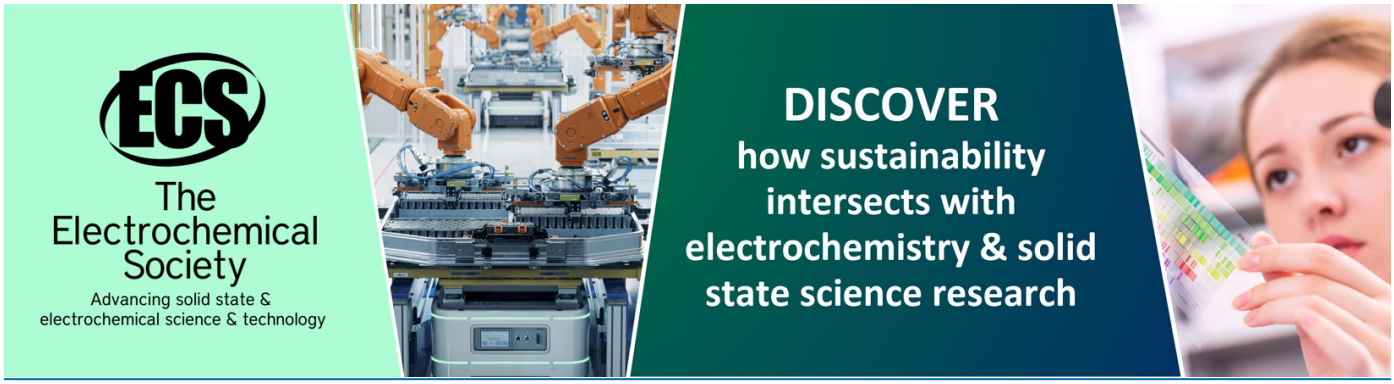
River archaeology – a new tool for historical hydrology



River archaeology – a new tool for historical hydrology

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Abstract. River archaeology consists of underwater research on the rivers themselves. It is also concerned with the archaeology of the valleys/floodplains with special attention to human-environmental interactions (reconstructing landscape, the environment, economy and society from material culture and traces of human impact on their surroundings). As historical hydrology is concerned with similar questions, from the hydrologist's point of view, the combination of different approaches offers the possibilities for fruitful cooperation for both disciplines. The intent of this paper is to present the type, nature and limitations of this part of the archaeological record through recent work in the Drava River basin.
Keywords: river archaeology, historical hydrology, underwater survey, GIS, Drava River

1. Introduction

River archaeology is a new field of research [1,2,3] consisting of underwater research on the rivers themselves, and also the archaeology of the valleys/floodplains with special attention to human-environmental interactions (reconstructing the cultural landscape, the environment, economy and society based on material culture and traces of human impacts on their surroundings). As historical hydrology is concerned with similar questions from the hydrologist's point of view [4] this combination of different approaches offers possibilities for fruitful cooperation between both disciplines. Geology (geomorphology, sedimentology, geophysics), dendrochronology etc. should be taken into consideration as partner disciplines [5, 6, 7, 8, 9, 10].

2. The nature of the data and time perspective

Due to extreme flooding events around the turn of the millennium, the study of paleofloods dominates research themes [11, 4, 12]. Historical hydrology may take advantage of the accurate instrumental observations from the 19th-20th c., as well as pre-instrumental written sources of variable nature and accuracy. Extreme flood events have been registered since antiquity, but continuous, more accurate records only begin from the end of the Middle Ages and beginning of the Early Modern Age (15th c.).

