeological field school organized through an ERASMUS collaboration between the universities of Rostock and Leiden. The funding for the project was provided by the respective universities, with support from the Cultural Heritage Agency of the Netherlands (RCE) in terms of materials and budget and LAKD M-V in terms of materials and personnel (Auer et al., 2023, p. 1).

The overall scientific focus of the field schools is to get a broader image of the whole valley with its river, the riverbank, and riverbed through time, but with a special focus on the Bronze Age battle that seemed to have taken place at 1300 BC (Jantzen & Terberger, 2019, p. 271-272). The work is executed primarily by the students from the respective universities. Rostock and Göttingen are focused on land, while Leiden is primarily active in the river, its riverbed, and the riverbanks. In 2022, the first year of the field school, the underwater archaeology team focused on the sites Weltzin 21 and Weltzin 32. In 2023, the underwater work focused on the site Weltzin 35. The underwater activities were complemented by extensive coring, geophysical surveys on both sides of the river by the Universities of Rostock and Göttingen, and limited excavation along the riverbanks by the University of Göttingen. Furthermore, the fieldwork also aimed at imparting training to students with interests in maritime archaeology. The maritime section of this archaeological site had students as supervisors, under the guidance of Prof. Dr. M.R. Manders from the University of Leiden, Faculty of Archaeology, and Dr. Jens Auer from the Landesamt für Kultur und Denkmalpflege Mecklenburg-Vorpommern.

1.2 Geographical classification

The Tollense River originates from the Tollense Lake near Neubrandenburg and flows northward through a predominantly agricultural landscape, eventually merging with the Peene River near Demmin after covering approximately 70 km. Passing through the municipalities of Burow and Weltzin, the river meanders through a marshy Tollense Valley, characterized by narrow valleys with slopes eroded by streams, separating agricultural pasture or grassland areas, see Figure 1. Despite its seemingly pristine appearance, the landscape has undergone significant changes due to decades of agricultural activities. Since the mid-19th century, intentional drainage measures have been applied in the valley. In the 1980s, certain sections of the riverbed were straightened and dredged, and the dredged material was deposited along the riverbanks (Lorenz, 2014). The Tollense River is very dynamic and its water level changes considerably depending on the season. In winter, the river carries a significantly higher volume of water, and the weirs are open to facilitate the water flow. This creates a powerful current that causes considerable erosion along the banks (Krüger, 2020a, p.18). The meandering sections are particularly susceptible to this phenomenon, as the strong current causes the water to impact and erode the riverbank. This poses a threat to the archaeological material in these areas. Constant monitoring of these river sections is therefore essential and emergency rescue actions might be necessary. Because the archaeological sites span several kilometers along the river, they cannot be adequately protected without considerable technical and financial investment (Krüger, 2020a, p.19).

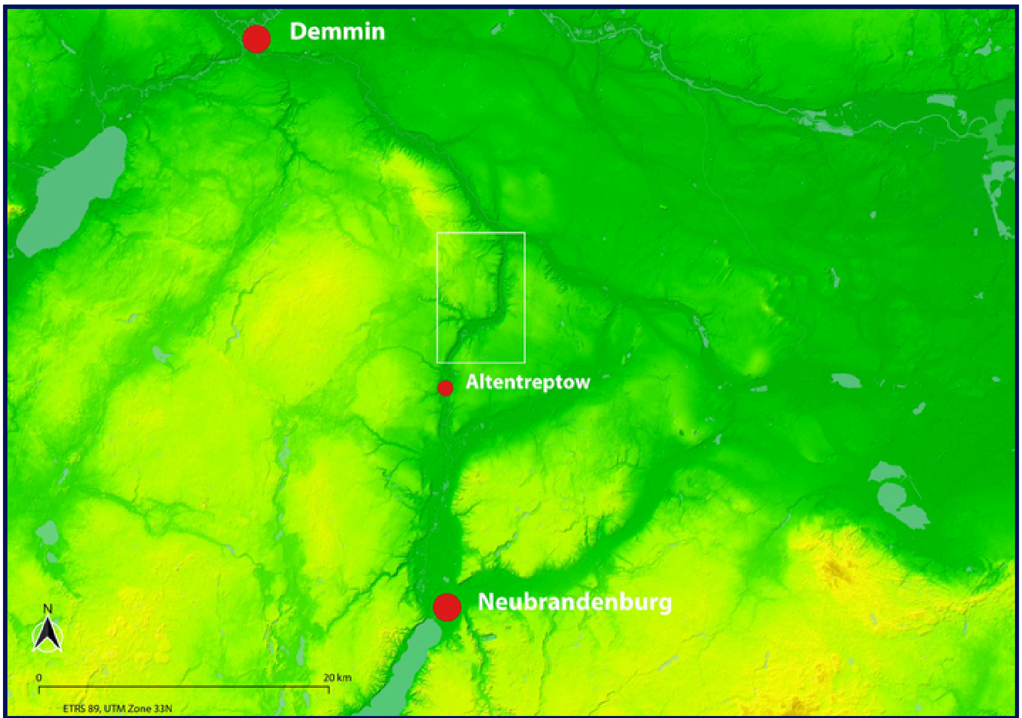

Figure 1: Course of the Tollense river and location of the Tollense valley north of Altentreptow, highlighted inside the white square. LAKD M-V, Landesarchäologie, J. Auer, 2022, based on DGM M-V. © GeoBasis-DE/M-V (Auer et al., 2023, p. 1).

1.3 History of the investigation

Although archaeological finds in the Tollense Valley date back to the 1970s, systematic investigations began in 1996 when volunteer cultural heritage custodian Ronald Borgwardt discovered a human upper arm bone with an embedded flint arrowhead (Lidke et al., 2018, p. 153). A site, where additional bones and worked woods - including two clubs - were found a bit further down the river from where the first bone was found, was registered as Weltzin, MSE, Fpl. 20 (Auer et al., 2023, p. 2). The bone fragment with the flint arrowhead could be dated to the Bronze Age, while several other finds at sites in the area also have been dated in that same period (ca. 1300–1250 BCE) with the help of Accelerator Mass Spectrometry (Terberger et al., 2018, p. 67-74). After securing the exposed archaeological layer at the riverbanks, systematic excavations and investigations began in 2007, both along the banks and in the riverbed of the Tollense. These efforts involved collaboration between staff from the State Office for Culture and Heritage Mecklenburg-Western Pomerania, researchers from the University of Greifswald, and volunteer cultural heritage custodians. While on land excavations were executed, in the river the method applied was that of regular monitoring of the riverbed after the winter by volunteer divers. It became apparent that the finds from the riverbanks as well as the riverbed represented the remains of a violent conflict, dating to a relatively narrow time frame around 1300 BCE, as we have seen above. Supported by the Ministry of Science, Education, and Culture of the state of Mecklenburg-Western Pomerania and the German Research Foundation, interdisciplinary investigations continued until 2017, helping determine the extent of archaeological sites in the Tollense Valley and providing insights into what must have happened.

Since the conclusion of this research project, regular archaeological surveys and conservation work have been carried out by dedicated volunteer cultural heritage custodians in the valley. Based on that information systematically collected since 2006, each year sites for practical training or field school have been selected. Natural processes and erosion affect the river valley and avocational divers still find large quantities of archaeological finds in the river every year. These finds however, may be out of context due to the erosion caused by rapid waters in the spring, but also the limited recording executed when discovered and being retrieved from the riverbed. In 2022, the State authority decided together with the three universities to execute archaeological excavations again. The prerequisite is that this is executed in a field school environment and that land, and underwater surveys and excavations will be combined. The first field school focused on the recording and reburial of a recently discovered dugout, as well as on limited excavation along the riverbanks to understand the formation processes. Additionally, a wide variety of finds detected by avocational divers were catalogued and assessed (Auer et al., 2023, p. 2).

1.4 Aim of the study and areas of investigation in 2023

The area of investigation consists of the northernmost site named Weltzin 35, see Figure 2. In 2016, a wooden structure emerged at this site from the western bank of the Tollense river, dating back to PIII of the Nordic Bronze Age (1286 cal. B.C). Unfortunately, due to restricted visibility at the time, no photographic or video documentation was made (Krüger, 2020b, p. 2). Initial observations revealed that the wooden structure extended only about three-quarters of a meter into the river. Subsequent documentations, made in the following summers however, showed a bigger exposure of the wooden structure, with approximately half a meter of the shoreline having succumbed to erosion between 2016 and 2019, see Figure 3 (Krüger, 2020a, p. 16). The coordinates of the wooden structure are 33388592 m east, 5958734 m north.

