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# THE POTENTIAL BENEFITS AND PROBLEMS OF MAGNET FISHING BASED ON THE EXPERIENCES OF UNDERWATER ARCHAEOLOGICAL RESEARCH

**Attila J. Tóth**[1]
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*The activity known as 'magnet fishing' has become increasingly popular in Hungary. Based on the news and reports appearing in various media, a significant number of 'magnet fishers' survey the waters. As an underwater archaeologist, I started thinking about whether magnets are suitable for archaeological research and what the impact of throwing magnets on ropes might be on underwater cultural heritage. This paper attempts to shed some light on the picture from the viewpoint of archaeology through a series of experiments and summarising available data.*

**Keywords**: magnet fishing, underwater archaeology, heritage protection

In the last two years, I only encountered magnet fishers at two sites. One is near the Tököl ferry of the Danube in Central Hungary, from which we received a box of sintels and wrought iron nails resembling 18th–19th century types. The area was explored previously with side-scanning sonar, which did not reveal any features emerging from the riverbed then. The repeated scanning of the area with a small Deeper radar only detected the steeply deepening (presumably dredged) bottom. Iron ship parts likely submerged more than once by the ferry, probably during repairs or due to the ships accidentally running ashore, but no wrecks were found, and further investigation on the site was not possible. The approximate location of the magnet-surveyed area was given as between two specific trees and with the length of the rope used, which is pretty far from the precision modern archaeology demands.

The second site was in Budapest, where a magnet fisher, otherwise active in social media, recovered an iron object resembling a sword from the water. With some help, the artefact got to the Budapest History Museum, where its conservation and analysis started. The finder could not give information (coordinates) on the findspot, but it could be established that the respective area was a registered archaeological site. The finder was informed about the regulations.

We have prepared a series of experiments to investigate the magnet as a potential tool of archaeological research. We selected a site where we had previously collected data using several methods and instruments, and we carried out the tests there.

The Becsei-mellékág, a tributary of the Danube near Szigetbecse, is a 1–1.5 m deep, muddy backwater blocked since the mid-19th century. Traces of an armed conflict between 1683 and 1686 have been identified on Becsei Island. Two rows of wooden posts become visible in the centre line of the tributary at low water level, known locally as Rosszhíd ('Poor Bridge'). The channel was surveyed with a side scan sonar (using a Humminbird Helix CHIRP MEGA sonar), which located the two post rows and a recent boat in the area (*Fig. 1*). The following dives confirmed the presence of an earthwork in the riverbed, extending from the two banks perpendicular to the channel towards the posts and closed by a series of horizontal planks, creating a small channel. A simple fish finder (Deeper Pro+) combined with GPS was also used to locate the earthwork on the topographic and 'bottom hardness' maps generated from the data. Ceramic and metal objects from prehistoric to modern times were found at the top of the earthwork. The date of its construction is uncertain, and the posts and planks could not be dated with dendrochronological methods. It was assumed that as the final act of the armed conflict, the two parties left the island in a westerly direction, perhaps leaving objects in the riverbed there, especially in the area of the built crossing, if there was one. According to a resident, someone had found a bayonet or spear near the posts.