Underwater archaeological research and the topographical survey of river valleys offer a wider perspective over the last 8,000 -10,000 years - since the beginnings of agriculture and the intensification of human impacts upon their natural surroundings. The archaeological record could be divided into direct and indirect information. Direct information consists of traces of floods (such as a layer of sterile river sediment lying over archaeological features) or erosion. The Governor's palace, seat of the governor of the Roman province of *Pannonia Inferior* was discovered in the mid-19th c. on an island (Hajógyári-sziget) in the Danube in Budapest, Hungary. The complex had been constructed for the first governor of the province (Hadrian, the later emperor) in the early AD 2nd century. The building was abandoned sometime around the second half of the AD 3rd century It has been suggested

that this abandonment was related to the rising of the Danube water level [13]. The Roman *limes*, the river frontier consisting of a system of watch towers, fortifications, forts, and bridge heads, was also influenced by Danube water levels. A bridge head at Bölcske (Tolna County, south Hungary) formerly sitting on the right bank of the river was found in what is now the middle of the river as the result of the movement of the river bed towards the west since the AD 4th century [14]. Bridges, ships, ports, fords and remains of fisheries also represent direct evidence for the nature and use of the rivers.

Indirect information derives from topographical survey: the geographical position of settlements and changes in settlement patterns reflect conditions in the river environment, the average level of floodings, and changes in river beds. Rivers themselves functioned as trade routes, boundaries, sources of energy and water etc.

3. Underwater archaeology and river archaeology

Underwater archaeology is treated as a synonym for maritime archaeology not only by the public, but even by many archaeologists. This situation is due to the hostile river environment. Strong currents and low visibility makes diving dangerous, and survey as well as documentation a time-consuming activity. Prospecting and photographing in the "Great Blue" is much more spectacular than in the "Great Brown" and easier to get sponsors for as well. It is largely forgotten that unlike the marine environment, organic material is much better conserved in sweet water (rivers and lakes).

Archaeological mapping has become one of the most urgent tasks for Hungarian archaeology. Although ca. 55,000 sites are known in the country, it is estimated that there are actually another 15,000-20,000 sites awaiting discovery. In the case of underwater sites and other riverbank sites (covered by dense forest or bush) the situation is even more difficult: probably 90-95% of the underwater sites has not yet been discovered! Naturally, only known sites can be studied and protected. The National Office of Cultural Heritage in Hungary has begun a topographic project in the Drava River valley (in southern Hungary). Dozens of new sites have been identified on the high bank and on the floodplain. These sites date frpm prehistoric times to Early Modern times and include earthwork-fortifications and an outstanding logboat "cemetery" discovered in 2005 [15, 16].

3.1. The Drávatamási logboat site and its environmental context

Drávatamási is a small village on the north bank of the Drava in southwestern Hungary (Somogy County). The river is approximately 100 m wide at this point with an average depth of between 4-7 m, the current is strong, and the visibility is good (up to 1 m and sometimes even better). First investigations at this site was carried out by the Dráva Museum of Barcs in 1992, when the low water level made it possible to photograph some dugouts lying beneath the water. An Ottoman period (17th c.) copper jug was also collected from a ship. Based on these discoveries, we were able to organise an international expedition including Austrian, Croatian, French and Hungarian archaeologists and divers.

Between 2005 and 2007, three surveys were organised by the National Office of Cultural Heritage and the Hungarian Archaeological and Art-historian Society. Altogether 30 very well preserved dugouts were found in a limited area of the river. This is the largest logboat cemetery in Europe, and one of the largest in the world! The boats were carved from a single oak trunk. They are very big (10-13 m long, 1.2-1.5 m wide). All the boats share the same characteristics of a round cross-section and absence of interior reinforcements. Fragments of Ottoman period ceramics as well as some earlier Arpad period 11th-13th c. ceramics also came to light close by. We concluded that the site extends to both the Croatian and the Hungarian sides of the river. One of these so-called monoxyls was documented in detail by the French team. We have also collected wooden samples for dendrochronological dating. One of the great surprises of this survey was the discovery of an almost intact copper cauldron which could be dated to the Ottoman period like the aforementioned jug. The cauldron was found in the immediate vicinity of two of our logboats.

All of the boats have pointed, flat bows. The aft however was straight and open. A notch with treenails is visible in this part suggesting that a wooden plank had been fixed there to close off the aft.