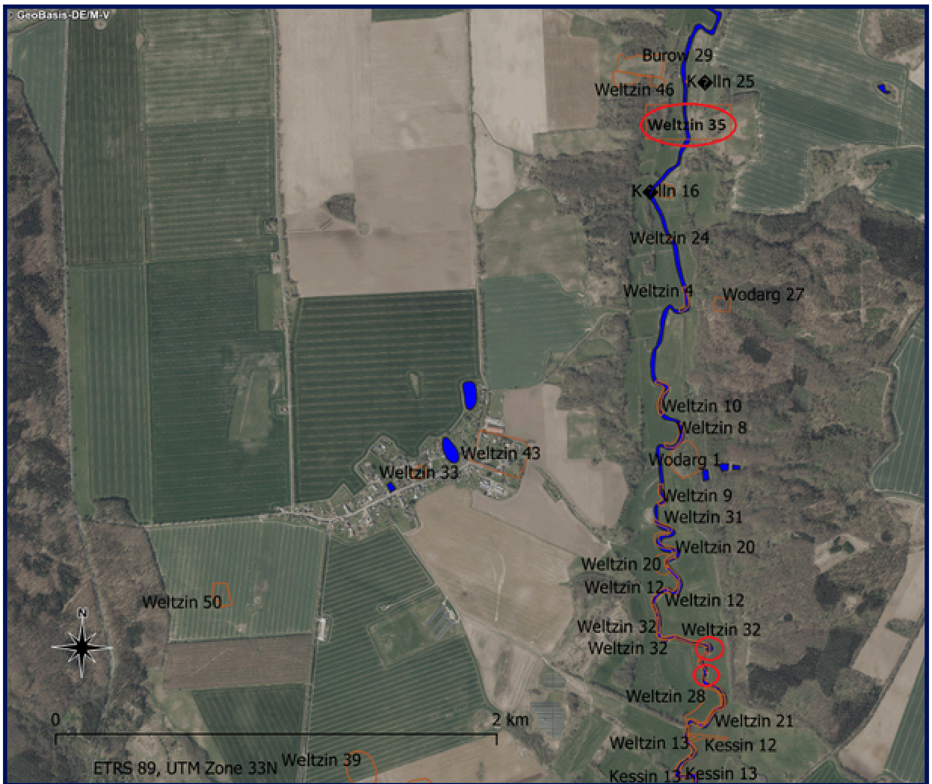

Figure 2: The Tollense Valley with the archaeological sites of the 2022 and 2023 fieldschools highlighted in red (Project figure).

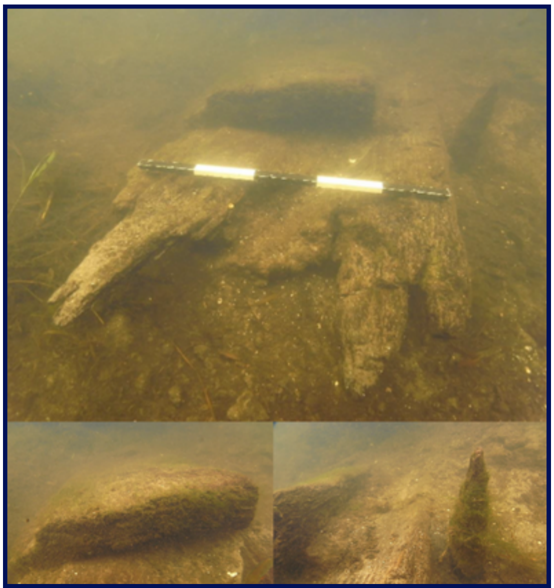

Figure 3: The exposed wooden structure at Weltzin 35 as photographed in 2019 by Frank Nagel. General view (top) and detailed views of a sawn part of the structure and a pole next to it (bottom), (Krüger, 2020b, p. 5-6).

The surroundings of the Bronze Age wooden structure were densely vegetated. Nevertheless, while searching for potential pile settlements and other wooden structures, the signs of erosion became apparent. Krüger (2020a, p. 16) indicates that it is likely that the riverbanks in this stretch suffer from strong erosion during periods of increased water flow in the Tollense. On the eastern bank, a marl edge covered in debris extends prominently into the river, while the western bank is composed of layers of peat. These sediment layers on the western bank are more susceptible to breakdown by the river's current (Krüger, 2020a, p. 16).

The dry summers of 2018 and 2019 exacerbated the situation. Despite the decreased water flow, which lowered the risk of erosion, the low water level exposed the wooden structures further. The exposure and consequent drying of these structures puts them in danger of decaying and even disappearing. Additionally, the impacts from paddle boats passing regularly by and the use of tools for the seasonal grass and reed cutting used by STALU (State Office for Agriculture and the Environment) employees constitute a severe threat (Krüger, 2020a, p. 17-19).

Besides the main wooden structure, other wooden finds were found North and South from it. Additionally, in 2019 other artefacts were found around the main wooden structure, consisting of a grinding stone, an iron lance tip, a bronze axe, and an Antoninian silver coin. The lance tip, bronze axe and coin were found by metal detector in the area surrounding the main wooden structure (Krüger, 2019, p. 1).

The main objective of the investigation underwater during the 2023 campaign was to find out how much of the wooden structure remained in the water at site Weltzin 35 and investigate if it continued into the river sediment.

Based on that, the goal was to interpret its function, to reconstruct what the landscape around the structure would have looked like around 1300 BC, and if the construction indeed could relate to the violent events in the valley. Finally, after the assessment of the preservation condition of the wooden structure, a conservation plan would be developed.

1.5 Coordinate systems and location determination

All geographical coordinates in this report refer to the official geodetic reference system European Terrestrial Reference System 1989 (ETRS 89) in the Universal Transverse Mercator (UTM) projection for Zone 33 N, which corresponds to the EPSG code 5650. For measurements in the field a DGPS system with Leica CS10 controller and GS12 antenna was used.

Archaeological Measures

2.1 Time frame

The Tollense Valley fieldschool lasted 10 days from the 17th to the 27th of July 2023. Usually, the team would arrive on site around 08:30 in the morning and the first divers would be in the water by 09:00. The average time for each diver pair in the water was around 1 hour. There were five daily dives where there would be two divers in the water, at least one lookout, a stand-by diver and one person always helping the divers. This means that around 15:00 the work would be finished, giving the team enough time to clean up and perform any other task which needed to be done, like cleaning up the site, filling the dive tanks and packing the finds and samples that were taken. At around 16:00 the dive site would be left and at the base a part of the group would do household tasks and the other would wash the diving gear and do the find processing. All divers needed to fill in the dive reports of that day. This means there is a paper trail of every dive made on the site. This was the schedule for most days. Saturday the 22nd was a non-diving full documentation day. Time was used to gather all the reports from the previous week and making scans and taking pictures of all the finds. This also included adding them to the database, gathering all the pictures which were taken on site, cleaning the diving gear, and filling up the tanks.

Throughout the days, there were no major weather changes. There were many sunny days, nut also some cloudy and rainy days. However, the weather was not so bad that fieldwork had to be cancelled.

2.2 On-site infrastructure

Personnel

The excavation group consisted of 20 persons split into three teams: the underwater excavation team from Leiden, the land excavation team from Göttingen and the ground-penetrating radar (GPR) team from Rostock. Jens Auer was the primary organizer and coordinator for the whole fieldwork, through his responsibilities as archaeologist from the Landesamt für Denkmahlplege. The underwater team was in the hands of Martijn Manders (Rijksdienst Cultureel Erfgoed and Leiden University) and Jens Auer (Landesamtes für Kultur und Denkmalpflege Mecklenburg-Vorpommern) while the land excavation team was directed by Lorenz Rahmstorf (Göttingen University) and Thomas Terberger (Göttingen University). The GPR team came from Greifswald University. The 2023 excavation field school was focused on one particular site, Weltzin 35 Here, the land- and underwater teams operated directly next to one another. The underwater team researched the above-mentioned wooden structure in the river, which supposedly ran further in the riverbed. This is where the land team made their excavation trench. The GPR team supported both teams and investigated other sites in the valley as well, see Figure 4.

Figure 4: The ground penetrating radar was used to detect any structures in the peaty soil on both sides of the river (Project photo).

However, the excavation personnel were not the only persons on-site. During a couple days a film crew (Alleycats Films) was filming for the Sky History Channel, and thus these days needed to be a bit different compared to the normal excavating days. It involved multiple drives into the valley, showing the equipment, and giving interviews.

The Leiden University team consisted of Jaume Hernández Montfort (MSc), Amber IJsveld (MA), Robin Jonker (RMA), Katrina Konzuk (BA), Emma Krijger (BA), Matija Poljansek (BA), Frieda Siebert (BA), Dion Stawrianidis (BA), Lotte Wever (MSc). The Göttingen University team consisted of Leif Inselmann, Louisa Rebmann, Louise Wilkening, Ariane Achenbach, Solveigh Fliegner, Lisa Bartols. The Greifswald team consisted of Nils Leppin, Sebastian Schille, and Iason Vogt.

Organization

The excavation was mostly led by the students themselves, with Jens Auer and Martijn Manders in an assisting/overseeing role. Every day one student was appointed site director who was responsible for the field organisation that day. The site director created the planning, divided the divers into teams and was responsible for making sure that all documentation was done that day. The site director changed every day, so that everybody could have that role during the project. In this way everyone could get the experience of having the extra responsibilities a site director has.

For the underwater archaeology students, there was also the possibility to join the land excavation team. In this way they could experience excavating the same site, but from a terrestrial point of view. It also helped to understand the underwater site better and vice versa, because what the divers had seen, they could transfer again to the land-team.

Additionally, each day one person from both Leiden and Göttingen University had to join the GPR team from Rostock University, see Figure 5. This was rotated every day. Sometimes this work meant to assist in measuring positions of structures and finds (data points) from the land and underwater teams, but other days it would involve assisting with the magnetometer at other sites in the valley as well.

At the end of each day all teams met at the Hay hotel – a former Zoo - in Mühlenhagen to evaluate the day. The site director of the respective teams gave a short summary of the work done. After the summary, a plan for the next day was presented and discussed. Through these meetings, every team was up to date with the progression and made sure everyone was on the same page

Logistics and accommodation

The underwater team and GPR team were staying in tents, and in an apartment at the Hay Hotel, just a few kilometres from the site. The group from Göttingen stayed in an apartment in the neighbouring town of Altentreptow.

