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**The Kupa River in antiquity:
A preliminary reconstruction of a fluvial landscape and its navigation practices**

Anton Divić *

Giulia Boetto **

Krunoslav Zubčić ***

* PhD candidate, Aix Marseille Univ, CNRS, CCJ, Aix-en-Provence, France; École française de Rome, Italy

** Senior researcher, CNRS, Aix Marseille Univ, CCJ, Aix-en-Provence, France

*** Senior archaeologist-conservator, Department for Underwater Archaeology, Croatian Conservation Institute, Zagreb, Croatia

1. This communication intends to present preliminary results, as well as some future aspiration, of a project focused on the reconstruction of the fluvial and nautical landscapes of the Kupa River in Croatia during the Antiquity. Although at its very beginning, my doctoral project forms part of two long-term research programs carried by the two co-authors of this presentation that were not able to attend the conference. The first program is carried in the inland waters of the Republic of Croatia in the last 10 years by the Croatian Conservation Institute; the second one, started in 2015, is a joint project between Croatian Conservation Institute and the French research laboratory Centre Camille Jullian focused on the study of a Roman river barge found at Kamensko site in the Kupa River.

2. The Kupa River, referred to as the *Colapis* by Strabo and Pliny the Elder, belongs to the Danube hydrographical basin. It's is just under 300 km long, with both its spring and confluence located in Croatia. Situated on the far south-western edge of the Pannonian valley, on the crossroad of communications between Italy and the Balkans and between the Danube and the Adriatic Sea, this river represents an interesting, although little studied, fluvial landscape with an great archaeological potential.

3. The river springs in the mountainous region just northeast of the city of Rijeka and flows few kilometres eastwards before starting to form the border with Slovenia. It then continues to flow in this direction for the next 120 kilometres before detaching from the Slovenian border taking a southern course towards the city of Karlovac. From there, it continues flowing eastwards for some 60 km of direct distance before inflowing into the Sava River at the town of Sisak.

4. Karlovac and Sisak, today towns with about 50 000 inhabitants, both functioned as important stations for the Kupa navigation through history in relationships with their strategic position at the confluences of several navigable rivers, each of them with an important historical significance in different periods.

5. The city-fortress Karlovac was founded ex nihilo in 1579 by the Austrian nobility as a defence against Ottoman intrusions. Dubbed as “The city on four rivers”, it was constructed on the strategic position where the Kupa receives the influxes of the Dobra, Korana and Mrežnica Rivers. This allowed Karlovac to develop into an important fluvial port during the 18th and the 19th centuries. At one point the richest city in Croatia, Karlovac owed its prosperity to this very good regional waterway connection and to a particularly well-placed geographical position on the shortest natural communication from the Pannonia towards the Mediterranean. It was at Karlovac that, until the development of the railroad in the second half of the 19th century, all the grain from Pannonia, sailed up through the Danube, Sava and Kupa Rivers towards the Adriatic and the Mediterranean, was transhipped to carts and horses in order to cross a narrow but mountainous strip of land and reach the Adriatic. The once important nautical status of the town is even today witnessed in the two crossed anchors that make up its coat of arms.

6. Some 60 km of direct distance east of Karlovac the Kupa inflows into the Sava River in the modern-day town of **Sisak**, Roman colony of *Siscia* that existed as an important fluvial port and one of the most important Roman regional centres. *Siscia* was founded after Octavian’s conquest and destruction in the year 35 BC of the Celtic-Illyrian settlement and river port *Segestica* and later flourished due to its exceptional position, subsequently reaching the status of provincial capital under Emperor Diocletian. In *Siscia*, the hydrographical network of the Kupa and Sava Rivers is complemented by the River Odra, which flows into Kupa just northwest of the city. These three rivers determined the localisation of first *Segestica* and then *Siscia*, ensuring it with an exceptional strategic position supplemented by economic and cultural benefits. The city was also the seat of an Imperial mint founded at the time of Emperor Gallienus and most likely functioned as a home port for a part of the Roman Pannonian fleet, *Classis Pannonica*. The nautical importance of the city is well attested by numerous archaeological finds hailing from the river, that include a great number of sporadic artefacts, remains of loading platforms, a large number of logboats, and the remains of a flat-bottomed river barge that was briefly excavated during a salvage operation.