There are oval or circular holes along the edges of the side-wall that probably held some attachments. A hexagonal axel from a watermill wheel was also found together with two large pieces of timber with attachment holes. The morphological homogeneity and the traces of attachment suggest that the monoxyls were not individual objects that had been deposited at this spot from time to time but were part of a larger structure. Although dendrochronology did not provide us with a precise date due to the lack of a "master chronology" for the Drava River, it still revealed that all the trees had been cut down during the same period.

The last, 2007 campaign presented us with new discoveries. We also found a millstone under one of our logboats. The most exciting finds included two planks found some meters upstream of logboat 20. There are hand made iron nails and iron sintels on the planks, which attest that they derive from a plank-built wreck, probably covered by the sand dune. The way the iron nails were used was quite unusual. They connected the planks together in a manner similar to the ancient "shell first" concept. There are only a few traces of the nails that connected the planks with the timbers. The only known parallel comes from Altenwörth, in the region of the Austrian Danube. That ship was dated to the early 19th c. The elongated oval plate of the sintels is identical with the figures from a catalogue of ironworks published in Gräz (Austria) in 1825. The Austrian catalogue referred to this kind of sintel as "Turkish-sintels". The main purpose of the 2008 research has been to excavate and document this strange wreck.

The question of interpretation has brought paleo-environmental problems into the focus. The study of 18th-19th c. maps, historical texts and the observations mentioned above give way to two hypotheses. The first one is the water mill hypothesis. It is based on the watermill axel the millstone found at the site, and ethnographic descriptions mentioning floating mills set on boats and logboats commonly used on the Drava. An 18th c. map shows a group of such mills just 1 km upstream from our site. Ottoman period sources mention a number of ship-mills in the environment of Barcs (nearest town to Drávatamási). This hypothesis raises the question of site formation: 30 logboats (or more) represent a large number of floating mills, destroyed at the same time in the same area. These mills were usually based in suitable places in groups, called mill-villages. The site may have been such a village. A possible hypothesis explaning the destruction is a flood which broke away the ropes of the mills.

The second hypothesis is supported by G. Petthő (a 17th c. historian), who described a Hungarian surprise attack against two small fortifications and a bridge at Drávatamási in 1603. The Ottoman period find material, a timber with rectangular holes (for attachment of the boats) and the absence of closing-planks in the aft of the boats (were they destroyed?) may also support this hypothesis. There is also a possible explanation for the question of watermill elements: the Turks may have confiscated all floatable objects, including boats and mills, on the conquered territory to build a military bridge.

Archive maps show that the river itself has changed a lot since the 18th century, mostly due to river regulations that regularized the bed of the river by cutting off meanders.. Unfortunately, we do not have accurate maps for the Ottoman period or the period before although the river environment should have changed since those times. The site needs to be interpreted in its original context, something that requires a broader, interdisciplinary perspective.

Figure 1. The copper cauldron *in situ.* (Photo: K. Zubčič, Croatian Conservation Institute)

3.2. First river archaeological observations

Parallel to the underwater survey we organised a short field survey east of Drávatamási and within a large sample area on the high bank of the Dráva west of Vízvár. Archaeological information from this border zone between former Yugoslavia and Hungary is scarce due to former border tensions related to the political situation during the Cold War situation when the river and its banks were not accesible to scientists. These preliminary surveys resulted in the discovery of a large number of new sites from different periods. An abundant source of information has been collected from archive aerial photos. The Museum and Institute of Military History has a large collection of archive cartographical ortophotos from the 1950's to early 1980's. A series of photos from the Drava area has been scanned and some of them georeferred. A large number of meanders and river channels are still visible (Figure 2.). Many of them could be identified on 18th century maps, although some were not shown because they were already inactive and filled up at the time of mapping.