The location in Mühlenhagen served as the excavation base. Here all the equipment was stored, and daily meetings were organized. Also,

Figure 5: The GPR system (Project Photo).

the compressor for filling the dive cylinders was stored at this location, which was mobile and could be brought to the site as well.

On-site, next to the river, a tent was built at the beginning of each day making sure there was protection against the rain and/or sun. Here the divers could change and store their clothes. Multiple vehicles from the different universities and the Landesamt made transportation of personnel and materials to the site possible, see Figure 6.

Figure 6: The divers' set up along the river Tollense. The white vans were used to bring and store materials, the 'party' tent was used for changing in and out of the diving suit. The little tent in the back was the cover for the land excavation team of Gottingen (Project photo).

Underwater work

The water depth ranged between roughly 50 cm and 2 meters, making it necessary to use SCUBA equipment with half masks and single cylinders filled with a normal air mixture. The water was entered from the riverbank with an aluminium ladder about 10m upstream from the first site. The divers were diving in pairs and were using partly their own basic equipment, while cylinders, BCD's, lead weights and some regulators were shared. The shared regulators were thoroughly cleaned between two dives. As mentioned above, on land, both the tent and a vehicle were used as the base for diving. Here the site director, a dive site watch and standby diver were always staying during the diving, coordinating the dives, and doing the safety briefings. The recreational boat traffic on the Tollense, like for instance, canoers, were warned early of the presence of divers in the water, primarily by the dive site watch.

Excavations were done with a water dredge. This tool was chosen because of the shallowness of the site and the fact that sediment can be moved away with more control than with for example an airlift. This equipment is also easy to set up and made operational. The water dredge, made of stainless steel, firemen hoses and a flexible pipe, was powered by a Honda pump.

All dives were registered on LAKD M-V forms by the site director of that respective day. Also, every individual diver filled in a dive form. In this form each day the work done by that diver was provided including a drawing or sketch of the situation. These dive forms served as the basic documentation made by each diver. It helped them to visualise the situation better and to compare with other days, but also the observations made by other divers. All the dive forms together formed partly also the basis for the daily reports, which were made by the site directors of each day.

Software

The evaluation of the work done and the making of plans was done through the digital environment of the site in Qgis the GPS data of all the finds and trench perimeters were added. The 3d photogrammetry models were made in MetashapePro (Agisoft Metashape 2.1.1) which extracted a model from the images/videos made by a camera. For the ground trenches a drone (DJI M3E) was used while for the underwater imagery a GoPro HERO8 Black was used. These models were also geo-located within the program by using the known GPS coordinates of the trench corners.

2.3 Methodology

In this section, an explanation follows of the different methods and techniques used. During the research, multiple archaeological methods and techniques were applied, on-land as well as underwater. The focus here will be mainly on the underwater part, but since two excavations were executed next to one another and both are important in the interpretation of the site, also some activities on land will be explained. The trench on land was made directly next to an excavation area underwater which was called trench 2. This was chosen since the construction underwater was disappearing into the riverbank. It was the hope that by situating the excavation pit inland next to the one underwater, depths could be compared and hopefully simultaneously the same structure on land and underwater could be excavated.

Underwater

The main archaeological structure underwater consisting of a big wooden plank sticking out of the riverbed has been identified already in 2019. The first thing that needed to be done in this season was identifying the site, and to record the current situation on the riverbed. When the first pair of divers identified the presupposed site multiple other interesting features were identified. Quickly the decision was made that the underwater site at Weltzin 35 should be split into two sections, the one with the wooden planking (trench 2), which was dated, and an additional site a few metres upstream where multiple smaller posts were found, which looked like they were placed in some kind of pattern (trench 1). When the presupposed site was identified the land team had an idea where to start excavating their trench, which was next to Trench 2). When the sites were identified they were bordered through four poles and measuring tapes. So that it was clear where the site started and ended. These corner points were measured with a GPS and put into the GIS database. During the first day, it was key to let the divers familiarize themselves with the layout of the sites. The diving team was split into two, corresponding to the two trenches. Through observing and sketching the sites the divers became quickly familiar with their respective sites. A rough sketch was made of the two sites and was used to make further plans on how to execute the excavations in both trenches.

Before more invasive methods were used a 3D-photogrammetry model of both sites was made. Other divers were gently wafting away the very top layer of silt which covered some of the construction features just before the diver with the camera entered the water. Using the software mentioned above and a GO-pro (HERO8 Black) camera, a photogrammetry model was made. Meanwhile divers were constantly sketching more details of the sites; details which might not be visible on the 3D model and interpretations of what could have been.

After the first models were made a more invasive method was used to remove the sediment, this was a waterdredge, see Figure 7. This apparatus uses water from the river and a pump to create suction in a hose to remove sediment. The sediment that was carefully sucked up from the trenches was deposited towards the middle of the river and through the running current of the river was deposited a few metres downstream. This spill was watched by an additional diver to see if any overlooked finds had disappeared in the waterdredge and from there in the spill. Later also a metal detector went through the spill once more, see Figure 8. Because of the waterdredge more and more of the site was exposed and more finds were done.

Figure 7:A diver using the waterdredge (Project photo).

Figure 8: a diver is going to use the metal detector underwater (Project photo).

Once more a 3d-model was made after the final usage of the waterdredge. Making a comparable model of the site before and after the excavation.
During all these endeavours quick reconnaissance's were done in other parts of the river, but always in view of the diving supervisor and diver site watch. Divers also surveyed the river with a metal detector. Hoping to find some metal finds outside of the trenches. All finds were measured with a GPS and were later entered into the GIS database, see Figure 9.

Figure 9: With the use of the GPS finds were measured in (project photo).

2.4 Sampling and Analyses

Samples have been taken from wooden construction features within the two trenches, but also from some poles that were discovered in other areas of the river section where the trenches were in. These samples have been mainly used for dating using dendrochronology and c14 dating, but also for wood identification. In total 45 samples were taken: 31 C14 dating samples, 9 dendrochronology samples, and 5 wood identification samples, see Appendix B.

2.5 Evaluation and Inventory

The various recovered finds in the field were sorted by the respective excavation teams, see Appendix C. After that, the animal bones that were found were sent to the Archaeological Faculty of Leiden University where the identification was carried out by students working at the zoology lab of the Faculty of Archaeology the identification of the bones was based on the KnoCod system (Uerpmann, 1978). All relevant material was labelled with inventory numbers and included into the LAKD M-V depot. The bones were labelled and send to the labs at Leiden university to be researched, after their analyses the bones will be send back to the LAKD-MV.

3.1 Weltzin, MSE, 35 – Trench 1 finds

Wood

Trench 1 was situated upstream (to the south) from Trench 2, see Figure 10. Trench 1 was filled with posts of varying thicknesses (4-15 cm diameter) with blunt or pointed ends, as seen in Figure 11. Radiocarbon dating samples (sample numbers 3001-3014) were taken of the larger poles, and some pointed poles, see Appendix B. If the wood pieces or sections were loose, then they were removed from the river to be processed for sampling, otherwise small 1 cm3 samples were cut out of the wooden structure for dating. During this process, some of the wood could be identified as oak. The wood itself was extremely soft and incredibly delicate; fragments would easily break off by accidentally being touched or when exposed to strong water movements from the fins of scuba divers. This meant that the people working in the trench had to be very careful moving around. The locations therefore also could only be accessed from the middle of the river. Based on the state of preservation of the wood, we assume it to be of a historical nature old. If it really is from the Bronze Age period, will be shown through the dendrochronological and 14C dating results that will follow.

Figure 10: Overview of Weltzin, MSE, 35, with diver entry point, Trench 1 and Trench 2 marked. Aerial image taken by drone (Project figure).

