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Recent underwater archaeological research off the Croatian coast

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Introduction

The Department for Underwater Archaeology exists and operates within the Croatian Conservation Institute and, as the leading team in the area of underwater archaeology. It carries out systematic and protective research of underwater archaeological sites, conducts underwater surveys and explorations in rivers and lakes and participates in expert surveys of numerous already known and newly found sites along the Croatian coastline, as well as in inland waters.

The Department’s field of work covers a large time span and encompasses prehistory, classical antiquity, the Byzantine period and the Middle Ages, post-medieval shipwrecks dating from the 16th to the 18th centuries and shipwrecks and sunken aircraft from World War I and World War II. The Department is also involved in exploration and research of submerged Roman period architecture, Roman villas and harbour objects, nowadays located below the sea’s surface, e.g. at the Vižula peninsula near Medulin.

The most important shipwrecks from the period of classical antiquity are the shipwreck at the Čavlin shallow near Murter with its cargo of Lamboglia 2 amphorae, the shipwreck in Vela Dolina bay on Mljet with a cargo of late Roman amphorae dating from the 4th century AD, and the shipwreck off Sutivan on Brač with a cargo of sarcophagi and other architectural elements. Research has been initiated at locations near the Stoba promontory on Mljet and the islet of Merara near Rogoznica, where various types of Byzantine amphorae have been found.

Post-medieval shipwrecks have also been explored: a shipwreck from the 16th century in the Sv. Pavao shallow off Mljet, with its important cargo of eight bronze cannons, commercial goods and Iznik pottery of Oriental provenance. The Murter shipwreck that has been dated to the early 17th century contains wares from Nürnberg and Murano glass. Research has also been conducted in the vicinity of Premuda, on the battleship Szent Istvan, one of the largest wrecks in the Adriatic Sea. All these examples, and the recent discovery of the B-24 Liberator class bomber near Viš, confirm that the Croatian sea bed shelters rich and abundant heritage. In the end, it is very important to underline the necessary cooperation between local divers and the State institutions responsible for the protection of Croatian underwater cultural heritage: the Ministry of Culture and the Croatian Conservation Institute. It is only through the cooperation and efforts of all of us who love our sea that we can discover its beauty and the secrets it hides.

1. Sunken architecture on the Vižula peninsula near Medulin

Since 1995, the Division for Archaeological Heritage of the Ministry of Culture, today the Department for Underwater Archaeology of the Croatian Conservation Institute, has carried out archaeological research of the submerged part of the architectural complex of a luxurious Roman villa on the Vižula peninsula by Medulin. As well as a residential part with ancillary production and thermal bath contents, the complex has an operational quay – a waterfront with several berths and other harbour and warehousing structures. The whole complex was created in the period from the 1st to the 5th century AD.

The shoreline part of this complex is located in the tidal area, and is today partially in the sea. Natural erosion brought about by wave action, the drainage of rainwater and the human factor have gradually changed the configuration of the land and the seacoast. In a similar way they have made an impact on the architectural remains, which are today visible mostly in the foundation footings. These facts spurred underwater archaeological research, documentation and repair of the whole architectural complex. During the investigation, at least eight structural complexes have been observed on the peninsula, some of which are below the surface, two of them having port features. The structures are labelled with letters from A to H.

The architectural remains of Structure A lie on a pebbled beach in the tidal zone. The wall footings are visible, an apse being also visible among them. Because of certain clues, such as a floor of impermeable mortar within the apse, it can be assumed that it was a pool and was part of the baths complex. The remains of architecture in the footings can be seen in the sea in front of the structure, and further underwater research could provide new information about Structure A (Miholjek 2008, 299).

Underwater test probes under Structure A, which was being at the same time investigated on land by a team of the International Research Centre for Archaeology, Brijuni-Medulin in association with the Archaeological Museum of Istria in Pula and the Faculty of Philosophy in Zagreb, yielded negative results in respect to the revelation of any kind of architecture. Nevertheless, a cultural strata 2 metres thick were found in four probes. They contained a large quantity of fragments of building material: tegulae, imbrices and mortar; fragments of marble paving: grey-white, red, yellow, black and green in colour; amphora

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1 This paper is dedicated to our late co-worker and friend Dr Mario Jurić.
fragments and fragments of ceramic vessels, from coarse kitchen ware to fine thin-walled vessels. Among other things, a fragment of Corinthian ceramic in relief was found. This is a type bowl, pyxis-shaped, with a frieze in relief showing a chariot with a goat team and a figure standing to one side, which shows that the theme is Dionysian in nature. This piece can be dated to the 2nd or beginning of the 3rd century (Jurišić 2006, 307).

Test probes made in Structure C and the still visible jetty of the peninsula also provided negative results. In three underwater probes made, not a single antique find was found, which means that this structure could probably be connected with the nearby quarry that was used in a later period. This may be confirmed by the fact that only recent ceramic material was found in the probes and also due to the nature in which the jetty was built, with no preparation of the ground, the stone blocks being laid directly in the ooze and immediately on the sea bed (Jurišić 1996, 33).

Testing alongside the blocks of the Roman period waterfront of Structure D reveals the existence of a cultural stratum. The material from these strata can be dated to the period between the 1st and the 5th centuries. A cistern was revealed in the coastal part of the structure; it is orientated differently from the structures in the sea. The lack of conformity between the orientations of the structures is related to the configuration of the shoreline, which the structures in the shore part almost always follow. Also observed here was the corner of a square structure carved in the solid rock of the shore, the footings for the walls and the channels of the drainage system. The remains of walls in the sea are not the foundations of buildings, but blocks placed in a sequence to strengthen the waterfront with a walking surface of fill, thus creating an operational quay. The investigations carried out in 1995 provided an answer to questions concerning the extent of the architecture under the sea, the thickness of the cultural stratum. On the basis of moveable architectural material answers related to the time in which this part of the complex existed (Jurišić 1996, 33).

Excavations within the architectural complex Structure E were continued during 1997. The excavations and making of drawn records of the structure were made in 2007, and continued in 2008, 2009 and 2010. Footings of a whole series of buildings were discovered. The sewage system carved into the bedrock following its natural edge served structures now situated on the land. Walls of the same orientation as those in the sea can be seen on the land, along with the earth profile; they belong to the same architectural complex. On the coast part, in the tidal zone, these walls are interrupted, which is an effect of wave action. The external edge of the structure onto the sea was reinforced with large roughly carved blocks, creating the operational quay or waterfront that can be followed from Structure D. The constructed Roman-period waterfront stretches under the surface of the sea for a total length of about 50 metres. A grid of walls or several large or small rooms or structures can be seen within, the purpose of which cannot be ascertained with any certainty, but which must have been used by the operational quay, such as cisterns, pools, stores or granaries (Fig.1). The walls of an oval room measure 12 x 5 metres in size. Almost square large room with two apses seen in the plan and alongside it a double square space suggest a religious structure or perhaps a space for public assembly. Between them are several spaces in a sequence, some of which have clearly reinforced walls, which might suggest the remains of cisterns or stores for various purposes. On the south west side of the structure there are the remains of a small landing, perhaps meant for smaller vessels (Miholjek 2008, 230).

It was ascertained that Structure F, excavated in 2000, 2007 and 2009, was the main operational quay for large vessels. Two test probes were dug alongside it; one at the very head, and the other on the western side of the quay. The purpose of the tests was to determine the manner in which this structure was built, the depth of the cultural stratum, and the repertoire of moveable archaeological material. The Roman period jetty 35 metres long was built at least three times; this was made visible by the actual sinking of the coastal zone, the rising of the sea level, and the influence of southern winds and waves. There had to be a certain depth alongside the quay to allow ships to dock. It was built of large solid stone blocks, while the interior was filled with smaller rubble and building material from earlier phases of the life of the antique complex. In some parts the remains of paving made of better worked stone slabs were preserved (Miholjek 2006, 296). In the two probes placed alongside the main jetty, a large quantity of archaeological material dated from the 1st to the 5th century AD was found. The finest were undoubtedly an almost complete amphora for wine of the horn-handled type, Aegean production, perhaps Cretan or Rhodian (Fig. 2), a Roman period lamp and a bone pendant in the shape of a phallus.