1 Árpád Museum in Ráckeve; e-mail: roncsok@yahoo.com

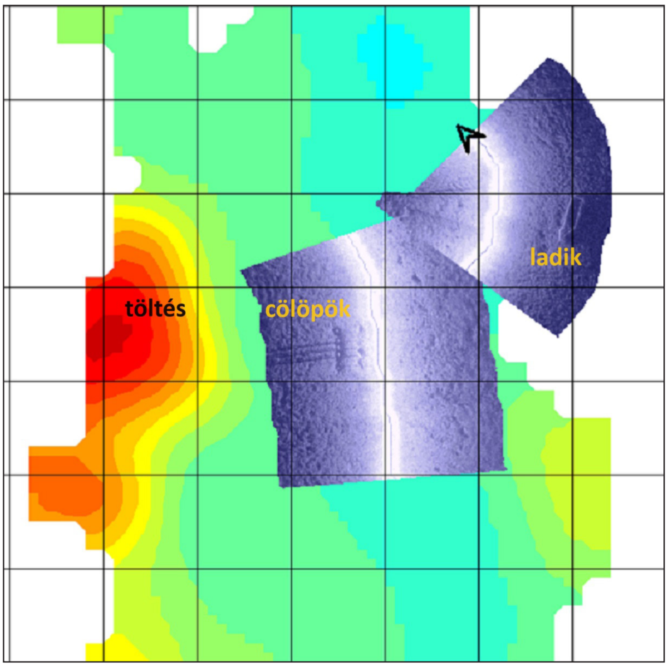


*Fig. 1. Sonar and riverbed survey map with a 5 m grid*

The use of a magnet in the backwater would be justified by that the surface dating to the active period of the riverbed is covered today with a 20–50 cm thick silt layer, making it difficult to find phenomena underneath. A magnet could greatly facilitate our work if it could help effectively in delineating a reasonably small part to be explored by divers in a multi-hectare muddy area.

Our starting point is that in any non-destructive instrumental survey or field exploration, it is essential to recording the precise findspots of the items found and place the observations in space with GPS coordinates. Accordingly, the throwing technique used by magnet fishers was ruled out, since GPS can only be used to locate the position of the person on the riverbank or in the boat, and the findspot could only be calculated approximately from the throwing direction, the length of the rope, and the estimated depth of the water. During the experiments, first used a large industrial magnet (designed for moving iron plates) was used; it was lowered to the bottom of the riverbed from a paddleboat serving as a pontoon and, allowing us to measure the point where the magnet sank. The heavy magnet could only be pulled to the surface by two persons, but we could be sure it would break through the mud and reach the solid substrate. Every round was logged, and when the magnet came back empty, we saved the coordinates as 'negative' (archaeologically). Whenever anything stuck to the magnet, we collected it, adding coordinates to all objects, regardless of size. After displaying the results on a map (*Fig. 2*), it turned out that the iron objects were found in the exact zone of the posts and earthworks. The recovered iron pieces ranged from a few millimetres to a few centimetres; most of them could not be identified, but there was a modern peg among them. Encouraged by the initial success, we decided to investigate a 200-metre-long part of the tributary north of the posts, where we had not yet detected any sonar anomalies, and no dives were made. Due to the thick mud layer, a negative sonar result does not rule out the possibility that finds are scattered underneath, especially as this water surface lies near the venue of the late 17th-century battle. Our measurement technique was modified using a type of strong magnet magnet fishers also use, not just lowering it but fastening it to the end of a long rod and actually pressing it down. This meant the magnet could be operated by one person, one person measured the GPS coordinates and bagged the finds, and the third team member operated the vehicle. This division of labour allowed us to take about 150 measurements in three hours. None of the measurements in the northern area yielded positive results. We feared that the problem might be with the magnet, so we returned to the posts' area, where we found more iron pieces, including a fragment of a thin iron plate corner mount, which made it clear that the problem lies elsewhere.

The magnetic survey was followed by a dive to test whether the section of the river branch yielding no iron finds at all was indeed negative or it did contain any artefacts. A 40–50 cm thick silt layer could be identified on the riverbed, and we could push our hands through it to examine the layer underneath only at one point. There was no point in using an underwater pinpointer because the mud layer was too thick. But does this negative result confirm that magnet is not an effective tool for detecting archaeological finds, or it does not represent conclusive evidence? In the underwater neighbourhood of an island battle, one expects to find artefacts similar to those scattered over other battlefields: lead bullets, bronze buckles and buttons, silver coins, possibly iron horseshoes, and iron weapon parts—in this respect, the magnet is a narrow-spectrum search tool (unlike the 'traditional' metal detector), unsuitable for finding most items on a battlefield.