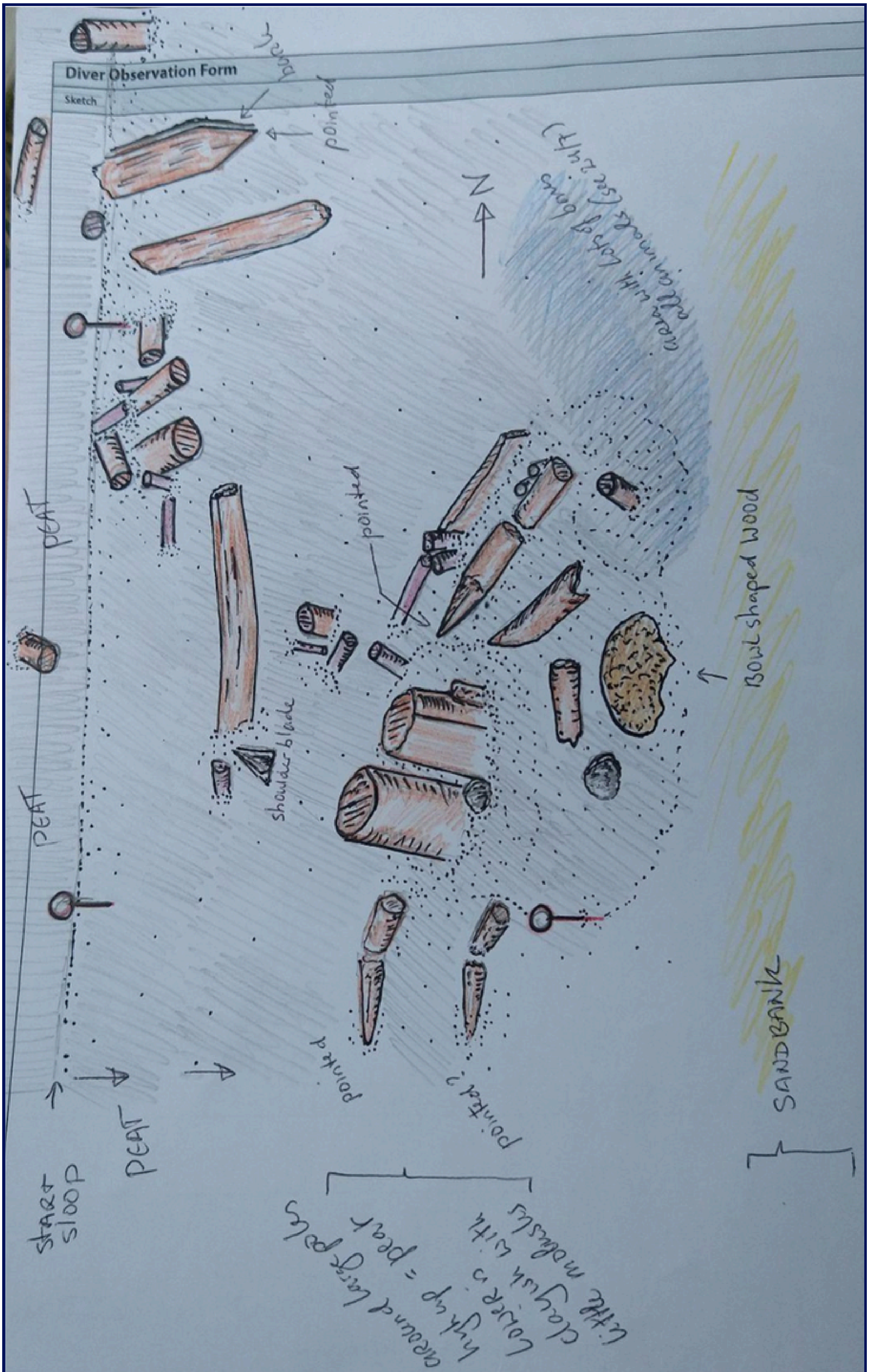

Figure 11: Drawing by Martijn Manders on the 24th of July, 2023, to give a rough overview of trench 1. The poles and the 'bowl shaped' piece of wood are visible and soil texture is described across the riverbed (Project drawing).

The second week of excavation uncovered a heavily degraded piece of wood (find number 1513), roughly shaped like a bowl (approximately 25 cm at its widest). See Figures 12, 13 and 14 below. It was rounded, and appeared to have a worked inside surface, although the decomposition made this difficult to discern. The object was located directly to the east of some wooden features (several poles of different thickness) in trench 1, and therefore may be associated with this structure, see Figure 15.

Figure 12: Find 1513, image of the convex side of the 'bowl' (Project photo).

Figure 13: Find 1513 overview of the concave bowl shape (Project photo).

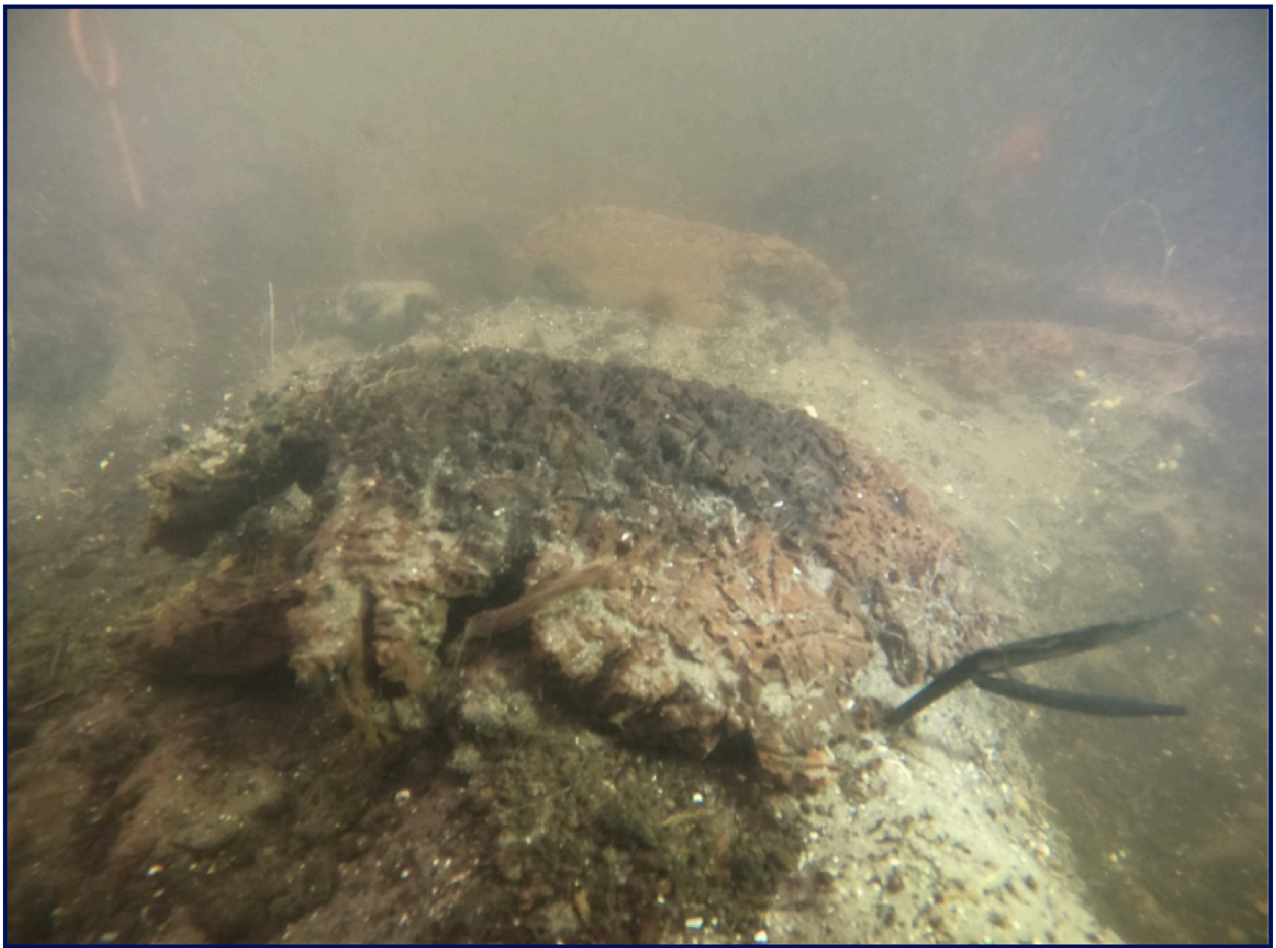

Figure 14: The bowl as it was found underwater (Project photo).

Figure 15: Photogrammetry model of trench 1. The bowl (find number 1513) and the two poles (numbers 1067 and 1068) are clearly visible (Project model).

Bone

72 bones were collected, and GPS measured during the two weeks spent at Weltzin, MSE, 35, with 3 additional bones being left in situ. A selection of bones that were found can be seen in Figure 16. Almost all were identified as animal however 3 were of human origin (a temporal bone, find number 1075, a toe and rib bone both find number 1509). Many of the 75 remains scattered across the riverbed were loose and out of context, sitting on top of the riverbed sediment, see Figure 17. They could have originated from further upstream, migrating down when their original context was eroded away. Some finds were however found in the banks of the river. These are considered to be still in context. A further in-depth report of the animal and human remains will be discussed in the "3.3 Weltzin, MSE, 35 - Material Finds" subchapter below. Appendix A provides more details about these finds.

Figure 16: A selection of bones found during the project (Project photo).

Figure 17: This figure illustrates how difficult it is to recognize bones underwater in the Tollense river. The water is brown, the riverbed and the bones too (Project photo).

Flint

During the clearing of Trench 1, a piece of flint was revealed (approximately 4 cm long). The general shape and distal side imply that it is a flake, see Figure 18. Find number of the flint is 2023/388,1512.

Figure 18: The small flint flake (2023/388,1512) found in Trench 1. As discussed, seen here is the flat distal side (Project photo).

Structures

Trench 1 turned out to be a complex area where poles of different sizes seem to be places vertically in the riverbed. Vaguely also horizontal lying poles/branches can be found sticking out of the riverbank. The poles are clearly worked, pointed and some larger ones are even split. The large vertical poles 1067 and 1068 were sampled for dating (see Figure 19 and 20) as well as a vertical pole (1069) a bit more upstream outside the focus area.

Figure 19: Two large vertically standing poles (1068 (left) and 1067 (right) in Trench 1 (Project photo).

Figure 20: The same two poles (1068 and 1067 (front)) after being excavated partly and sampled for dating (Project photo).

Interpretation

We believe that Trench 1 shows us the last remaining bits of what may have been a wooden path through the moor that existed along the river Tollense for many centuries, see Figure 21. Earlier found objects and those found during this campaign (among the wooden bowl) strongly indicate a Bronze Age date.

Figure 21: A reconstruction of what the features in Trench 1 (and possible also Trench 2) may have been part of: a pathway through the moor (Project drawing).

3.2 Weltzin, MSE, 35 - Trench 2 finds

Wood

Trench 2 contained a large wooden structure, with heavier and more worked beams/planks as those observed in Trench 1, see Figure 22. The first dendrochronological dating of this structure, taken in 2019, indicates that it was built in the Bronze Age, around 1300 BC (Krüger, 2019, p. 2-7). The structure contains a few beams/planks on top of each other, poles situated next to it and others, of different sizes spread all over the trench, however mostly present (and preserved) in the riverbank. Like in Trench 1, sampling for 14-C dating, wood identification and dendrochronology (sample numbers 4001-4017) was undertaken, see Appendix B. Each sample was taken from different pieces of the structure, and some spread out poles in the trench.