The next structure seen on the shore was Structure G. Visible remains of walls on the land and on the very shoreline are discovered, while no remains can be seen in the sea. Thus far a geodetic survey was performed, while further investigations of the structure are still expected.

Structure H was investigated and documented in 1997. It concerns remains of a complex of walls, a not very distant and interesting structure under the surface, originally thought to have been the remains of a road. After investigations in 2010 several elements were ascertained in support of the conclusion that it was a channel bringing water from the mainland used to supply whole complex with water. It is more than 118 m long, and about 3.5 metres wide (Miholjek 2008, 303).

Research to date around the Vižula peninsula has given us an interesting picture of the way the place looked during antiquity and all the contents it might have had. For a clearer image of the whole land and underwater
part of the complex, it is necessary to carry out further investigations. For the moment it can be concluded that it was a large *villa maritima*, with continued existence for 500 years, that it had prestigious contents of considerable architectural achievements, alongside which, strung along the coast, were thermal and production complexes with a properly engineered quay and several landings. In future research it will certainly be necessary to place the emphasis on the unexplored part of Vižula, in order to link the research on the mainland with that in the sea in order to obtain a complete and clear image of the life of the villa in Roman times and Late Antiquity, when this complex, judging things all in all, took on the appearance of a rural settlement.

2. Roman period shipwreck in the Čavlin shallows

In the Croatian part of the Adriatic there are several hundred ancient wrecks, from which most are devastated, and yet, a dozen or so have resisted the ravages of time and unscrupulous looters. They are preserved either in their entirety or only slightly damaged, which gives underwater archaeologists the opportunity to carry out a detailed research. The exceptionally large number of vessels that were wrecked in ancient times is not surprising, rather, it tells of the trade and the importance of navigation along the eastern side of the Adriatic, as well as of the perils lurking in the Adriatic Sea. Ancient wrecks can be dated either by kind of cargo or some other analyses (such as the age of the wood); the dating ranges from the 4th century BC all the way to the 6th century AD. The cargoes vary: from fine ceramic objects, bowls and plates, stone structural elements and bricks, to the most common of all, amphorae. The amphora was a form of packaging used from the time of Greek colonisation to Late Antiquity and the domination of Byzantium. There are remains of wrecks with a cargo of amphorae that can be explored and protected on the seabed with a protective iron cage; there are also some that – according to the documentation, should be raised and presented on dry land.

The remains of a Roman period wreck with a cargo of La. 2 amphorae near shallow waters called Čavlin not far from the island of Murter have been known since 1998 after being reported by a German diver. At the moment the site was found, it was only very slightly disturbed. Because of other high priority research projects, it was not investigated at once, but placed under constant supervision. For three years the site was kept in secret, after which the research began in 2001. Systematic rescue excavations lasted for five years, and the site was completely documented and investigated in 2005 (Fig. 3).

A report that devastation of the site had begun came at the end of 2001. During October 2001, an inspection carried out confirmed the report. An amphora that had been uncovered and prepared for raising, the lower part of a stone quern, and one lead crossbar of an Antique anchor of the so called moveable-model were found. These finds were, because of the imminent danger of looting, retrieved at once. The next month, a provisional protective grid was placed over the site, with the task of protecting the site until the following season. At the same time, the site was provisionally documented. Because the finds were scattered over a large area, the placing of a protective cage was ruled out.

The actual salvage excavation started during May 2002. The peripheral part of the site (about 150 square metres) was investigated and moveable finds were raised. The central – smaller – part of the site, an area spreading across about 40 square meters, was still covered by a protective grid. Around fifteen more or less complete amphorae were raised, along with the second part of the quern, and a number of smaller finds.

The research went on in 2003, when the remaining part of the site was excavated. The find of the wooden structure of the ship and the appearance of small finds slowed down the work, so that this sector was not completely investigated. Along with the amphorae, three large iron anchors and two large lead braces of wooden-cum-leaden anchors were found at the site. Their position suggests that they were part of the cargo. The most interesting find was a bronze appliqué in a stylised duck figure, the closest analogy to which are the later figureheads (Jurišić 2004, 95).

The end of the research was planned for the 2004 season. Extremely bad weather made the work too difficult, and no more than a few amphorae and small pieces of pottery were raised.

In 2005 the remains of the wreck were investigated, and the research brought to an end. According to expectations new remains and wooden elements of the ship and a sector of the ship’s kitchen and appropriate ceramic inventory appeared. Around ten amphorae and a large number of potsherds were raised.

The amphorae belong to the widespread type the northern Italic *vinaria* Lamboglia 2, presented in several versions, dated to the 1st century BC. Their volume is a little under 30 litres (Fig. 4). Six stamps were found, most probably Italic. There were fifty or so amphorae of this type at the site, 30 of them complete. Two of them have smaller capacities than the standard (the mini model). The number of retrieved tops is much smaller, which indicates that when the vessel sank the amphorae were empty. Two amphorae found in previous years are different. One is a North African amphora in the Punic tradition, Dressel 18 type, probably used for the transport of fish products, while one neck looks like a south Italic Brindisi amphora.

Among the finds of the ship’s ceramic ware found in the last season, two later Hellenistic oil lamps of eastern origin, an Italian mortar of the same period and a service of Eastern Sigillata A consisting of a shallow and a deep plate and a calotte-shaped small bowl (Hayes form 3, 12, 5A). This is the earliest and most widespread red glazed eastern pottery, originally Syrian-Palestinian, dated to a period from the mid-2nd century BC to the last years of the 2nd century.
AD, and was the dominant export ware on the market from about 100 BC to the time of Hadrian. These vessels are the most common forms in the 1st century BC. Further finds included several items of Eastern kitchen ware from the early phase of production. Two-part stone quern which was raised earlier also belonged to the equipment of the ship’s galley. The finds date the shipwreck to the second half of the 1st century BC (Jurišić 2005, 328).

The remains of the wood structure of the vessel are not well preserved. Some pieces of the wood are dispersed over a wide area, but consistent remains stretch some ten metres in length. The remains of the keel and parts of 36 ribs have been found. The ribs are made of elm (*Ulmus sp.*). In any case, these are parts of the bottom of the ship, which means that after the sinking the ship sat on the sand with its bottom. The sides, bow and stern parts have rotted away in the course of time. The dimensions of the ribs suggest a smaller vessel, some 13 to 15 metres in length. The stern is at the north, as shown by finds of ceramic ware from that sector. The heavy cargo, the anchor, would have been placed on the bow, or perhaps slid there during the process of sinking. According to the position, the accident happened when the ship capsized due to windy conditions, previously thrust onto a shallow reef by the strong north wind. According to established practice, the wooden parts of the ship’s structure have not been raised. They have been covered with geotextile and a layer of sandbags, above which was placed a protective iron grid anchored in place using concrete blocks. The image suggests a ship that was carrying intermediate products. This shipwreck, in finds and dating, is very similar to the wreck that was found off the island of Šćedro in 1986 (Jurišić 2006, 329).