7. This **barge** was discovered on the eastern bank of river Kupa and was excavated as a dry land excavation during a severe drought of 1985. It was first mentioned in a very brief excavation report, and after 20 years the collected data were analysed and published by Andrej Gaspari and Miran Erič from Slovenia. The barge was found at an end part of large concentration of vertical wooden piles installed in the riverbed, partially excavated, falling in a time span between the 1st and the 3rd century AD, that most likely supported a high load capacity platform. Large concentrations of uniform metal objects, supported by the finds of coin blanks and coin die, led to the conclusion that the piles possibly supported the aforementioned mint that was known to be active in *Siscia* from the half of the 3rd century up to the beginning of the 5th century. The concentration of piles was separated by a gap, some 9 meters long and 2 meters wide, following the course of the river and interpreted as

a waterway providing the mint with hydraulic power. The remains of the barge were located at the downstream end of this waterway where it was most likely deliberately sunk to regulate the flow or relieve water pressure.

This box-shaped vessel with flat bottom and low, steep sides was documented in the length of 7 meters, with its preserved width amounting up to 4 meters, and with no extremities located. The bottom and side planks were fastened with numerous tightly spaced iron **clamps**, an interesting and unique construction feature placing this barge in a close relation with several other vessels to which we will come back later. The clamps are varying in size but not exceeding 5 cm in length, and were driven into the planks across the seams every 4 to 7 cm. They also held in place a luting material of an undetermined plant species that was inserted in the seams between the planks. The planks themselves were between 25 and 40 cm wide and around 6 cm thick.

Concerning the framework, massive oak floor timbers and knee-shaped oak frames were set alternately and fastened to the planks by cylindrical **treenails**. The transition from the bottom to the sides was made by two monoxyle L-shaped **chine-girders or bilge strakes**. Dendrochronological and radiocarbon analyses dated the barge at middle of the 3rd century AD.

The site was never fully excavated as looters tried to plunder it over a weekend, destroying the uncovered part of the barge and forcing the archaeologists to suspend the research. It seems that the western part of this vessel, the one close to the riverbank, still lies under the river bed and most likely contains one of its extremities.

In spite of these unfortunate circumstances and the limited documentation, some conclusions can be derived from the existing data. The Sisak barge seems to have operated in the 3rd century AD, before being deliberately sunk in the second half of the 3rd century during the construction of the platform. Due to its documented width of 4 meters, its length can be reconstructed anywhere between 25 and 40 meters, making it a large river barge most likely intended for the transportation of heavy bulk cargoes.

8. A very good example of the fluvial transportation of heavy cargoes hails from the site of **Kamensko** few kilometres from the centre of Karlovac, where the Kupa riverbed holds the remains of another sunken Roman-era river barge well preserved under the cargo of bricks it was transporting. Discovered in 2009 and briefly excavated from 2011 to 2013, the shipwreck has been systematic researched since 2015 by an expert team from the Croatian Conservation Institute and Centre Camille Jullian, making Kamensko the first river shipwreck in Croatia to be systematically excavated underwater.

9. The Kamensko shipwreck was not discovered by accident, as the riverbed of the Kupa next to the village of Kamensko has already been known to archaeologists due to numerous

fragments of Roman bronze sculptures extracted for decades from an unknown location in the river by sand dredgers. These irregular pieces of destroyed, roughly broken, Roman monumental bronze sculptures made up a cargo most likely transported by the river, possibly to the *Siscia* foundries, in order to be melted and reused. Extracted from the riverbed as early as 1913, the fragments were generally sold to collectors or in Karlovac for scrap metal. The bulk of the finds has unfortunately been lost, sold, and melted so that the real quantity of pieces extracted from the river remains unknown. Eighty-nine pieces, however, remain preserved until today, some of which are stored at the City museum of Karlovac.