Figure 22: Photogrammetry model of trench 2 (Project model).

Bone

The bones were found in trench 2 were mostly animal skeletal remains. Examples are ribs, teeth, long bones and mandibulae. These bones and bone fragments were handled, quickly scanned and processed. The dating of the bones and bone fragments is at this moment still unsure. Some bones have been sampled and may eventually be dated by 14-C.

A quick scan concludes that most bones belong to a bovine. During the last dive of the excavation, a piece of the temporal bone of a human skull, as seen in Figure 23, was found underneath the wooden structure in trench 2. Research regarding the age and sex of the person is still ongoing.

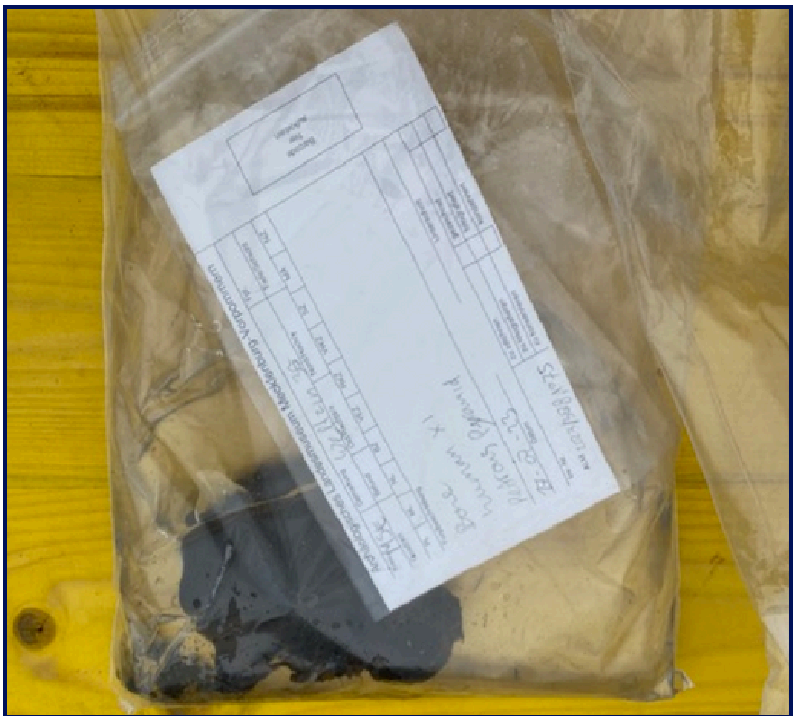

Figure 23: The piece of temporal bone (2023/388,1075) found underneath the structure of trench 2 (Project photo).

Ceramics

The team also discovered six ceramic pieces in Trench 2. Three of them are identified as a regular sherd (numbered as collection finds with number 2023/388,503), one piece is identified as a rim (find number 2023/388,7) and two pieces remain unidentified. The ceramic pieces contain a coarse temper and are gray in color. It is very likely that these ceramic pieces were part of one and the same object dating back to the Iron Age.

Structure

The heavy planks/beams that were discovered in Trench 2 are clearly different from what was observed in Trench 1. The heavy structure seems to stick out of the riverbank, pointing towards the middle of the river. This is however only approximately a metre long. The vertical poles seem to hold the planks into position. Heavy wood was also found in the land excavation pit from the university of Göttingen at the same level as the structure in the underwater trench. However, no clear construction could be observed there.

Interpretation

In is difficult to interpret the structure that was found in Trench 2. Some say it might be the continuation of the path as discovered in Trench 2, the heavy planks could then be interpreted as cross beams build on a foundation of poles. Another interpretation could be that this structure is part of a river crossing. The 2023 fieldschool campaign has unfortunately not given a definite conclusion regarding these theories. A possible reconstruction can be seen in Figure 21.

3.3 Weltzin, MSE, 35 -an overview of the bone finds

Both animal and human osteological remains have been found along the Tollense river. This subchapter summarizes the finds of the 2023 season. The total number of bones has been recorded in Table 1 both human and animal bones. The list is divided by mammal size and order or species whenever they were possible to be identified. Identification was based on The 'Knocod' system for processing data on animal bones from archaeological sites by Uerpmann, H.-P., 1978 by archaeozoology students of Leiden University, Faculty of Archaeology. In the abovementioned system large mammals range from European red deer to large cattle or Aurochs. Medium sized mammals range from a large rabbit or small dog to a wild boar and small mammals are anything smaller than these.

Weltzin 35	Bones (N)
Large mammal	30
Medium mammal	3
Equus	2
Cervidae	2
Bovine	27
Human	3
Otter(cf)	1
Bird	1
Unidentified	3
Total	**72**

Table 1: list of bones found at Weltzin 35.

At the site of Weltzin 35 several bones of bovines, deer and an otter were found. Unlike the 2022 season, not many human bones were found. The human bones found at Weltzin 35 during the 2023 season consist of one rib, one phalange and one temporal bone. The most interesting animal bone finds include commingled bones that could possibly belong to a single juvenile bovine. No clear signs of butchering have been found but the scapula is broken in a way that could suggest that the animal may have been hung on a hook, see Figure 24.

Some of the bones could only be identified as belonging to a large mammal, however, several of these also exhibit signs of belonging to a juvenile, such as unfused and semi-fused growth-plates. This means that they could possibly also belong to the abovementioned bovine.

The other interesting find is a humerus belonging to what looks like an otter, see Figure 25. This bone is the only sign that does show a cutmark, suggesting some kind of human intervention. While otters were historically butchered and eaten occasionally, the placement of the cut is somewhat odd for the act of butchering.

Figure 24: A bovine scapula and a broken scapula. Which might be an indication the animal was hung on a hook (Project photo).

Figure 25: A humerus, most likely belonging to an otter. The highlighted area shows a small cutmark (Project photo).

Weltzin, MSE, 35 -an overview of other finds

Although the bones are the biggest find category and the wood is mostly only sampled, there are also a few other finds recovered, see Table 2. This relatively small group includes an iron arrowhead, several coarse sherds of pottery and a flint. One of the pottery sherds is a rim. Due to the location they were found and the coarseness of the pottery, they probably belong to one and the same pot dating to the Iron Age. This however should be further investigated by a pottery expert.

Weltzin 35	Finds (N)
Coarse pottery	6
Iron nail	1
Iron arrow	1
Flint	1
Wood	4
Stone	2
Total	**15**

Table 2: list of other finds from Weltzin 35.

3.4 Weltzin, MSE, 35 – Other Locations

Wood

On the last fieldwork day, a few students stumbled upon another wooden structure underwater, situated near the right (east) side of the riverbank. This structure was measured in, sampled, and sketched during the very last dive of the season, see Appendix B. Presumptions are that this structure is modern due to its placement and its build, as it contains posts in a row along the riverbank. Elements of wooden planks that were found in the same area show potential for further investigations, however.

Also, approximately twelve pieces of wood were uncovered in a 3m^2 area directly under and around the ladder that was used by the divers to enter and exit the water, see Figure 26. The majority were lying horizontally on the riverbed and were post-shaped. Multiple animal bones were also uncovered in this area, including quite a few shoulder blades. This small wooden structure was only discovered and lightly cleared on the second-to-last day of excavation, and so it is still largely uncovered and not investigated. The GPS positions of eight pieces of wood were taken. Three poles were sampled for dating.

Figure 26: Field sketch of the find location in the direct vicinity of the ladder where divers went in and out of the water (Project sketch).

Metal

The metal detector was also used outside Trench 1 and 2. During these surveys along the riverbank a sharp and small arrowhead was found (find number 1051, see Figure 27), as well as a bent iron nail (find number 1035, see Figure 28).

Figure 27: The arrowhead (find number 1051) that was found while using a metal detector on the riverbank (Project photo).

Figure 28: The bent iron nail (find number 1035) found in the riverbank (Project photo).

Stone

A large stone with a worked indentation (find number 1074), interpreted as a grinding/mill stone was discovered between Trench 1 and 2, on the western side of the riverbank, see Figure 29. It measures 67 cm long and 43 cm wide, with the actual indentation being 45 cm long by 26 cm wide. It was positioned with GPS and left in situ.