### 3. Shipwreck with sarcophagi near Sutivan on the island of Brač

In November 2008, divers from the diving club ‘PIK Mornar’ of Split decided to check out an information obtained from local divers concerning an ancient wreck with a cargo of sarcophagi and other stone material lying to the west of Sutivan on the island of Brač. The information turned out to be correct and the very next year the Marine Archaeology Department started investigating and documenting the site. The site extends over a surface area of about 40 square metres at a depth of 32 metres. 20 stone objects arranged in two rows could be seen on the sandy bottom, the lower part being totally covered by sand (Fig. 5). Seven sarcophagi of simple workmanship without decorations were recognised among the objects, along with two lids made in the shape of a gabled roof with corner acrotera. The dimensions of the sarcophagi are 200 x 92 cm, and 72 cm high. The lid is of similar dimensions, 215 x 107 cm. Also found on the bottom were a round bowl made of stone with two semi-circular handles and a perforation at the bottom, nine stone blocks and one pillar of a circular cross-section (Miholjek-Mihajlović 2010, 6). According to the distribution of objects on the bottom, it can be assumed that the stone material on the vessel was arranged in the same way. The breadth of the main concentration of finds, not including the stone bowl that rolled off during the sinking, comes to 4.10 metres, which tells us that the ship could have been a bit wider than 5 metres, hence the length of the ship should not have been more than 18 metres. A surface survey of the site and surrounding area revealed no objects possibly belonging to this wreck, either ceramic or wooden. Taking that into account, it can only be hypothesised that the remains of the wooden structure of the ship are still lying in the deeper layers of the sand, along with the remains of the vessels of the ship’s gallery, which might give a more precise dating of the shipwreck. Analyses of the stone bowl fragments show that it is made of alveoline - nummulite limestone, which can be found at numerous sites along the Adriatic coast and most of the islands, whereas on Brač it may be found around Sutivan, Splitska and Babin Loz bay. According to available data, this must have been a ship that carried intermediate products in the form of sarcophagi, stone bowls and parts of stone architecture from the quarry on Brač or other Adriatic quarries, to the inal client, in the time after the 3rd century AD, judging by the sarcophagus cargo.

Several other shipwrecks containing stone cargo have been found on the eastern side of the Adriatic, apart from this wreck. A cargo of eastern Mediterranean origin ceramics and some ten stone blocks were found off Cape Izmetište on the Pakleni Islands near Hvar, one of them made of greenish granite with traces of working, the others made of limestone. The entire cargo is ascribed to the Aegean region and dated to the beginning of the 2nd century AD (Jurišić 2006, 181). 11 worked pillars of white marble and several semi-worked stone blocks were found off the island of Sušak (Cape Margarina), along with a cargo of tegulae and imbrices (Vrsalović 1974, 53, 240). The classic shape of tegulae and imbrices date the site to the 1st centuries AD (Jurišić 2000, 40). This is the greatest cargo of stone on the eastern Adriatic coast, weighing more than thirty tonnes.

A wreck with a cargo of stone bowls was found in 1975 under the sea off the island of Veli Školj, on the eastern part of Mljet island. Along with five stone bowls with dimensions of 150 x 50 cm, there were several slabs, all highly encrusted and overgrown with flora and fauna. Around fifteen stone elements were noted. One neck of an amphora and several fragments of ceramic vessels were also found on that occasion. Report from 1975 describes three kinds of vessels: bowls of various sizes with conical lids and a handle at the top, a fragment of a small jug with a spout for pouring and an elongated rounded handle, and part of an egg-shaped small vessel. (Brusic, 1975). The first two kinds belong to Eastern kitchen ware.

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2 The analysis was done by the Mineralogical-Petrographic Institute of the Science and Mathematics Faculty in Zagreb.
The Department for Underwater Archaeology reviewed the site in 2009. Photographic records of the site were made on this occasion, along with records of three necks that belonged to small jugs with spouts and a longish round handle like the one found on an oinochoe. Further investigations will give more information about the wreck and the origin of the cargo and finally reveal if it is a shipwreck with a cargo of stone jars, sarcophagi or something else. Remains of a shipwreck that carried a cargo of sarcophagi were found in 1991 on the northern side of the island of Jakljan, between the islets of Crkvena and Tajan. Three caskets and three sarcophagus lids in the form of gable roofs with four acroteria at the corners were found at a depth of 37 metres. The lids in their dimensions correspond to the caskets and we can conclude that three sets are involved. The wreck can be dated to the 3rd century AD (Perkić 2009, 327).

4. Late Roman shipwreck in the Vela Dolina bay on the island of Mljet

The Conservation Department in Dubrovnik received a report in spring 2005 from Miljenko Marukić of the MM SUB diving centre in Lumbarda on the island of Korcula, concerning a newly discovered ancient submarine site between the settlements of Sobra and Kozarica on the island of Mljet. During the first inspection in 2006, six whole amphorae and three iron anchors 80 to 100 cm long, lying one next to the other, as they probably were originally placed on board ship were observed lying on a sloping sandy bottom at a depth of 41 to 44 m, (Perkić 2009, 323). Other whole amphorae were situated in the sand below them, so it might be assumed that there are the entire wreck and the rest of the cargo below the surface of the sand and that the site was discovered in a totally intact condition. In October 2007 the Department for Underwater Archaeology of the Croatian Conservation Institute launched an underwater archaeological excavation of this site (Miholjek 2007, Report) (FIG. 7). The research unearthed the remains of a wreck with a cargo of two different types of amphora. The first are of Keay XXV/B type, dating to the 4th century AD and produced in northern Africa (novadays the territory of Tunisia), used for the transport of oil (oleariae) (Peacock-Williams 1986, 158). African amphorae are distinguished by long, narrow, cylindrical bodies, pointed feet, short handles of mainly rounded forms on a short neck below a simple funnel-shaped rim with a triangular edge. The amphorae are mainly from 110 to 115 cm long, with a maximum width of body in the shoulder area of about 27 to 30 cm (Keay, 1984, 83). The second type of amphora has smaller dimensions. On average it is 66 cm high, and has a maximum width of about 22 cm. It has pear-shaped body with a small pointed foot and an elongated neck, with handles that reach the amphora rim. The neck and the part of the belly below the shoulders are ribbed vertically (Fig. 8). This type has so far not been classified into any known typology of amphora. Up to date, no similar specimens have been found on the seabed of the eastern Adriatic. Several specimens of these amphorae were found during research into the Agora in Athens in a stratum belonging to the 4th century.

Research of this site was carried on during 2008 and 2009, when another iron anchor, somewhat smaller in size, was found close to the three anchors known from previous research. Twenty-one new amphorae were found, and the total number of amphorae recorded and drawn rose to 27. All amphorae were intact, with small amount of damage. Part of the wooden ship’s structure with bronze nails and several parts of the planking were found along with the ceramic material, as well as small sized lead plates with rivets that were used to line the wooden planking of the ship for protection against shipworms (Teredo navalis).

Since only the surface stratum of the find has been investigated and documented, there is a great probability that in the deeper strata of the sand there is an intact part of the ship and the cargo, it is important that the salvage excavations continue, so the whole site could be systematically investigated, protected and presented to the general public.

5. Shipwreck with Byzantine amphorae off the Stoba promontory on the island of Mljet

An underwater archaeological site comprising a sunken merchant vessel with materials of eastern Mediterranean origin dated to the 11th century is situated off the village of Okuklje on the north east of Mljet island and off Ilijina Voda Bay, 500 metres east of Cape Stoba. It was discovered by local divers in the early sixties, when the removal of amphorae and other valuable material started. After a look into the private collection of J. Pedrini, rich in material from this site, the first expert inspection was made as part of the underwater archaeological reconnaissance of the south east shore of the island of Mljet in 1975, led by Dr J. Luetić, A. Kisić and Dr Z. Brusić (Brusić 1975). At that time, some twenty amphora fragments, parts of two pithoi, a small jug with a handle and a flat bowl were raised (Kisić 1988, 162). Several types of amphorae were distinguished, so Dr Brusić, basing his observations on the mainly fragmented amphorae retrieved from this site,
on whole specimens from the J. Pedrini collection and other known amphorae from the same period, divided the Byzantine amphorae into 5 groups (Brusić 1976, 37-49). Apart from the ceramic material, the site also yielded a large number of glass vessels and one specimen of a whole glass goblet. Since most of the material was found only in fragments, it was concluded that the site had been completely devastated and that no further investigations were required.