10. In an attempt to locate this endangered “bronze shipwreck”, Krunoslav Zubčić from the Department for Underwater Archaeology of the Croatian Conservation Institute (HRZ) launched a systematic prospection campaign in 2007. Although no bronze fragments were ever located, the 2009 prospection of the Kupa riverbed next to Kamensko led to a discovery of a tumulus of rectangular bricks, spreading over some 12m² on the depth of 5m. The site was identified as a Roman-era river barge and its importance immediately asserted, followed by several short annual research campaigns under the direction of Zubčić. These campaigns allowed for an initial assessment of the site and paved the way for the upcoming, and still on-going, Franco-Croatian collaboration that began in 2015 under the direction of Giulia Boetto from the Centre Camille Jullian and Krunoslav Zubčić from the CCI.

11. The **Kamensko vessel** is a flat-bottomed river barge, 2 meters wide and conserved in the length of 12 meters. It is constructed mostly from oak and dated between the 1st and 2nd century AD, and on its last journey it was transporting a cargo of several hundred bricks. The remains of its hull lie on the Kupa riverbed at the depth of some 5 meters, following a Northeast-Southwest inclination that approximately follows the direction of the river flow. Its upstream extremity is partially preserved, while on the downstream side it is broken, most likely destroyed by sand dredgers. This is indicated by an approximately 100 m² large and 1 m deep recess, characterized by a greasy clay deposit that might mark the site of sand dredging activities practiced on the river through the 19th and 20th centuries. The conserved remains of the barge are composed of several architectural elements: two chine girders, three bottom stakes, five frames and a keelson.

12. The bottom of the barge is flanked by two monoxyle L-shaped **chine-girders**, sometimes referred to as bilge strakes. Carved out from tree trunks, they form the transition between the bottom and the flanks as well as provide the vessel with longitudinal stiffness.

The northern **chine-girder** can be continuously followed in the length of 10 meters and it seems to have been carved out from a single tree-trunk. Due to the northern inclination of the barge this chine-girder was fully covered in sediment and remained preserved in its original height, which measures 60 cm. It seems that the top of this chine-girder also

represented more or less the gunwale of the barge, as there are no indications of any side planks being added.

13. On the **southern side**, the chine-girder is composed of two carved-out timbers connected by an oblique scarf. Its side remained less conserved than the side of its northern counterpart due to greater exposure.

14. The **bottom** of the barge has been constructed by inserting three strakes or bottom planks between the chine-girders. All three are of different width, varying between 20 and 40 cm, while their thickness amounts to 6-7 cm.

The **framing** is made out of paired ribs that have been carved out from already curved oak branches and attached to the planking by **treenails**. They are widely spaced, the room-and-space being approximately 1.5 meters.

16. Another interesting longitudinal architectural element is a timber which could be interpreted as a **keelson**. This timber, amounting to 30 cm in width and 15 cm in height, leans directly on the planking between two pairs of frames and is around. The visible eastern extremity has been carved in order to be settled on a pair of ribs and is attached to one of those ribs by an iron nail driven from the inside of the hull. Although not yet completely excavated and still covered by the brick cargo, the original length of this longitudinal piece can be reconstructed at 1.5 m. It seems likely that this element might contain a **mast-step**, a carved recess for housing the **mast** of the barge. If that is the case, what we hope to confirm during this year's excavation campaign, it would not only shed some light on the propulsion system of the vessel, but would also define western extremity of the vessel as the prow, possibly also indicating the direction in which the vessel was heading before its sinking. The **mast** housed in this mast-step might have been a towing mast used for hauling the barges upstream, a method of propulsion typical for inland navigation that has not only been archaeologically documented on other shipwrecks but heavily practiced on the Kupa River up to the 20th century.

17. The joining between the bottom strakes and the chine-girders has been achieved by the use of numerous, small, tightly spaced metal **clamps**. The clamps measure between 3.5 and 5 cm in length and no more than 1 cm in width and have been nailed across the seams in short intervals varying between 4 and 15 cm.

18. The clamps also served to keep in place the luting material. This **watertightness** material of unknown vegetal origin was probably inserted in the seams between the planks during the construction. Additional analyses are planned in order to determine the exact species of this vegetal material.