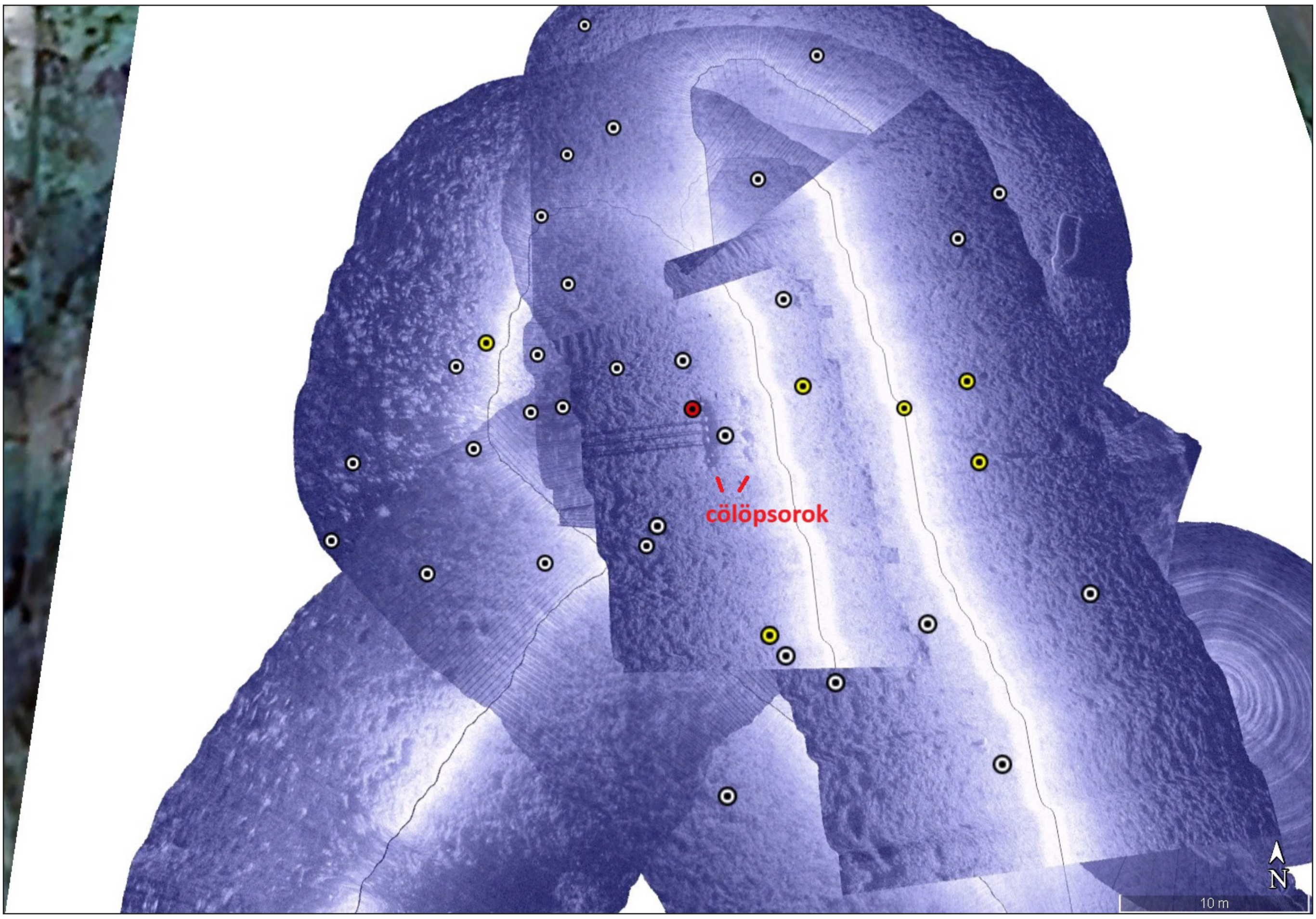


*Fig. 2. Results of the magnetic survey on a sonar map. White circle: no items found, yellow circle: one iron item, red circle: more than one item*

Of course, one can check the entire riverbed with an underwater metal detector, but the aim of the magnet survey is exactly to replace diving in completely opaque waters over a diluted mud-covered bed. Pottery fragments were also found in the submerged earthwork; such finds, as well as wood and other organic materials, cannot be detected with either a magnet or a metal detector. The other weakness of the magnet is proper adhesion: the surface of the magnet must be in contact with the iron to adhere to it. If there is a thick silt layer in the riverbed, there is a chance that even if the magnet is pressed down strongly, a silt layer remains between it and the hard soil of the bottom, preventing the extraction of small iron fragments. The magnet proved to be effective in the area of the earthwork and the posts, i.e., where the silt layer was thin, but these are the areas where one does not need a magnet to locate a site anyway.