Nevertheless, because of the extremely rare and interesting finds, the Department for Underwater Archaeology led by I. Miholjeć decided to check out the condition of this site once again in November 2009, almost 35 years after the first survey. The objective was to document the existing condition of the site and check if it was still possible to find objects on the bottom in order to supplement the typology of Byzantine material from the 9th to the 11th centuries, which is extremely rare in our region.

On that occasion it was established that the site stretched in the north-south direction over the area of about 100 square metres. No parts of the ship’s structure were observed, but remains of the cargo of the ship in the form of ceramics, amphorae, pithoi and glass vessels appeared at a depth of from 6 to 25 m scattered over the stone slope, encrusted in fissures in the rocks. The major concentration of fragments lay at a depth between 18 and 20 metres. It was possible to observe sporadic amphora fragments below the rocky slope from 23 to 25 metres in depth on a sandy plateau with scantly seaweed. In this very spot an entirely whole amphora was found, mainly buried in the sand, closed with a convex wood resin-covered stopper (Zmaić 1009, 13). The amphora has a funnel shaped, moulded rim, a short neck that gently expands toward the bottom, and wide handles of an oval section that start below the rim to extend to a point between the neck and the body. The body is pear-shaped, a bit wider in the upper part, narrowing gently to the bottom. The body is ribbed vertically through the whole length of the amphora, although the ribs are more obvious in the upper part. The ending of the amphora is concave, so the bottom is stable. It is 40 cm wide, and the greatest width is 30 cm (Fig. 9). In the shoulder area, in the middle between the two handles, is a monogram incised before firing.

Dr Brusić placed this amphora into Byzantine amphorae group I (Brusić 1976, 38). Several fragmented amphorae were found, one of which was missing the lower part of the belly. According to the neck and handles, it could be classified in Byzantine amphorae Group II (Brusić 1976, 40). According to dimensions and form these amphorae are very similar to Group I. The main difference is in the upper part. The rim is funnel shaped, but it is not moulded, and turns into a short neck that spreads out downwards. The handles of oval section start immediately below the rim and extend to the place where the neck transits into the body of the amphora. In the upper part the body is wider and gradually attenuates towards the bottom, totally horizontally ribbed. The greatest width is 28 cm, but because of the absence of the lower part, the height and form of the bottom of the amphora is unknown. Two necks with handles and part of a belly were found, belonging to the Va group of Byzantine amphorae (BRUSIĆ 1976, 48).

These amphorae are quite small in size, from 30 to 40 cm high and about 30 cm wide, with a pear-shaped body with a small rim and an unobtrusive neck, and very heavy rib-moulded handles of an oval cross-section, surmounting the opening of the amphora. Complete body of the amphora is horizontally ribbed.

The Department for Underwater Archaeology continued to conduct the investigations in June 2010, primarily because of the find of a whole amphora, with its original stopper of wood covered with resin that lay beneath a deep stratum of sand, probably in its original position. At that time a totally unexpected state of the site came into view. At a depth of 21 metres, a 2-metre long iron anchor was spotted on the edge between the rock bottom and a sandy plateau. An oval ceramic jug with two handles and a funnel shaped rim was found in the surface layer; instead of having a standing surface on the bottom, it had a standing flat surface on one side of the belly. Two complete amphorae of smaller size, belonging to the Byzantine amphorae Group IV, after Z. Brusić, were found in the vicinity. One was 30 and the other 32 cm long, while both had a diameter of 17 cm at the widest point. Below two small oval handles, which fitted into a totally straight and unobtrusive rim, in the upper third the body was very much widened, and also horizontally ribbed, while in the lower part it gradually narrowed and passed into the elongated oval bottom.

Three archaeological test probes sized 2 x 2 metres were made in the sand plateau in front and below the iron anchor. Two amphorae lying next to each other were found (Fig. 10) in probe 1, at a depth of 24 metres, beneath a 20 cm thick layer of sand. One belonged to Group I and the other to Group II after Brusić, but in form they are very similar, and probably the same kind of cargo was carried in both. The bodies of both amphorae were broad and pear-shaped, with a surface to stand on and a slightly concave bottom. The difference can be seen on the rim and on the graffito placed on both amphorae in the shoulder area. The Group I amphorae have a graffito on which a ligature composed of AM can be recognised, while on Group II amphorae, the ligature is composed of XM.

Five amphorae of the same type were found in probe 2 and 3, at a depth of 24 metres, below a twenty or so centimetre thick layer of sand. In probe 2, four amphorae were laying one next to the other, probably in the same way in which they were stacked in the hull. An amphora of the same type was found in probe 3, two metres from the group of amphorae, in the same position and orientated in the same way, which suggests there might still exist more identical amphorae in the lower stratum of probe 2 and 3. The amphorae are 57 cm tall, have a funnel-shaped rim, a short neck reaching the shoulder were the amphora is at its widest, 24 cm, after which it gradually narrows into a cone shape. The handles reach from below the rim to the shoulder. Below the shoulder, the body is horizontally
ripped. One of these amphorae has a graffiti in the area of the neck with a stamp in the form of two concentric circles. According to the Z. Brusić typology, these amphorae belong to Group III (Brusić 1976, 40).

The basis for dating the five amphorae groups from this site, according to Brusić, are similar amphorae found in Istanbul, embedded as a building material into buildings of the Mangala area constructed during the time of Emperor Basil I (867–886). A large number of these types have also been found in many sites in Bulgaria, Romania, Ukraine and Chersonesos/Kerson, dated by coins of Basil I and Basil II, which would place them in the 9th and 10th centuries. In the Agora in Athens they were found in Saturn IX, dated to the 11th century (Kisić 1988, 162).

In addition to amphorae and ceramic vessels, several fragments of glass vessels were found at the site. The fragments belong to plates on an annular foot and plates of transparent light green-yellow glass in the lower part and cobalt blue in the top part. There is a motif of an eye imprinted hot in several rows on the walls of the vessel. Fragments of the necks of glass bottles mainly green in colour with appliquéd horizontal blue ribs, undulating filaments or with expansions of coloured glass and a fragment of richly decorated candlestick of multi-coloured glass with undulating applications were also found. The upper part of a goblet identical to that which was found intact in 1975 was discovered among other finds. Decoration in two-colour glass is fairly rare; it is known in Egypt, Armenia and some sites in the Caucasus in the 9th and 10th century. The eye motif is specific to the Islamic world and along the eastern borders of the Byzantine Empire in Syria, Egypt, Tunis, Mesopotamia and Armenia, whence Byzantine 9th and 10th century glass blowers took over this manner of working and decorating glass. Since the amphorae are of the Byzantine type, then the glass objects too were probably procured in Byzantium from some of the glass workshops of Syria or Egypt (Kisić 1988, 162).

Since wrecks of this period are extremely rare along the Adriatic, this shipwreck is the most important site from that period, with a rich repertoire of archaeological material, varying from several types of amphorae and other ceramic ware to objects made of glass. At that time the Croatian dukes were dominant on the Adriatic, and the trade of Byzantium became very insecure because of the frequent attacks by Croatian ships on merchantmen. Therefore, land trade routes were preferred almost to the exclusion of sea routes. The Department for Underwater Archaeology will continue the systematic investigation of this valuable site in order to acquire new knowledge related to the trade and seafaring of Byzantium in the 9th and 10th centuries.

6. Post-mediaeval shipwreck of the 17th century in the Mijoka shallows off the island of Murter

The submarine archaeology site by the Mijoka shallows was put on the map in 2001, although local divers had known of it for many years, which led to considerable devastation of the site. Soon after this, Dr M. Jurišić led an expert inspection of the site. It was determined that there were remains of a sunken ship that had carried a rich commercial freight, probably loaded in Venice and intended for ports around the Adriatic and eastern Mediterranean, since the first finds showed a similarity with material from a sunken ship off the islet of Omlađ (Petricioli, 1970). The richness of the cargo and the typology of the material indicate a merchantman of the early 17th century.