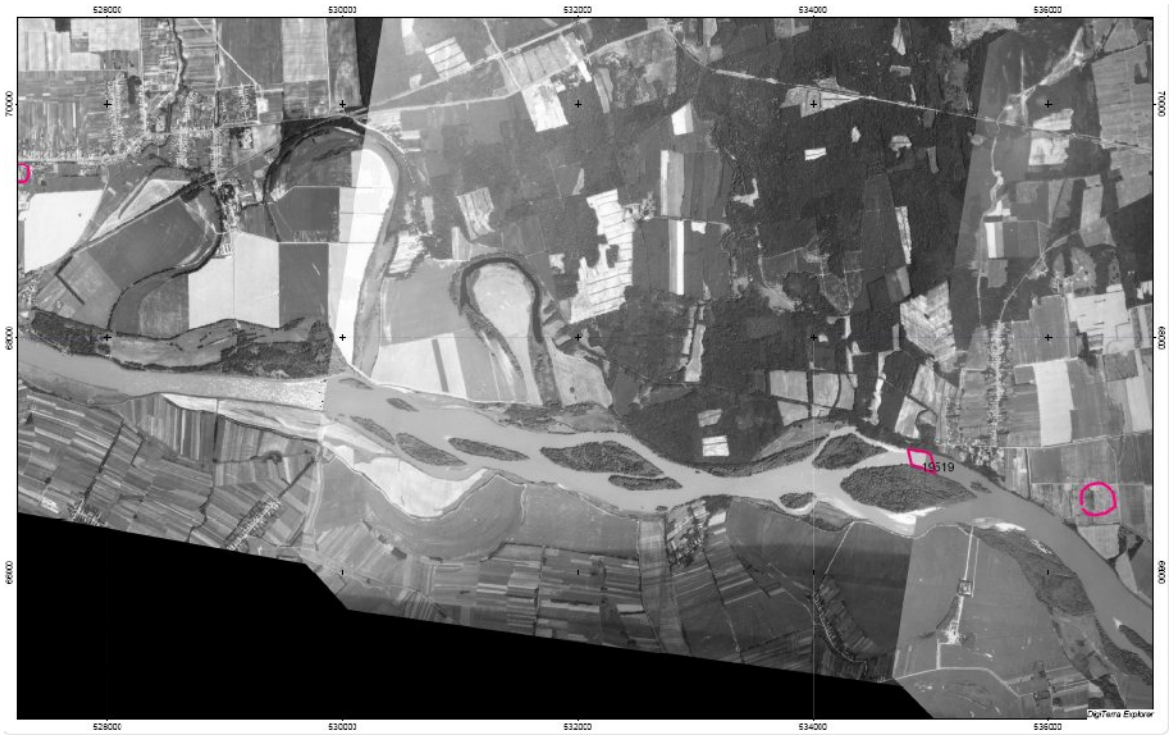

Figure 2. Mosaic of georefered aerial photos of the Dráva valley, near the logboat site. Archaeological sites marked with in pink. Meanders (oxbow lakes) cut during the 19th c. are clearly visible. By Péter Szőcs, National Office of Cultural Heritage