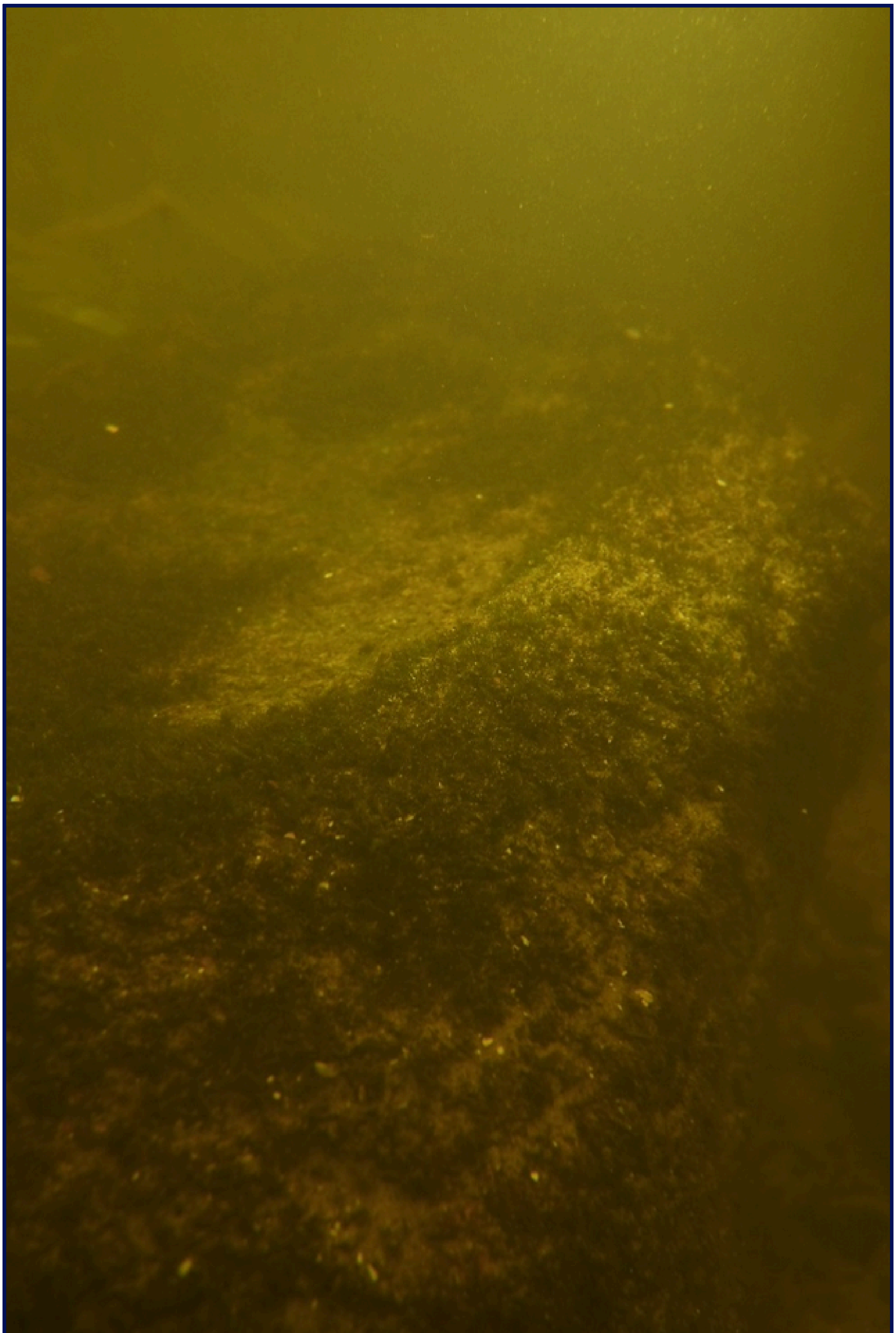

Figure 29: The grinding stone photographed underwater. Only half of the stone is visible in this picture due to the poor visibility, but the indentation on the top is clearly visible (Project photo).

Monument preservation aspects and site management

4.1 General comments on site (management)

To understand how past societies interacted with their environment, archaeologists research historical environments, reconstructing them in the process. This not only entails examining artefacts and remnants but also considering the broader context where landscapes and environments played a pivotal role. By comprehending past landscapes and environments, we gain insights into historical human interactions with their surroundings and their strategies for coping with long-term climate changes spanning from millennia to centuries.

Climate change is a significant point of debate, while it is also a concern for the preservation of archaeological sites. The climate change we experience now is due in large part to the human-enhanced greenhouse effect, altering typical weather patterns over extended durations (Masson-Delmotte et al., 2021). The changing weather patterns affect -, among other things -, temperature, precipitation, soil processes and vegetation types (Australian Academy of Science, 2015). It also affects (amongst others) water levels, currents, pH levels and influences the spread and introduction of invasive species and therefore influences directly and indirectly also archaeological sites above and underwater (Manders, 2024a, 104-107). When parameters change, nature always tries to get into an equilibrium – a balanced state of being – again. If the current climate course is not altered, the effects will only get worse.

In Germany, the primary risks include heightened occurrences of intense heatwaves and droughts. During the period from 1961 to 1990, the average temperature stood at 7.9 °C, with an average rainfall of approximately 535 mm. However, in 2018, the average temperature rose to 10.5°C (Welke and Beck, 2019, p. 9), marking it as the warmest and sunniest year on record in Germany. That same year, 2018, was also characterised by extended periods of extreme dryness. While this pattern may not necessarily repeat itself, the likelihood of extreme heat events increases with each passing summer (Welke and Beck, 2019, p. 9).

The effect of extended periods of dryness will influence a variety of soil processes. The Tollense Valley consists of peaty grounds of a moor which used to be waterlogged up until or right under the surface. Normally these moors provide favourable preservation conditions for organic material due to their high acidity and lack of oxygen and high-water table (Holden et al., 2006, p. 61). However, due to the implementation of a drainage system in order to farm the land, the upper layers have become drier, threatening organic material such as wooden structures in the valley (Kaiser et al., 2012, p. 124). With a loss of soil moisture, the oxygen saturation of the pore volume increases. The pore volume determines the porosity of the soil, facilitating the circulation of air or water within it. The air-filled pores foster aerobic conditions, allowing microorganisms or fungi to penetrate deeper soil layers (Ramesh et al., 2019, p. 29). Consequently, the process of draining wetland soils leads to the oxidation of organic matter. In the instance of peat soils, this action can significantly diminish the soil profile's depth, thereby destroying crucial stratigraphic evidence and damaging archaeological remnants in the process (Kibblewhite et al., 2015, p. 251). An increase in temperature will accelerate the process (Rosenzweig & Hillel, 2000).

Due to hydrological improvement measures and dredging activities, the Tollense is now narrowed and cut into the moor, while the top 100 - 130 cm of peat is not saturated with water most of the year (Auer et al., 2023, p. 24). This contributes to bank erosion. The primary hydraulic factor for bank erosion in the Tollense Valley is the narrow and deeply incised dredged riverbed, resulting in high flow velocities and significant lateral (meander) and vertical erosion (Lidke & Lorenz, 2019, p.74). Consequently, the riverbanks become unstable. Furthermore, the decomposition of peat, a biochemical process, weakens cohesion among sediment particles, leading to the loss of soil structure and making bank edges more susceptible to erosion. Nevertheless, some of the bank sections of the Tollense are partly overgrown with grass and reeds. Such vegetation might mitigate flow speed and strengthen the banks through their roots (van Rotterdam et al., 2019). On the other hand, these roots can damage archaeological structures and artefacts, especially when they need to find water in continuously deeper layers of soil. The process of bank erosion is most likely to occur during strong winds, a storm, heavy and/or prolonged rainfall, and drought.

The dredging activities not only deepen the riverbed but also have adverse effects on the preservation of archaeological remains. As the dredging process involves excavating soil and depositing it on the riverbanks, both the riverbed and its edges, which often harbour archaeological finds and structures, suffer damage. Moreover, previously waterlogged artefacts, displaced during dredging, become vulnerable when exposed to the elements. These exposed artefacts are now more conspicuous to opportunistic individuals searching for archaeological treasure damage. These people who look for archaeological 'treasures' also dive in the river, taking away artefacts from their context without, most of the time, proper registration.

All these factors, in effect in the last 40 to- 50 years of agricultural use have had a negative effect on the archaeological layers in the valley (Auer et al., 2023, p. 24). Peat mineralization and moor decay led to a lowering of the moor surface and thus threatened the archaeological finds (Kibblewhite et al., 2015, p. 251). When trying to protect and manage the Tollense Valley as a whole, implementing the same specific management strategy will not work. Therefore, for each site, a management strategy should be developed and tested. The different strategies should then be implemented into an overall management plan of the valley. The summer of 2022 a logboat at Weltzin site, MSE, 21 was reburied (Auer et al., 2023, p. 25) and in the summer of 2023, Trench 1 and 2 of the the Weltzin site, MSE 35 were covered and reburied with polypropylene mesh. The white mesh has been applied a bit tight in order for it not to get near the surface. The depth in the area is not exceeding 100 cm. The mesh was first fixed with steel pins and after that weighted down with stones from the area on the edges. There are two areas covered: Trench 1 and Trench 2. In between there is an open space with riverbed plants, see Figure 30. The excavated wooden elements of both trenches have been all covered by the mesh. The soil near the riverbanks is still peat, while more towards the middle of the river it becomes fine silt and then coarser sand. In the middle of the river is a sandbank. The sites need to be monitored in the coming years to find out if this protection method also works in this river.

Figure 30: These are the kind of river plants that were growing between Trench 1 and 2 (Project photo).

4.2 Future forecasts

A study on climate change in northern Germany mentioned earlier, showed that the temperature has increased over the years and with-it especially drought will become a huge problem. This may continue in the future. A consequence for the Tollense Valley would be the further drying out of the peat layers and the associated accelerated erosion of the bank edges and lowering of the moor surface. The disturbance of the soil could have irreversible consequences for the archaeological finds in the valley. In addition, dredging displaces finds from their original location, ripping them from their context and in the process, destroying complete sites. Nevertheless, strategies exist that can be implemented to address or potentially mitigate the impacts of climate change. These should be developed for the Tollense Valley. These mitigation strategies can only be executed in an overarching management plan that is accepted by a wide range of stakeholders present in this area.

4.3 Possible measures to preserve the sites

For most threatened land-based archaeological sites, documentation and emergency recovery is the usual method of obtaining and safeguarding information. This means that the site is preserved 'ex situ' as a surrogate through its documentation and the finds resulting from the excavation. This works well when it comes to scattered finds or a clear structure that is threatened by construction work, for example, but excavating an archaeological site of the size and complexity of the Tollense is currently neither practical nor a suitable way to preserve the history of the valley.