During the 16th and 17th centuries, the main trade route between western trade centres like Venice and the ports of the eastern Mediterranean went along the eastern Adriatic. The great Ottoman Empire became a large and rewarding market and because of the openness of Turkish trade policy and the privileges that foreign traders enjoyed during the 16th century, there were increasing numbers of Venetian merchantmen who were sailing along the Adriatic Sea with goods deriving from the whole of Europe. The navigation routes stuck to the eastern coast of the Adriatic with its many safe ports and havens that were used mainly for the sake of protection against bad weather at sea, but also because of the many vicissitudes at the level of wars, politics and economics. This kind of situation was caused by the successive Turkish-Venetian conflicts aimed at gaining supremacy over the Adriatic ports as well as by conflicts with the Uskoks of Senj, who constantly upset both Venetian and Ottoman trade by sea. The Mijoka ship was sailing along the usual route from Venice to the east, and whether it was hit by bad weather or an attack from the enemy or pirates can only for the moment be conjectured (Zmaić 2009, 430).

Underwater investigations of this site were carried out in four campaigns from 2006 to 2010, and showed that, as a result of many years of devastation, the ship’s structure was totally destroyed and all visible material had been looted (Fig. 11). Nevertheless, there was still a stratum with very valuable archaeological material on the bottom. Since only very small movable finds had been preserved, the research methodology required placing bags on the ends of water dredges with which the excavation was carried out, in order to collect all the sand from the bottom. The bags filled with sand were transferred to the land and sieved. The material that appeared indicated the remains of a sunken ship with a commercial cargo mainly deriving from Nuremberg and the glass workshops of Murano. Because of depredations and of devastation of the site which lasted for numerous years, the remains of the original packaging were found only in traces, and material without any particular order was scattered over the sandy bottom over an area of about 100 square metres. The commercial freight consisted of raw materials and intermediate products as well as goods

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6 In 2006 the Department for Underwater Archaeology discovered a wreck laden with amphorae of the 9th/10th century off the islet of Meraro, south of Rogoznica.
meant for practical and consumer use, decorative goods and goldsmith’s materials.

Since no coin was found at the site during the first campaign, nor were any written sources concerning the wreck discovered, the dating of the shipwreck could be set only on the basis of the inscriptions of the workshops and craftsmen on individual items such as jettons, or reckoning counters, forged in Nuremberg and small sundials of the same origin (Zmaić 2009, 431).

During the 16th century Nuremberg was the main European centre for the production of reckoning counters used in calculations and accounting. In the mid-16th century the craftsmen started placing their names on the counters they made. From most of the brass counters found, according to the signature, can be concluded that they were made in the workshop of Hans Schultes of Nuremberg. Two basic types with the diameter of 22 cm are distinguished, with an identical depiction in the central field of the obverse – a six-pointed coat of arms consisting of three semicircles and three points of a star within which was an orb and cross. Type 1 has the name of the craftsman and the principal place of business of the workshop on a strip on the outside: HANS·SCHVLTES·IN·NORNBERG and on the reverse in the central field is a bust of Mercury and a caption on the external inscription field: GLVCK·KVMBT·VON·GOTALEI (Luck comes from God alone). Type two has the caption on the obverse in the outer strip HANS·SCHVLTES·ZV·NVRNBG, and on the reverse: in a central field a depiction with three crowns and three lilies alternately placed around a central rosette while on the external inscription field there is the caption: GLICK·KVMBT·VON·GOT·IST·WAR (Luck comes from God, it is true). According to information from written references (Gebert 1917, 80) the making of these counters can be ascribed to Hans Schultes II, who was at work from 1586 to 1603, or Hans Schultes III, from 1608-1612. Although it is impossible to say which Schultes is the right one, we can certainly place the wreck at the beginning of the 17th century.

This is borne out by several folding sundials of ivory with an incised inscription of the master craftsman. These sundials were made from the 15th to the 17th century, and were characteristic Nuremberg products and trade goods; they were invented in the city. They were used as travelling clocks, and were made of precious metals, bronze, brass, ivory or wood, composed of two plates of equal sizes, rectangular, circular, oval or heart-shaped in form, joined by a hinge. In the lower plate, a compass was inserted, to enable determination of the north-south direction. Between the plates there was a polos, a thread, of cotton or silk, serving as a gnomon or indicator (Syndram 1989, 77). Several rectangular sundials of ivory, sized 50 x 30 mm were found, most of them missing either the top or the bottom flap. In the centre was a circular groove for a compass with the cardinal points indicated. Traces of the polos or cotton thread were also preserved. The maker’s signature was incised at the bottom of the lower flap of two specimens. On the first, ...ANS MILE... is visible, and on the second HANS,. ER. The historical sources mention a Hans Müller, Miller or Miler, member of the guild of compass makers, also a clockmaker for the small folding dials from Nuremberg, who became a citizen in 1601 and died in 1620. He incised rosettes or stars over his name as his trademark (GOUK, 1). These signs above the signature are also found on sundial specimens from Mijoka. Taking into account the mentioned information, the dating of the trading goods cannot be established earlier than the beginning of the 17th century. Folding sundials in brass boxes with gilding, two of circular shape, 35 mm in diameter, one of oval shape, 30 x 38 mm, and two cordiform specimens sized 35 x 38 mm were also found. Sundials of ivory with finely incised markings, a housing for the compass and traces of the polos were found inside the brass boxes. The box would be richly decorated with incised and gilt motifs. In two cases a motif of a heart shot through with two arrows inside a circular wreath was found on the lid of a round and a heart-shaped specimen. One specimen had the inscription on the bottom of its round box (which served as instructions for use at the same time) COMPASSVS·PROPE·FERRVM·NON·RECTE·ASSIGNARE·POTEST – which means that a compass close to iron will not show the right bearing. Every dial had a lug by the hinge through which a little chain could be drawn. So far no dial in the metal boxes has the signature of craftsman or workshop, but because of the rosette incised on the cordiform clock, which is the trademark of the Hans Miler workshop, it is possible that his workshop could have accounted for all of them (Zmaić 2009, 433).

A silver coin which does not enter this timeframe was found at the site during the campaign of 2008. The coin is much older than the rest of the finds, which means it was obviously hoarded and that one must not always rely to finds like these when dating a site. These are two types of Polish half-grosz. Ten specimens have the signature on the obverse: MONETA:REGIS:POLONIE (coin of the kingdom of Poland), while in the central field there is the depiction of a crown. On the reverse in the inscription field is the signature ALEXANDER:DELG[RATIA]:REX (Alexander, king by the grace of god), while in the central field is a depiction of an eagle with spread wings and a crown on its head. This coin is dated to 1501 to 1506 and is a century older than the latest dated objects at the site. The second type has an identical depiction in the central field, but on the obverse it has the inscription CIVITAS SVIGN:1526, and on the reverse ...LVODVICVS... (Zmaić, 2008).

In the most recent campaign (the one from 2010) several silver Hungarian denarii were found, but because of the incrustations, it will be possible to decide which series it belongs to only after restoration. Several Polish half-groszy are bonded with Turkish akçes, which will provide new guidelines after they are cleaned. The most recent investigation found a gold Hungarian forint with the figure of the Virgin and Baby Jesus in her lap
(Patrona Hungariae) on the obverse and the inscription: PATRONA·VNGARIAE. The central field of the reverse holds the figure of a king placed full face, in armour, crowned, holding an orb with a cross in his left hand, and a halberd in his right hand. To the left and right in the field is the year 1587, and in the inscription field: TRA II SIGI·B·D·S MONE (Zmaić, 2010) (Fig. 12).