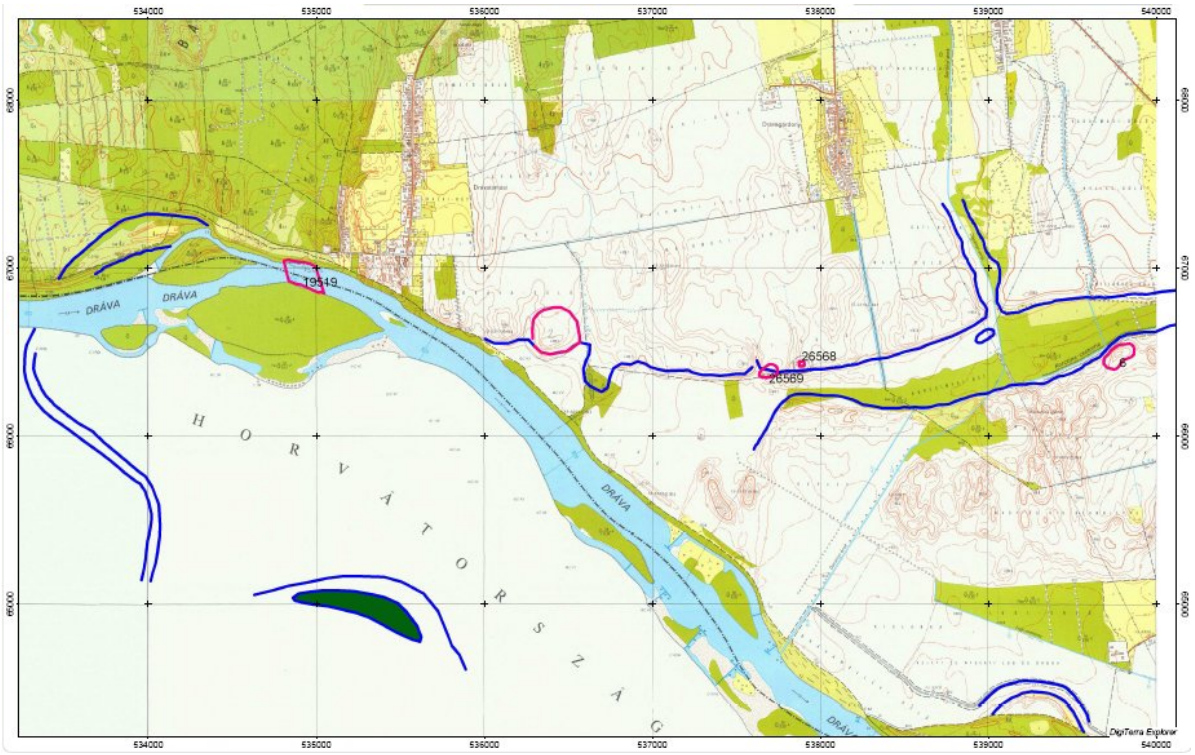

Figure 3. Topographic map with the paleo-channels (blue) and archaeological sites (pink) marked in the area of Drávatamási

Combining archaeological observations and paleo-channel data resulted in interesting paleo-hydro-environmental information. West of the logboat cemetery (id.no. 19519) an S-shaped meander was cut off during 19th century river Regulation work. Our site was however, already in the active riverbed at that time. A large east-west running channel has been identified east of our site (Figure 3, blue). We documented archaeological sites both on its north and south banks (Figure 3, pink). It is evident that the ancient Drava was the main reason for human activity there.

It has been possible to link thecreation, life and abandonment of these sites, not only to historical events, but also to the life on the river. The earliest finds come from the Late Bronze Age. Roman and Medieval finds have been also collected. The latest feature is an Ottoman period small earth-fortification, a guard-post, which served to control that stretch of the river. It may mean that at one time there was a river channel running there from the Late Bronze Age to the Ottoman period (sometime during the 17th c.) although this channel had disappeared by the end of the 18th century. The formation of the logboat site and the closing of the east-west channel occurred (archaeologically) at the same time. Relation of historical and natural events require futher research.