An excavation always means the irretrievable destruction of a site. It may be a solution for small locations inside the wider Tollense valley. However, the resulting finds require extensive and expensive conservation. In-situ preservation is a broad term for protecting and preserving sites in their context (Manders, 2012, pp. 2-3). This can be done through various methods, such as reburials to help slow down chemical, biological, and physical decay, or using barriers to prevent for example human intervention. After protection and establishing a benchmarking, regular monitoring will detect changes or deterioration that could mean that the chosen form of in situ protection is not working as it should (Manders, 2012, pp. 14-15). Then action should be taken to change the methods of protection, to excavate or to consider the site as a loss (Manders, 2024b, 62-65). This is also the case for the areas within Weltzin 35 that are in situ protected with polypropylene mesh.

But different-tailormade-protective measures can be taken. The easiest way is to rebury with local sediments. This - of course - only works if one also takes away the reasons for erosion. Other methods include the use of geotextile, artificial seagrass, and the already used polypropylene nets (Manders, 2012, pp. 20–27). Each of these options is suitable for specific environments and varies in cost and effort. In Manders (2012), UNESCO provided a list of the advantages and disadvantages of each in situ conservation strategy. In addition, everything is checked during inspections and dives.

Because a lot of organic archaeological material in the form of a wooden structure was present on the surface of the riverbed in Trench one and two, it was decided to protect these locations with polypropylene nets that were fixed against the lower part of the west bank and the riverbed with long stainless-steel pins, see Figure 31. As mentioned above, the edges were also weighed down with rocks from the riverbed. When this was done, the whole protection area was checked and sketched to have a benchmark for future monitoring. This monitoring will be done during the Greifswald fieldschool in the summer of 2024.

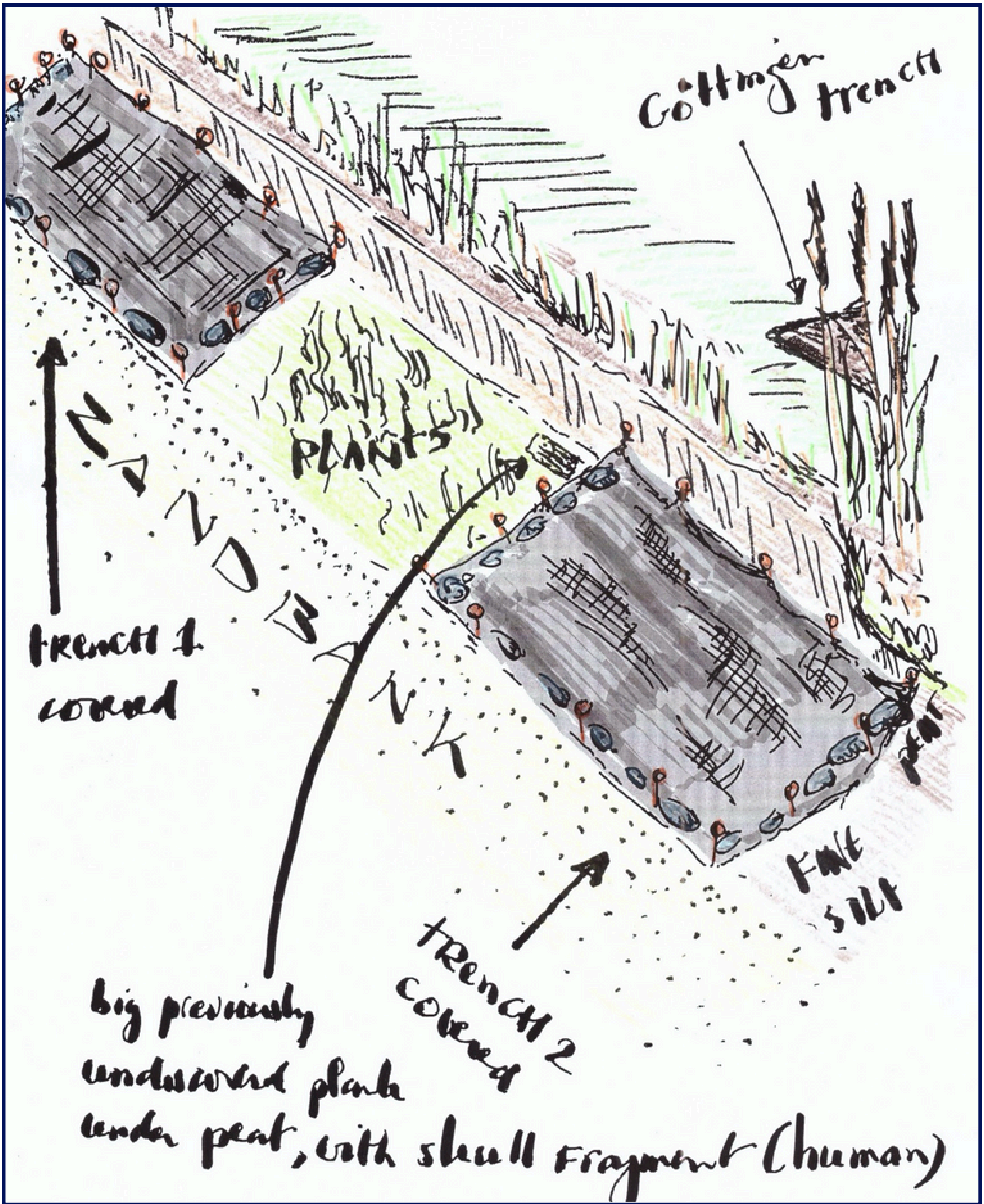

Figure 31: A situation sketch on how Trench 1 and 2 were left behind after the in situ preservation methods were laid out on the site on the last day of the fieldschool (Project photo).

Conclusion and discussion

The Tollense Underwater Archaeology Fieldschool in 2023 was executed at Weltzin 35. At two locations small excavations were done in order to try to understand the wooden constructions that were observed on the riverbed. Trench 1 is an area with mainly vertical pointed poles of different sizes that may be the foundation of a wooden pathway through the moor, alongside the Tollense river. Trench 2 has a larger structure of flat horizontally laying roughly cut planks or beams that stick out of the riverbank and point towards the middle of the river. The exact use of this is not immediately clear. This can be the horizontally laying planks for the same pathway as observed in Trench 1, or it can be the start of a rudimental bridge across the river. The different wooden structure parts were sampled in order to get them dated. The results eventually may tell us what does and what does not belong to the same period of time.

The focus of the overall research has been on the period, or actually moment in the Bronze Age, around 1300BC, when probably a fears battle took place, resulting in the many human victims that have been found so far, in and on both sides of the river. Also other places in the focus area of 2023 revealed some evidences of human presence in the past: animal bones with cut marks, a possible wooden bowl, ceramics, a grinding stone a flint and an iron arrow head need to be mentioned, as well as an interesting third area with wood construction south of Trench 1, right in front of the dive station where the divers entered and left the water each day. The latter has not been researched yet. It is clear that this is an interesting area with still a lot of potential. However, erosion of the river banks and the riverbed is ongoing and the area is large.

It is remarkable that no bronze objects have been found up until now during the fieldschools. It is remarkable because avocationals did find a lot of them over the years. Even with the metal detector it was only a small iron arrowhead that was discovered this year, besides some more recent objects that have no archaeological value. It looks like the rivers is being systematically and very thoroughly surveyed every year, resulting in the spring in many finds of which it is not certain if all of them eventually find their way to the LAKD M-V. This means that many objects can only be researched out of context. Although it is understandable that this is being accepted and even encouraged in order to get some sort of grip on the situation, it has to be also understood that it is a drainage of knowledge of the site which may very well result in not getting the right answers for a site that seems to be one of the most important in Europe for this area.

2024 will not have a fieldschool campaign. There is thus no continuation (except for the monitoring that will be taking place for the in situ protected trenches in Weltzin 35) in research. The researchers have also no idea if this is only temporary or definite. We believe that if there is no visible research from the professionals (and students) in the area, it will be even more difficult to convince others not to touch, to report and to be careful with this unique part of our European history.

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Appendix A

Available data of bone and tooth finds of 2023/388 (year/site code) with find number, GPS, and date.