In addition to these datable finds a large part of the ship’s cargo consisted of goods meant for practical and consumer use, decorative material and goldsmith material. Several different kinds of cutlery could be distinguished. By far the most common was cutlery with wooden handle and triangular head packed in a tripartite set with six dimensions. In all cases the blades of the knives had corroded away, but in some cases their shape was extant. The 2008 investigations showed that the cutlery was transported in wooden crates, iron bound, 60 x 40 cm, and 30 cm high. The metal handles of more luxurious cutlery was fond, decorate with diamond shapes in relief and a crown in the form of a rosette on the head. Knives with a several-part handle of bone decorated with a turned decoration in the shape of a rosette were found accompanied by the remains of leather sheaths (Zmaić 2009, 436).

Razors had long narrow wooden handles made of two parts, between which the steel blade was inserted. The blade was retained by a brass part, which was preserved, unlike the blade, which had corroded away. The blades of knives, razors and other cutlery were in all cases corroded, while the brass fittings from the head was preserved along with the handles where the state of preservation depended on the material they were made of.

The ship was also carrying in its cargo a large number of glass objects of various purposes, probably deriving from the glass workshops in Murano. Beads of various forms and sizes made out of glass or glass paste were found scattered in great numbers over the sandy bottom. The bigger beads were made in the form of calyces, oval or round or cut in the shape of a polyhedron, while the smaller bead were of a very simple annular or cylindrical shape of blue, white, green and black, violet or red in colour. Several multicolour large beads were made in the Murano technique and smaller oval beads of transparent glass with the characteristic longitudinally inserted white filaments, or vetro a reticello.

As for glass vessels, only two fragments of a small bottle with thin walls of transparent glass, pear-shaped with a very short foot and a low placed belly that gradually narrowed into a very narrow neck and ended with a small straight edge were found. Identical bottles were found at the Gnašić site with other glass material, which, considering the excellent quality, was ascribed to Murano glass workshops. It is possible that a bottle of this shape might be one of the two glass parts of an hourglass (Lazar, Willmott 2006, 103), but it is not ruled out that fluids, oils, expensive fragrances or medicine were kept in these phials. Small round pieces of glass, 3.5-4 cm, used for eyeglasses were also found.7 A large number of smaller and larger square pieces of glass that were used as frame-less mirrors were found. Mirrors were an important item of Murano production and were exported in large quantities. An amalgam of tin was used for fabricating the mirrors. Mercury would be poured over the thin tin plate, this would be covered with a sheet of paper, and the pane of glass placed over it. When the paper was withdrawn the mercury came into contact with the glass and left a reflecting layer of amalgam on the surface (Kelez 1970, 42). The amalgam layer remained on several specimens in mere traces for the tin had corroded away in the course of time and the mercury between the glass panes had almost totally drained away and was mostly found on the sea bed in cracks between the rocks. In the 17th century mercury was also used in pharmaceutical preparations, and also for the extraction of gold by the amalgamation of auriferous ore or sand (Kelez 1970, 42).

Metal objects found at the site could be divided into several groups: parts of candlesticks, small objects of practical or everyday use, goldsmithing and decorative materials. Parts of brass candlesticks were found in a very small number, because they had been alienated from the site, with respect to their size. The other found parts were of similar moulded forms, without any surplus additions (Stadler 2006, 109). Because the candlesticks were identical to those found from the Gnašić site, their origin can be sought in the workshops of northern Europe, particularly in Nuremberg and Lübeck (Petricioli 1970, 33), where the production of such candlesticks flourished during the 16th and 17th centuries.

As for small everyday use items found, there was a large number of metal weather or fishing bells of the same form as those found at the Gnašić site, packed in oval wooden boxes (Schich 2006, 111). In these cases the oval wooden boxes were found only in pieces, and the bells were lying on the bed mixed up with other material. They were all made of thin brass plate of circular form in several dimensions, in diameters of 16 and 24 mm, made of two hemispheres with an annual lug at the top and an elongated hollow in the lower part. At the join of the two hemispheres were two horizontal grooves on the upper and lower sides.

Very interesting finds are also small padlocks with a combination mechanism. Like the combination locks of today, they consist of several movable circular rings with signs, letters or numbers, which when arranged into an appropriate combination release a small rod, and the padlock is opened. Made of brass, in small dimensions, 20 x 33 mm, they consisted of seven circular rings, two of which were linked with bolts for locking. One of the padlocks was opened after the input of the combination ERSE.

7 Among the finds of the Gnašić wreck was a package of spectacles with leather frames (lederbriller) (Božulić 2006, 18). The round lenses for these glasses were of the same dimensions as the lenses found at the site of Mijoka.
Other metals for consumer and everyday use are brass pins with a small spherical head packed together in bundles of twenty. Appliqués in the form of a rosette were also packed so that one lies inside another in tens. Considering the nail hole in the middle, they might have been in use for furniture upholstering. Snuffers found were identical to those found at the Gnalić site. Several kinds of metal boxes of various shapes and sizes were found: circular and semi-circular, brass and often richly decorated with pressed or incised decorations or with handles in the form of small lion heads. Small boxes oval in shape made of tin and cast in perforated form like lace with rich tendrill motifs had the inscription LBGG in the middle of the oval lid in a square frame (Zmaić 2009, 438).

Among the goldsmith materials carried on board the most common were small precision scales with a set of weights in oval boxes of brass plating with a decoration in the form of rosettes and radial motifs. In the centre of the oval lid was a stamp with initials of the artisan or the workshop, the letters P and L, between which is the stylised head of a bird facing left. Only the brass plates for the weighing of the raw materials are extant; one has a flat and the other a round bottom, with three little holes for the cords they were suspended from. A large number of small brass weights were found, from simple ones in the shape of thin square brass plate, marked only with impressed circles or dots to those of greater weight in the shape of prism, cube or circles. Assay marks were impressed on the prism and cube weights, representing the marking of the weight or a coat of arms. The marks were impressed in lead, and represented a crown, an orb and cross, a ruler with a cross in one and an orb in another hand, or a coat of arms. Weights with identical assay marks were also found at the Gnalić site in a wooden box within an ironbound chest with textile items and a set of weights of a somewhat different type.  

Also comprising goldsmithing material were ceramic moulds for embossing and impressing in the form of rosettes, berries or of a drop-shaped form with and without nipples, which probably served to fabricate jewellery. Ready-made embossed rosettes of brass plate were also found, similar in shape to the mould. The cargo also contained goldsmithing intermediate products in the form of small silver granules for the granulation of jewellery. A large quantity of crystallised nodules of iron pyrite, iron disulphide, FeS2, were also found, often known as fool’s gold for its golden yellow colour. Sometimes real gold can be found in the pyrites, though in smaller quantities, and this kind of gold-bearing pyrite is a very rare ore. Pyrite, because of its colour, is often used in the making of cheap jewellery that imitates gold. Of ready-made goldsmithing products, only brass rings with a square crown in which there was a nugget of turquoise paste or some semi-precious stone was set were found. Several of them were found together, arranged in a sequence of one on top of the other, probably packed like that for transport.

One should also mention small two-sided horn combs, often shown in the pictures of the Renaissance masters as an essential part of women’s beautification equipment. The tines are closer together on one side, apart on the other. They were found in two dimensions, either 50x45 or a larger version, 90x50 mm.

Large numbers of coral beads were found, finely shaped and polished in various dimensions.

This is not a complete inventory of the material from the Mijoka site, for a large number of the finds is very fragmented and hard to identify, while other items, having spent a long time in the water, have corroded and turned into an amorphous mass, or have become bound together with limestone deposits and other material, and will be recognisable only after thorough cleaning and conservation. Irrespective of both the mentioned issues and the great devastation, the results of the investigation at the Mijoka site and the great amount of material found have greatly contributed to the image of life and material culture in the 17th century. They have also given an insight into the way things were produced in the late Renaissance workshops of European production and commercial centres, the reciprocal links between these centres throughout Europe and the connections with eastern trading centres, where the Adriatic Sea had an important and indispensable role.