19. The use of **clamps** for connecting architectural elements has been very sporadic in Roman fluvial shipbuilding. Their use has been documented in some occasions, such as for

repairs on Yverdon and Oberstimm barges or for reinforcements on the Zwammerdam 2. However, they have never been used as a principal joining element, except on a small group of relatively less-known river barges, all hailing from the Danube hydrographical basin, two of whom we just presented. Third is the barge from **Sinja Gorica** in Slovenia, found in the river Ljubljanica, also a tributary of the Sava, that has recently been excavated and published by Gaspari and Erič, while the fourth comes from Kušjak site on the Danube in Serbia and was published by Ronald Bockius, based on the data gathered from an 80's excavation.

On the basis of some architectural similarities and, in particular, due to the use of the clamps for assembling the architectural elements, it has been proposed by G. Boetto that the barges from Kamensko, Sisak, Sinja Gorica and Kušjak, constitute one of the fluvial shipbuilding traditions of the Danube hydrographical basin, the second one being represented by the flat-bottomed barge from Lipe barge, found in the 19th c. in the Ljubianica River, whose strakes were connected by the sewing technique.

20. On its last journey, the Kamensko barge was transporting a cargo of several hundred **bricks**. Their dimensions of approximately one cubitus and one pes classify them as lateres sesquipedalis, one of the most common types of Roman construction bricks.

21. During their transport, the bricks were settled on a support made out of branches and smaller tree trunks. This dunnage is not integral part of the barge's architecture, but a solution in order to facilitate the transport of the bricks and prevent any damage both to the bricks and the hull. On the end of its journey, after unloading the bricks, the wood might have also been sold or used for firewood.

22. In order to reach and study the barge's architecture, 130 bricks were extracted from the hull, and were inspected in detail in order to try and locate any production stamps. Unfortunately, no stamps have been found, but a number of other impressions were noted, both accidental and deliberate. We therefore have traces of human and animal footprints, tool traces, as well as two types of deliberate markings. One, less common, is the impressed semi-circle, while the impressed **alpha**-shaped symbol appears at more than 80% of the bricks. It has been carved with a sharp object or a finger in the humid clay before drying and firing and it testifies to the homogeneity of the cargo, which was most likely loaded into the barge from a single production centre that relied on extensive regional waterways to distribute its product.

23. The last year's campaign on the site left us with a nice surprise, when this alpha-shaped symbol impressed in most of the brick has been found inscribed with a burnt point into the southern side of the barge as well. If this is a testimony that connects the cargo to the barge, or maybe both to the same owner, or if it's just scribble by one of the boatmen, remains to be determined.

24. In that context, it would be interesting to mention a group of bricks that were dredged out from the Kupa in the mentioned Roman colony of *Siscia*. These epigraphic monuments bear dates, personal names, and numbers inscribed by a foreman of a brick production workshop that in this way kept track of the daily productivity of each worker. It is a very interesting group of epigraphic monuments that provides us with an insight to the daily activities of a construction ceramics workshop. It also serves as an epigraphic assessment of such a workshop in close vicinity of the Kamensko site that surely relied on the extensive local waterway network to transport its product.

25. Bricks bearing the stamps of *Siscia* workshops have been found in the valley of the **Japra** River in modern-day Bosnia, in an area known for the exploitation of its iron ore deposits. It is most likely that those bricks have been transported from *Siscia* to the Japra valley by the river axe Kupa-Sava-Una-Sana-Japra and that iron ore has been shipped in the opposite direction to the metallurgical workshops of *Siscia* to fulfil the increased need for iron ore due to the presence of the Roman army. We could assume that the before-mentioned large *Siscia* barge, or a barge of the same type, might have taken part in the transportation of similar bulk cargoes.

In the opposite direction, the same bricks bearing the *Siscia* stamps have been found in **Drnovo** in Slovenia, on the banks of the Sava River, testifying to their transportation via this important historical waterway.