Find-ID	Find place	x coordinate; y coordinate	Description	Collection Date
1	MSE;Weltzin 35	-	Bone; animal	17-July
2	MSE;Weltzin 35	-	Bone; tubular fragment	17-July
3	MSE;Weltzin 35	-	Tooth; horse?	17-July
5	MSE;Weltzin 35	-	Bone fragment	17-July
6	MSE;Weltzin 35	-	Bone	17-July
8	MSE;Weltzin 35	-	Bone fragment	17-July
501	MSE;Weltzin 35	-	Bone; collection find	17-July
1002	MSE;Weltzin 35	33388588.497;5958706.648	Bone	17-July
1016	MSE;Weltzin 35	33388586.075;5958732.276	Bone; animal	19-July
1017	MSE;Weltzin 35	33388586.056;5958731.203	Bone; animal	19-July
1018	MSE;Weltzin 35	33388586.034;5958730.220	Bone; animal	19-July
1019	MSE;Weltzin 35	33388585.694;5958730.372	Bone; animal	19-July
1020	MSE;Weltzin 35	33388585.559;5958730.245	Bone; animal	19-July
1021	MSE;Weltzin 35	33388585.538;5958730.398	Bone; animal	19-July
1022	MSE;Weltzin 35	33388586.417;5958729.940	Bone; animal	19-July
1024	MSE;Weltzin 35	33388587.445;5958734.246	Bone; animal	19-July
1025	MSE;Weltzin 35	33388586.899;5958732.804	Bone; animal	19-July
1026	MSE;Weltzin 35	33388587.263;5958732.125	Bone; animal	19-July
1027	MSE;Weltzin 35	33388586.003;5958730.741	Bone; animal	19-July
1028	MSE;Weltzin 35	33388587.171;5958731.346	Bone; animal	19-July
1029	MSE;Weltzin 35	33388586.528;5958731.335	Bone; animal	19-July
1030	MSE;Weltzin 35	33388586.922;5958731.738	Bone; animal	19-July
1031	MSE;Weltzin 35	33388587.240;5958731.420	Bone; animal	19-July

1032	MSE;Weltzin 35	33388586.982;5958731.956	Bone; animal	19-July
1033	MSE;Weltzin 35	33388587.375;5958731.706	Bone; animal	19-July
1034	MSE;Weltzin 35	33388585.981;5958730.264	Bone; animal	19-July
1036	MSE;Weltzin 35	33388587.121;5958731.396	Bone; animal	19-July
1038	MSE;Weltzin 35	33388586.563;5958731.360	Bone; animal	20-July
1039	MSE;Weltzin 35	33388587.240;595706.025	Bone; animal	20-July
1040	MSE;Weltzin 35	33388587.855;5958705.747	Bone; animal	20-July
1041	MSE;Weltzin 35	33388588.114;5958705.530	Bone; animal	20-July
1042	MSE;Weltzin 35	33388586.960;5958732.361	Bone; animal	20-July
1043	MSE;Weltzin 35	-	Bone; animal	20-July
1050	MSE;Weltzin 35	-	Bone; animal	21-July
1504	MSE;Weltzin 35	-	Bone; animal	20-July
1505	MSE;Weltzin 35	-	Bone; animal	20-July
1506	MSE;Weltzin 35	-	Tooth; animal	21-July
1507	MSE;Weltzin 35	-	Bone; Animal	21-July
2001	MSE;Weltzin 35	-	Bone fragment	17-July
2002	MSE;Weltzin 35	-	Bone	17-July
2003	MSE;Weltzin 35	-	Bone; animal	17-July
2004	MSE;Weltzin 35	-	Bone	17-July
2005	MSE;Weltzin 35	-	Bone; rib	18-July
2006	MSE;Weltzin 35	-	Tooth; horse	18-July

Appendix B

List of samples

Sample number	Type of sample	Goal of sample	Digital photo number	Date
3001	14C	To determine age of wood		26-07-2023
3002	14C	To determine age of wood		26-07-2023
3003	14C	To determine age of wood		26-07-2023
3004	14C	To determine age of wood		26-07-2023
3005	14C	To determine age of wood		26-07-2023
3006	14C	To determine age of wood		26-07-2023
3007	14C	To determine age of wood		26-07-2023
3008	14C	To determine age of wood		26-07-2023
3009	14C	To determine age of wood		26-07-2023
3010	14C	To determine age of wood		26-07-2023
3011	14C	To determine age of wood		26-07-2023
3012	14C	To determine age of wood		26-07-2023
3013	14C	To determine age of wood		26-07-2023
3014	14C	To determine age of wood		26-07-2023
4001	14C	To determine age of wood	4001 overview KK.JPG	22-07-2023
4001	Wood identification	To determine species of wood	4001 cross section KK.JPG, 1001 cross section reverse KK.JPG	22-07-2023
4002	14C	To determine age of wood	4002 overview KK.JPG	22-07-2023
4002	Dendrochronology	To determine age of wood	4002 overview reverse KK.JPG	22-07-2023
4002	Wood identification	To determine species of wood	4002 cross section KK.JPG , 1002 cross section reverse KK.JPG	22-07-2023
4003	Dendrochronology	To determine age of wood	4003 overview AI.JPG, 4003 cross-section AI.JPG	26-07-2023
4003	14C	To determine age of wood	4003 overview AI.JPG, 4003 cross-section AI.JPG	22-07-2023
4004	C-14	To determine age of wood	4004 overview KK.JPG	22-07-2023
4004	Dendrochronology	To determine age of wood	4004 cross section KK.JPG	22-07-2023
4004	Wood identification	To determine species of wood	4004 cross section reverse KK.JPG	22-07-2023
4005	C-14	To determine age of wood		22-07-2023
4006	C-14	To determine age of wood	4006 overview KK.JPG	22-07-2023
4006	Dendrochronology	To determine age of wood	4006 cross section KK.JPG	22-07-2023
4006	Wood identification	To determine species of wood	4006 cross section reverse KK.JPG	22-07-2023
4007	Dendrochronology	To determine age of wood	4007 cross-section 2 AI.JPG, 4007 cross-section AI.JPG, 4007 overview 2 AI.JPG, 4007 overview AI.JPG	26-07-2023
4007	14C	To determine age of wood	4007 cross-section 2 AI.JPG, 4007 cross-section AI.JPG, 4007 overview 2 AI.JPG, 4007 overview AI.JPG	25-07-2023
4008	C-14	To determine age of wood	4008 overview KK.JPG	22-07-2023
4008	Dendrochronology	To determine age of wood	4008 cross section KK.JPG	22-07-2023

4008	Wood identification	To determine species of wood	4008 cross section reverse KK.JPG	22-07-2023
4009	14C	To determine age of wood		25-07-2023
4010	14C	To determine age of wood		25-07-2023
4011	Dendrochronology	To determine age of wood	4011 cross-section AI.JPG, 4011 overview AI.JPG	26-07-2023
4011	14C	To determine age of wood	4011 cross-section AI.JPG, 4011 overview AI.JPG	25-07-2023
4012	14C	To determine age of wood		25-07-2023
4013	14C	To determine age of wood		25-07-2023
4014	Dendrochronology	To determine age of wood	4014 cross-section AI.JPG, 4014 overview AI.JPG,	26-07-2023
4014	14C	To determine age of wood	4014 cross-section AI.JPG, 4014 overview AI.JPG,	25-07-2023
4015	Dendrochronology	To determine age of wood	4015 A cross-section.JPG, 4015 A overview AI.JPG, 4015 B cross-section AI.JPG, 4015 B overview AI.JPG, 4015 cross-section AI.JPG, 4015 overview AI.JPG	26-07-2023
4015	14C	To determine age of wood	4015 A cross-section.JPG, 4015 A overview AI.JPG, 4015 B cross-section AI.JPG,	25-07-2023
			4015 B overview AI.JPG, 4015 cross-section AI.JPG, 4015 overview AI.JPG	
4016	14C	To determine age of wood		25-07-2023
4017	14C	To determine age of wood		25-07-2023

Appendix C

List of finds

Find description	Trench	Plane	MP	ALM	Date	Additional information
Animal bone	1	0	6	2023/388,1	17-07-2023	
Tubular bone fragment	1	0	7	2023/388,2	17-07-2023	
Horse teeth?	1	0	8	2023/388,3	17-07-2023	
Silex	1	0	9	2023/388,4	17-07-2023	
Bone fragment	1	0	10	2023/388,5	17-07-2023	Possible Ulna fragment.
Bone	1	0	11	2023/388,6	17-07-2023	
Slavic Earthenware	1	0	12	2023/388,7	17-07-2023	
Bone fragment	1	0	13	2023/388,8	17-07-2023	
Collection of bones	1	0		2023/388,501	17-07-2023	
Colection of Silex	1	0		2023/388,502	17-07-2023	
Collection Slavic earthenware	1	0		2023/388,503	17-07-2023	
Straw and collection of bones	1	0		2023/388,504	17-07-2023	
Pointed wooden stake	1	0		2023/388,505	19-07-2023	
Flint fragment	1	1		2023/388,1512	/	
Bone fragment	2	0	2007	2023/388,2001	17-07-2023	
Bones	2	0	2008	2023/388,2002	17-07-2023	
Animal bones	2	0	2009	2023/388,2003	17-07-2023	
Bones	2	0	2010	2023/388,2004	17-07-2023	
Rib fragments	2	0	2011	2023/388,2005	18-07-2023	
Horse teeth	2	0	2012	2023/388,2006	18-07-2023	
Wood (worked?)	2	ZW.-Planum2	2019	2023/388,2007	20-07-2023	
Wood (Pointed-end was burned)	2	ZW.-Planum2	2020	2023/388,2008	20-07-2023	During excavation this find was broken in two fragments.
Wood	2	ZW.-Planum2	2025+2026	2023/388,2009	20-07-2023	Broken in fragments (ca. 37cm long, Höhe: 3,707in HN, Water level. Could be find in O-Profil.
Elongated wooden fragment	2	3	2031	2023/388,2010	21-07-2023	Broken in three pieces with a round cross-section. Possible worked in the form of a decoration.

Universiteit Leiden
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In the summer of 2023, a second archaeological fieldschool was conducted in the Tollense Valley. It was a joint Maritime and Underwater Fieldschool organized by Leiden University, the University of Göttingen, and the University of Rostock, in cooperation with the Landesamt für Denkmalpflege Mecklenburg-Vorpommern and the Rijksdienst voor het Cultureel Erfgoed.

This year's project focused on a specific site in the valley, Weltzin 35, where a wooden structure, dated to the Bronze Age, was visible. During the field school, two trenches were excavated, providing an opportunity to gather more information about the mysterious wooden construction, as well as allowing students to gain hands-on experience in underwater archaeological work.

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