7. Investigating a 16th-century shipwreck at the site of Pličina Sv. Pavao, Mljet

The seabed off the island of Mljet is now richer for one more valuable archaeological site. This concerns the remains of a merchant ship from the 16th century that in unlucky circumstances ended its voyage at the bottom of the sea in the Mljet archipelago. The find is an extremely valuable and unique one in a sense that it is the only site discovered in a perfectly intact state, which is nowadays a great rarity. The significance of the site inheres in the fact that archaeologists now have, after many a long year, the chance to explore a totally preserved modern shipwreck.

Pličina Sv. Pavao (St Paul’s Shallows) lies on the southern side of the island of Mljet and is several hundred metres off the shore. The shallows are completely open to the winds and waves from the south. Somewhat to the west of the shallows is the islet called Preč, and the point or cape Dugi rat with its beach, which makes a natural haven and anchorage on the way along the southern side of the island from the area of the Mljet lakes to Saplunara Bay. The shallows rise just a few centimetres above the surface of the sea and are difficult to see, and in bad weather present as a very dangerous trap on the way towards a safe refuge (Miholjek 2009, 273).

The site was discovered by the Medveščak-Sava Diving Club; during a diving camp on Mljet in 2006, at a depth of

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Footnote:

8 A set of weights consisted of nine items in the form of small bowls, which fitted one inside another, the biggest having a lid that can be closed and a small handle for transporting (Božulić 2006, 18).
40 to 46 metres, on a rocky part of the sea bed, divers came
upon six bronze cannons, around which were scattered
fragments of ceramic ware, glass and metal items. The
existing situation suggested a new and intact archaeological
site, which was at once reported to the appropriate
institutions. Not long after the discovery came an expert
investigation by the Inspection Affairs Department of the
Ministry of Culture, of the Port Authority of Dubrovnik
and the Croatian Conservation Institute’s Department for
Underwater Archaeology. Photographic records of the
site were made on that occasion, and several objects were
raised for the sake of expert appraisal. It was determined
that these were remains of a merchant ship of the 16th
century that was carrying a rich commercial cargo on the
route between the eastern Mediterranean trade ports and
Venice. For the sake of defending against enemies at sea,
the ship was furnished with several bronze artillery pieces.

In the very next year, 2007, the Department for Underwater
Archaeology, with many associates from outside, started
underwater archaeological investigations at this site (Fig.
13). The investigations have been carried out in four
campaigns to date, the most recent having ended in May
2010.

The objective of the investigation of the first campaign
was to draw up the whole of the drawn and photographic
records of the site as found. Because of the great value of
the bronze artillery pieces and the other preserved objects,
it was decided that all the objects that had been documented
would be raised, in order to prevent possible devastation.
On this occasion, seven bronze artillery pieces and some
thirty items were raised.

Six of the artillery pieces recovered belongs to the group
called perrier, breech-loading, with one muzzle-loading
esmeril. Two almost identical perriers were of large
calibre, and the others were all of smaller calibres. All
the perriers were manufactured from a combination of
two metals. The barrel was of cast bronze, and the breech
chamber of iron. Alas the six breech chambers found were
severely corroded and incrusted in the sea bed, and hence
were not raised to the surface.

The ammunition used was stone shot, found in large
quantities at the site. Most of the stone balls correspond
to the calibre of the two large cannon, which were richly
decorated in Renaissance-style reliefs. Just one of the
seven cannon found was a muzzle-loader, in which,
during restoration, an iron ball was found. The barrel
had a polygonal cross-section, without relief decorations
or markings to enable identification of its origin and year
of production (Mihajlović 2009, 269-270). Several metal
objects were found, particular importance attaching to a
large pail decorated with bands of decorative rivets, to parts
of a candlestick and a pewter jug. Close to the pail was a
large engraved ceramic bowl, decorated with a depiction
of a mandolin player in an enclosed flower garden with
a wickerwork fence, two trees and three flowers with a
particular symbolic meaning. Such bowls in the 16th
and 17th centuries had pictures alluding to the virtues;
given on the occasion of engagements or weddings, they
constituted highly luxurious goods. Most of the material
found at the site was of ceramic ware. Some of the ceramic
objects were produced in the Venetian workshops of the
16th century, while the other group belonged to oriental,
highly luxurious and richly decorated ceramics or perhaps
oriental kitchenware in simpler forms. The luxury ware,
according to quality of workmanship and rich polychrome
decoration, can be ascribed to the ceramic workshops of
the Turkish city of Iznik. The creation of the unique style
of decoration of these products was much influenced by
the tradition of making luxury silver vessels, as well as by
the production of Chinese porcelain, particular from the
Yuan (1260-1368) and Ming (1368-1644) dynasties, as is
visible in the mass of similar forms and motifs done in
cobalt blue on a white ground. They are characterised by
decoration done in cobalt blue or ultramarine on a white
ground, with the frequent employment of black, green and
red. In several cases the edges of plates are undulating,
and the painted motifs are most often stylised waves and
foam of the sea, as well as lotus flowers and lilies as well
as other flowers in bloom, leaves and vines (Pešić 2009,
343).

Because of the great value of this material and the intact
state of the site, the investigation was continued in 2008
and 2009. The material that emerged was related to that
from 2007, and among the many objects, one more artillery
piece was discovered, raised together with an iron breech
and an iron swivel; the artillery piece would have been
mounted on the rail with this swivel. Before conservation
and cleaning, the artillery piece that in the raised incrusted
part had a partially preserved breech chamber and, of
course, the last cannon found were X-rayed in order
to clearly see and study the breech mechanism, and
ultimately to be able to make a theoretical reconstruction
of the cannon.

As for newly discovered items, of particular interest are
seven large luxury Iznik plates fitted one on top of another,
and several bowls packed for transportation, confirming
the hypothesis that the ship contained oriental commercial
cargo meant for the western market. In addition, other
outstanding finds are a two-sided comb of horn, a lead
musket bullet that shows the ship was armed not only with
cannon but also with muskets or arquebuses, and nine
small silver coins. These were silver Turkish akçes that
were struck in the mints of the Ottoman Empire from the
15th to the end of the 17th century. Further analysis of this
coinage, after cleansing, will give us additional guidelines
to go on in the ABSOLUTE dating of the sinking of this
ship (Zmaić 2009).

Within all the open documentation quadrants, after the
surface layer of sand had been removed, the wooden
structure of the ship appeared, with the corroded parts of
iron. Since the site was found in an untouched condition,
while the underwater works were being carried out, a special
effort was made to keep the structure of the ship untouched,
preserved in the condition in which it was found. Special attention was devoted to recording the architecture of the ship, in order to be able to obtain an image of the actual ship that was as complete as possible. For this purpose, in May 2010, an international collaborative team was set up, including marine archaeology divers from Italy, led by Professor Carlo Beltrame (Dipartamento di Scienze dell’Antichità e del Vicino Oriente, Università ca’ Foscari) of Venice. Their purpose in being involved in this campaign was to assemble complete drawn and photographic records of the wooden structure of the ship. This collaborative venture will continue in campaigns to come, until the architecture of the ship is entirely documented.

The material that emerged in the 2010 campaign is related to that found in previous campaigns. Several complete luxury plates were found, together with teapots and bowls made in Iznik, and a large number of fragments of vessels of the same source, northern Italian ceramics, a large number of fragments of glass bottles, and copper vessels. One of the more interesting objects found is a small bronze ship’s bell with the year M D LX VII (1567) in relief (Fig. 14). As well as ten silver Turkish coins, akçes, found in 2009, in the last campaign two silver talleri were found, bonded together with several tens of akçes. The akçes are for the moment unrecognisable, but the talleri, according to the depiction and the caption on the obverse can be ascribed to an issue of 1559 during the reign of Elector of Saxony Johann Friedrich I, or his sons. On the visible obverse there is a bust of the elector, Johann Friedrich I, in armour, with sceptre in hand, and on the external inscription field runs the legend: MO:NO-FRATR-V(-)M:DVC(V):-SAXO(N) with a coat of arms at all four sides.