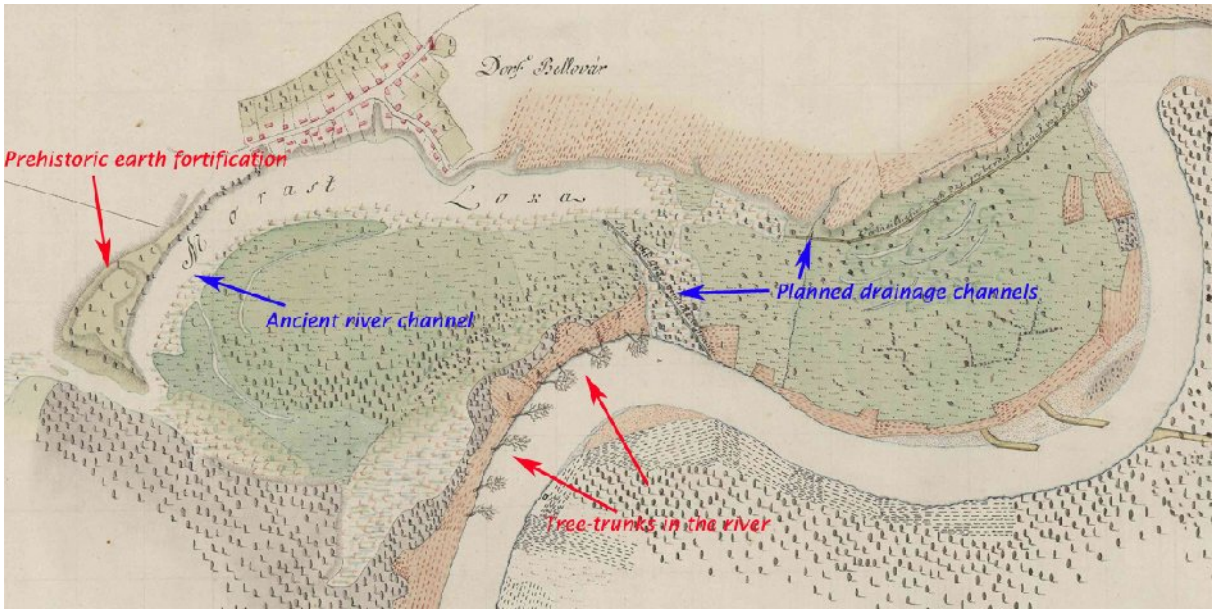

Figure 4. Archaeological and hydro-environmental features at Bélavár (Somogy County). Detail from a manuscript map,1795. Collection of the National Széchenyi Library, Budapest

In the sample area between Őrtilos and Vízvár the survey shows us that fortifications and fortified centres were built on the high (loess) bank on the north edge of the floodplain. Natural loess "peninsulas" cut by paleo-channels were preferred for fortified sites. The river is in a reasonable distance from this high bank nowadays, but surface morphology, aerial photos and in some cases archive maps testify to the former connections between the Drava and these sites. In the case of the prehistoric fortified site (re-used in Ottoman period) at Bélavár, the late 18th century map shows the last phase of the transformation of this historical-hydrological situation. Large settlement sites were also found on the low floodplain in some cases but these date to the Árpád period (11th-13th c.) which suggest that the average flood levels were low over a considerable period, or some kind of adaptation to this humid environment.

Further questions

Although a number of historical, archaeological studies have discussed the special problems connected to working in a riverine environment, even in the Danube Basin, complex, interdiscilinary studies are still awaiting. At this point, it is enough to refer to the close connections between Early and Middle

Neolithic sites and the Tisza River, running though the Great Hungarian Plain [17] and studies dealing with the history of navigation on the Danube [18] or the studies of the Drava River [19] based on images and written sources. Underwater archaeology came into the picture much later, but studies carried out on some European rivers are now accessible (Saône: [1]; Charente: [20]; Ljubljanica: [21]). The idea for and first example of studies combining underwater archaeology and the natural sciences came from France [2] within the framework of international cooperation programmes. The circle of research fields and disciplinas are broadening. Thepurpose of this paper is to inform hydrologists about this new field of research.

Proposed fields for cooperation:

- Paleochannel study (formation, evolution, characteristics).
- Question of the driving forces: extreme, violent events (floods) versus gradual changes.
- Traces of the human impacts on river environment (e.g. built elements like bridges or ports as part of the long-term artificial landscape along the Roman period Tiberis River: [22].
- River and sediment types and strategies employed by archaeological cultures to exploit the riverine environment (e.g.[6, 7]).
- Islands as special places in culture and history (Roman and Medieval towns were often founded near river islands, and the life of these islands influenced developments on the settlements).
- Land use, changes in vegetation cover, and climate change and their influence on rivers and local communities.
- GIS used to combine interdisciplinary data.

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