26. Concerning the other archaeological sites that bear witness to the usage of the Kupa fluvial network for the transportation of bulk cargoes, we should also take into account a group of **stone quarries** located on the narrow strip of land between the Korana and Mrežnica Rivers, both tributaries of the Kupa. On an area of some 300 km², twenty-five small quarry sites have been located that all form a part of a unique production complex that was active during the 2nd and 3rd centuries AD. Out of thirty-eight known sarcophagi produced in this complex, three semi-worked sarcophagi were found in the rivers: two in the Korana and one in the Kupa, testifying to the transportation of these heavy stone cargoes through the local waterway network.

27. Although the reconstruction of the Kupa fluvial landscape during the Antiquity will be based mainly on the archaeological sources, a special emphasis could be placed on the analysis of the regional **ethnographic** and historiographical data as well.

Due to the important nautical tradition of Karlovac, the modern navigation practices on the Kupa, intensively practiced until the 2nd half of the 19th century, remained relatively well documented.

Due to the conservatism of the fluvial transport zone, the navigational practices on the Kupa does not seem to have changed much from the Antiquity until the 19th, when the industrial revolution transformed the fluvial landscape with both the reinforcements of the riverbanks and the abandonment of the river structures connected with navigation (harbours, towing

paths, etc). Therefore, the ethnographic sources documenting the modern navigation practices on the Kupa can be used for the careful extraction of analogies with the antiquity.

28. It was mentioned earlier that **hauling** might have been one of the propulsion methods used for moving Kamensko barge upstream. This type of propulsion was well known in Roman time as demonstrated by a number of literary or iconographic sources such as this relief from Cabrières. The use of the towing is attested in archaeological sources as well, as shown on the example of the Arles-Rhone 3 barge.

Indeed, this propulsion method has been intensively practiced on the Kupa during the 18th and 19th centuries, even all the way to the 20th century as witnessed on this photography taken in 1912. The men towing the boats, **burlaci**, were convicts, serfs of poor peasants from the surrounding villages. Five men were needed for a small boat, while the bigger barges were pulled upstream by groups of 10 men, and a path at the banks of the river needed to have been constantly maintained to allow their passage. Some of the devices used by the Kupa haulers are today preserved in the City museum of Karlovac. Further study of historical documents describing this activity, which has not changed at all in 2000 years, will surely result with our better understanding of this activity practiced on European rivers during the antiquity.

Second example is a **letter** of a merchant from Karlovac, dated 11th of June 1773, that speaks of a shipwreck that occurred at the confluence of the Korana with the Kupa River, just 4 kilometres upstream from the Kamensko site. While being towed upstream towards Karlovac, a careless helmsman ignored the warnings from the shore and steered the boat straight onto an underwater log that broke one of the boat's ribs. As soon as it happened, the steersman abandoned its post, the boat got stranded aground, and the water started flowing in rapidly. The owner managed only to grab the money from his cabin kept before climbing into a small boat and abandoning the vessel to the mercy of the river. This document, although describing an event that took place more than a millennium and a half after the scuttling of the Kamensko barge, is giving us a detailed insight to a process that must not have greatly differed from the ones that took place in the Antiquity, and that would have hardly remained documented in ancient sources.

We would like to finish with by invoking the seemingly out-of-place myth of Jason and the Argonauts. The myth states that, after stealing the Golden Fleece and escaping from Colchis, the Argonauts took an inland return route and sailed up the Danube all the way to the northern Adriatic via a fictive branch of the Danube. Although no such river exists, this myth could be considered a reminiscence of real inland navigations activities, keeping in mind that sizeable ships could have been sailed between the Black Sea and the hinterland of the Adriatic, just 70 kilometres from its shore.

This connection between the Kupa River and the Black Sea has been documented in modern time, in the venture of a 19th century Karlovac merchant who built two "sizeable ships" in

the city, loaded them with domestic goods and set sail down the Kupa, Sava and Danube, across the Black Sea, all the way to Istanbul where he landed safely with one ship. Even before this venture, letters of an anonymous trader from Prague speak of a ship he refers to as a "frigate" that was built in Karlovac and sailed down the same route loaded with lumber, safely reaching the same destination. Although the story of Jason remains nothing but a myth, the question remains whether a part of this myth was based on existing and known riverine trade routes.