Other material found included a number of pine cones (pinus pinea), animal bones and some cutlery. A stone quern and several stone cannon balls were found, including one of a diameter of 16 cm, which means that there must have been an artillery piece of this calibre on board, although so far 8 cannon of smaller calibre have been found.

Although modern wrecks are no rarity in the seabed off Croatia, they are seldom found in such an intact state, and still less often can we talk of systematically investigated modern wrecks. The investigations carried out from 2007 to 2010 are just the initial part of systematic salvage excavations, which with the common drawn, photographic and video records of the site and the finds, will be used in an attempt to obtain as wide as possible a view of the circumstances of this shipwreck, and provide knowledge about the production, economic conditions, commercial navigation routes and the dangers of sailing in the turbulent 16th, 17th and 18th centuries.

8. B24 Liberator wreck off the island of Vis

During the second phase of reconnaissance and investigation, the objective was to look for the plate with the serial number in the shattered cockpit, which was almost impossible because of the thick deposits of shells and marine growth. Nevertheless, after photographs came from America with the precise location of the plate, the investigation could be continued. And so on May 31, 2010, the second investigation was organised, carried out as organised by the Coordination for the Protection of the Rights and Interests of the Republic of Croatia at Sea, collaboration with the Ministry of Culture and the Croatian Conservation Institute, and the Split Harbourmaster’s Office, which put its ship Pojišan at the disposal of the research crew. In spite of a strong sirocco and high waves, the campaign was a success, because the divers searched through the cockpit and found the plate with the serial number. The research crew had earlier determined certain indications based on the condition of the wreck that it could be a really special find – the last produced Liberator in the Douglas works in Tulsa, Oklahoma, which got the nickname Tulsamerican. To our great satisfaction, it soon turned out that our clues were correct – when the plate was cleaned, it turned out that it was indeed the Tulsamerican that had been found, a B-24 J, serial number 42-51430, which was famed even during its lifetime and covered in the media all the way to its last mission.

The Tulsamerican was part of 765 Squadron of the 461st Bombardment Group, and flew on its last mission on December 17, 1944. On its hull, in a large black square, the number 24 was written in white, and on the nose below the cockpit it had a colourful emblem and the inscription Tulsamerican. This plane was the last one produced in the Douglas factory in Tulsa, OK. It was paid for with war bonds bought by factory workers and citizens. As a sign of gratitude, after the plane left the assembly line, all the external surfaces were thickly covered with the signatures of the factory workers. A circular emblem in the shape of a globe was drawn on its nose below the cockpit a, on which was a Red Indian with a knife in one hand and an American flag in the other. Below the emblem the name of the plane was written – Tulsamerican, which was invented by one of the factory workers in a competition. Thus embellished, the brand new Liberator flew half across the globe and after a number of stopovers finished its journey in Italy at the Torretta field.

On December 17, 1944, Allied heavy bombers from the base in southern Italy took off to bomb the city of Odertal close to the Polish-German frontier. On the way to Odertal, the formation was attacked by Germany Messerschmitt 109 and FW 190 fighters. In the first wave, they managed to down several of the bombers. They damaged one engine of the Tulsamerican, which the pilot had to shut down. Because of the damage, the plane began to trail behind the formation and before it had dropped its bombs, the German fighters harried it again. One hit damaged the hydraulic system. Before they had reached the Croatian coast, it was clear that they would have to land on Vis, which was a little further south than the course to Italy. Close to Vis they found out that because of the damage they could not deploy the undercarriage, and since there were several other planes on the approach, the flight controllers would
not let them make a belly landing. The heavy bomber would have blocked the strip. Having arrived in the Vis airport space, the bomber began to circle over the open sea south of Vis, in the area foreseen for abandoning a plane and landing in the sea. While the undercarriage was being released, the engines suddenly stopped, and the pilot decided on the only possible course of action – landing on the surface of the sea. The impact was so great that the force of the water crushed the front and lower part of the fuselage with the bomb doors, and tore off the tail. When the crushed fuselage disappeared under the surface in a few moments, seven aviators were left swimming in the icy sea. Pilot Ford, navigator Landry and engineer Priest, who had not managed to get out in time, vanished with the Tulsamerican into the depths. The survivors were saved by a British boat and dropped off in Vis. After some time they took off for their base. Some were lightly wounded and sent to the USA for treatment and recuperation, while the others went on with their combat missions. However, the story of the celebrated Liberator and its crew was soon lost among the hundreds of similar dramas of World War II.

In the reconnaissance and investigation of the wreck of the Tulsamerican, we saw once again how useful is the cooperation between divers who discover a wreck and the Ministry of Culture or the CCI, charged with its protection. Only by respecting the legal procedure and the obligation to report every find, of ancient shipwrecks or the wrecks of ships and planes from the World Wars can we protect and preserve the cultural heritage of the seabed off Croatia. The incredible coincidence of the recent finding of the wreck of the Tulsamerican opens up new vistas in the investigation of more recent Croatian military history. The wreck of the plane is in a protected area where diving is permitted only through authorised diving centres, and the wreck of the plane is in a protected area where diving is permitted only through authorised diving centres, and the depth of 41 metres is still within the borders of sporting diving, and is thus accessible to most diving categories. At the moment no diving is allowed around the wreck of the Tulsamerican, we saw once again how useful is the cooperation between divers who discover a wreck and the Ministry of Culture or the CCI, charged with its protection. Only by respecting the legal procedure and the obligation to report every find, of ancient shipwrecks or the wrecks of ships and planes from the World Wars can we protect and preserve the cultural heritage of the seabed off Croatia. The incredible coincidence of the recent finding of the wreck of the Tulsamerican opens up new vistas in the investigation of more recent Croatian military history. The wreck of the plane is in a protected area where diving is permitted only through authorised diving centres, and the depth of 41 metres is still within the borders of sporting diving, and is thus accessible to most diving categories. At the moment no diving is allowed around the wreck of the Liberator, but after the making of a complete record and the establishment of legal protection, there is no doubt that the wreck of the Tulsamerican will enrich the supply of diving locations in the sea area of the island of Vis.


Igor MIholjek and Vesna Zmaić: recent underwater archaeological research off the Croatian coast


Figure 1. Vižula site near Medulin, structures E and F

Figure 2. Vižula near Medulin
Figure 3. ČAVLIN WRECK PLAN (NEAR THE ISLAND OF MURTER)
Figure 4. Lamboglia 2 amphorae, Čavlin wreck (near the island of Murter)

Figure 5. Sutivan wreck (near the island of Brač)

Figure 6. Documentation of Sutivan wreck

Figure 7. Vela Dolina wreck (on the island of Mljet)
Figure 8. Unclassified type of amphorae, Vela Dolina wreck

Figure 9. Byzantium amphorae 9th - 10th century, Stoba promontory wreck (on the island of Mljet)

Figure 10. Documentation of Stoba promontory wreck (on the island of Mljet)

Figure 11. Post-medieval shipwreck in the Mioka shallows (near the island of Murter)

Figure 12. Golden coin from post-medieval shipwreck in the Mioka shallows (near the island of Murter)
FIGURE 13. POST-MEDIEVAL SHIPWRECK IN THE SV. PAVAO SHALLOWS (NEAR THE ISLAND OF MLJET)

FIGURE 14. SHIP’S BELL ON THE SEA BOTTOM, POST-MEDIEVAL SHIPWRECK IN THE SV. PAVAO SHALLOWS

FIGURE 15. B-24 J LIBERATOR ‘TULSAMERICAN’ NEAR THE ISLAND OF VIS

FIGURE 16. B-24 J LIBERATOR ‘TULSAMERICAN’ NEAR THE ISLAND OF VIS