The bottleneck of magnet fishing surveys is that its effective application requires a team of at least three people. A side-scanning sonar can be operated efficiently by two people, while even a single person can do a full job with fish radar (e.g., a Deeper model). The sonar represents the fastest, most efficient method of surveying a large area if even a small part of the objects to be found is above the riverbed's surface, while diving may yield the most reliable results. In this context, the magnet is not considered an effective searching tool because of its narrow spectrum, questionable reliability in deep mud, and cumbersomeness; it would have certainly been useful in the 19th century, when diving was not widespread and sonar and radar technology did not exist. It is not an accident that the magnet survey did not gain ground in underwater archaeology: the magnetometer is a much more effective tool for searching for large buried metal objects over large areas, and the underwater metal detector is more effective because of its broader spectrum.

After clarifying that using magnets to survey underwater sites is not recommended, let's see if they can cause any damage to sites, and what legislation is currently in force regulating their use.

Magnet fishers use powerful magnets with an adhesion force of tens, sometimes even hundreds of kilograms claimed by the manufacturer (in reality, this adhesion is not always achieved). This force, when present, is enough for pulling bicycles, safes, gun barrels out of the water, and also to remove small objects from their context if they are bound to that with a force smaller than that of the magnet, the tensile strength of the rope, and the force exerted by the person pulling the rope. In practice, this represents danger to shipwrecks: the sheets of the sintels securing the sealing on the side of the ship are held in place by two thin, rusted-through nails to the possibly brittle edges of the planks, and can fall out of place even at a gentle touch. Accordingly, these wrecks can be damaged by a magnet (moreover, if the rope gets stuck, a strong pull can also disintegrate the structure).

According to Act LXIV of 2001 on the Protection of Cultural Heritage (hereinafter: Heritage Protection Act) and the related regulation, interventions involving a change in the condition of registered archaeological sites, especially the protected ones, should be avoided as far as possible by, and interventions involving a change in condition may only be carried out based on an official permit. Research activity on archaeological sites may only be carried out in ways determined by law (e.g., after notifying the local museum, or with an excavation permit), which in our view means that carrying out magnet surveys on registered archaeological sites is prohibited.

Besides the Heritage Protection Act, there another legislation concerns underwater cultural heritage: Act IX of 2014, the Hungarian ratification of the 2001 UNESCO Convention on the Protection of the Underwater Cultural Heritage (hereinafter: the Convention). This paper is no place to dwell on the details of the Convention (the text of which is available in Hungarian and English in the National Legislation Repository and on the website of UNESCO), but a few basic principles seem worth highlighting:

1. Underwater cultural heritage includes all underwater objects more than a hundred years old, save for, e.g., pipelines and engineering works in use.
2. Underwater cultural heritage shall be protected *in situ*.
3. If the heritage element cannot be preserved *in situ* or its research is justified professionally, it may be removed under the supervision and direction of a qualified underwater archaeologist, according to professional standards (e.g., in documentation).
4. Underwater heritage elements shall not be sold or transferred to private ownership.

It is easy to see that the ad-hoc collecting of objects older than a century for private collections is not compatible with the Convention (which Hungary has ratified). In our view, any search for archaeological finds in temporarily dry river and lake beds, including metal detecting activities, falls within the scope of the Convention.

Currently, no legislative act regulates magnet fishing; however, it certainly cannot be practised on archaeological sites. The finder must report and hand over free of charge any discovered underwater cultural heritage element to the respective authority and stop any research activity in the area concerned immediately.

Of course, magnet fishing can yield objects other than archaeological: crime-related stabbing weapons, sidearms, firearms, safes, vehicles, explosive devices, weapons of war, ammunition, and weapon parts. Material remains from the Second World War will only be covered by the Convention in another twenty years but may be part of the military cultural heritage. There may also be safety issues (unfortunately, a child died recently while magnet fishing in Hungary) and the possible hydrological effects of the unwanted changes caused in the beds of watercourses by removing objects must also be considered. These concerns, albeit related primarily to underwater cultural heritage, are beyond the scope of this study, but should be taken into account when developing a new, respective legislation.