

Marko
Stokin

Andrej
Gaspari

Snježana
Karinja

Miran
Erič

Archaeological research of maritime infrastructure of Roman settlements on the Slovenian coast of Istria (1993-2007)

Abstract

The presentation focuses to the recent archeological investigations of the submerged architectural remains from Roman period on the shores of north-western Istria, carried out by the Institute for the Protection of Cultural Heritage of Slovenia and Maritime Museum »Sergej Mašera« Piran between 1993 and 2007, and addresses the relation between acquired data on sea-borne transport, maritime infrastructure of coastal settlements and their economic base. High-precision measurements of the submerged and coastal structures also supplement the paleo-environmental data on sea-level rise on the northern Adriatic during last two millennia.

Beside historical back-ground and methodology, particular attention will be paid the results of the underwater survey of the submerged structures of the piscina vivarium at Fizine near Portorož and subsequent probe excavations within one of the basins, which revealed its early 1st century AD origin. The ceramic material, collected during previous interventions on the site, confirms the more or less continuous use of the basins up to the 5th century, which is in concordance with the chronological span of the nearby settlement, partly documented during the preventive excavations in 1998. The remains are located on the slopes above a small bay, well protected from bora and western winds, and consist of excellently preserved architecture and complex stratification with a number of small finds, indicating intensive fishing activity, ship maintenance and cargo manipulation from the Late Republican period onwards.

Underwater survey of another maritime complex in the Jernejev zaliv near Ankaran, supplemented by multi-beam sonar measurements, enhanced the previous documentation of two Roman structures on the sea floor. The architectural remains of two large basins, recognized as vivarium and accompanied by a curved pier, are located at the eastern edge of the bay. They are roughly dated to the Early Imperial period. The submerged structures in the central part of the bay consist of two piers with internal basins and long approach ramparts, all being built of large blocks and irregular infill of smaller stones. Together with the remains of walls on the shore of nearby peninsula they probably form the maritime infrastructure of the yet unidentified Roman estate. Early Modern fishery arrangements with embankments, basins and channels were also identified in the tidal area in the immediate vicinity of the former border crossing between Italy and Slovenia. The mentioned peninsula, bearing characteristic name Carigador, took present dimensions during Early Modern interventions and perhaps served as a loading platform for a quarry.

Preface

The essence of conservation archaeology in Slovenia and elsewhere is to plan for the best long-term use of cultural resources, today the widely accepted philosophy of conservation. During the last seven decades, the archaeological research into maritime villas and other coastal settlements and submerged architectural remains, such as ports, piers, fish ponds, salt-pans etc., especially from the Roman period on the shores of north-western Istria in Slovenia has significantly enriched the interpretation of archaeological context of settlements along the sea and upgraded the archaeological database so important for better legal protection and preservation. We should bear in mind that in gross terms there appear to be more underwater structures now than there were, say, a hundred years ago. This is a result of greater archaeological endeavours, as well as of improved techniques now available for the identification and recording of monuments and sites on the coast and in its vicinity.

The Interreg "Alto Adriatico" project is important owing not only to its general aims, but particularly with regard to looking at sea landscapes rather than sites, for seeing the historic environment as part of the natural environment and, above all, for emphasizing the role of archaeology in conserving rather than destroying the resources.

The most important sites as part of maritime villas or settlements on the coast of Slovenian Istria are Seča, Fizine, Piran, Simonov zaliv, Viližan, Jernejev zaliv and especially the less well known area around Sermin and Koper. The paper presents a synthesis of the recent archaeological survey and research carried out at the mentioned sites.

Historical background

The first interest for the underwater remains of Roman port dates back to the 16th century, when Pietro Coppo, a well known geographer who lived for some time in Izola/Isola, described the site of Simonov zaliv (Coppo 1540, 34, 35). But the first systematic research in Roman ports in this region was initiated by Atilio Degrassi in 1922 with a collaboration of engineers Cusmani, Valesini, photographer Pietro Opiglia and probably with the support of »soprintendente« Ferdinando Forlatti. With the methodology and technology available at that time he was unable, however, neither to document all underwater structures nor to carry out a precise architectural and constructional analysis.

In the 1922-1929 period, he recorded many ports and other structures, like Simonov zaliv, Viližan, Savudrija, sv. Ivan, Katoro, Valbandon and Verige in Brioni islands: underwater structures were measured, recorded with detailed descriptions and photographs and in the end published in the article entitled »I porti Romani dell Istria« (Degrassi 1962, 821-871).

After the Second World War, some important reforms took place in the organization of underwater archaeology and research in Slovenia. In the beginning of the 1960s, the "Sergej Mašera" Maritime Museum from Piran (at that time Town Museum) and E. Boltin-Tome as Archaeology Curator began to carry out, in cooperation with the local diving team of the »Underwater Research Society«, surveys and documentation of structures along the Slovenian coast. They surveyed the seashore from Portorož to Koper in the area 150-200 metres wide and new records of the mentioned archaeological sites were made (Boltin-Tome 1975; Ead. 1979; Ead. 1986). At some places, like Fizine near Portorož, underwater archaeological excavations were conducted.

Of particular importance were the efforts made by the »Underwater Exploration Centre, which united several marine biologists and professional photographers under the direction of Jože Štirn. In collaboration with the Archaeological Museum of Istria in Pula and under the archaeological supervision of Prof. Štefan Mlakar they documented and partially excavated remains of a Roman cargo ship from the second half of the 2nd or early 1st century BC off Savudrija's Cape Oštro during the of 1963 and 1964 seasons (Bačič, Štirn 1963). The wreck was preserved only by small fragments of the hull with mortice-and-tenon joints, bronze nails, lead anchor beam and perhaps base stone of *molla*. The cargo seems to have consisted exclusively of late Graeco-Italic, Lamboglia 2 and transitional types of amphorae (Fig. 1). During the thorough examination of the remains, conducted by Marko Uhač from the Archaeological Museum in Pula during his excellent work within the framework of his graduate thesis, it turned up that a cargo ship of *bragoc* type from the 18th/19th century sank at the exact spot of the ancient shipwreck (Uhač 2003).

In 1983-1987, a joint team of the Maritime Museum Piran (Elica Boltin-Tome) with collaboration of the Museum of Poreč (Vladimir Kovačič), Department of Archaeology at the University of Ljubljana, the Regional Museum Koper and for a short period in 1987 by the National Museum of Slovenia guided by Timotej Knific upgraded the survey, especially in Simonov zaliv near Izola (St. Simon Bay). It was for the first time that the research was documented by a video film and photos made by professional photographers (Knific 1993). The mentioned institutions carried out the first interdisciplinary research in Jernejev zaliv and for the first time the structures were interpreted as »*piscina vivaria*« (Regional Museum Koper and Slovenian National Museum).

The Piran »Sergej Mašera« Museum performed many other minor interventions and rescue projects with important new discoveries, especially in Simonov zaliv in 1994 (Karinja 1997; Karinja, Čerče, in print) until the beginning of 2001 when the »Underwater Archaeology Workgroup« was established within the Institute for the Protection of Cultural Heritage of Slovenia. The mentioned group of specialists led by Andrej Gaspari started to work intensively at different coastal sites. Precision measurements of the submerged structures also supplement the paleo-environmental data on relative sea-level rise in the northern Adriatic during the last two millennia (Antonioli et al. 2007).

Methodology

The main objective of underwater research is to deliver reliable and high-quality information, guidance and advice, common database for future research, evaluation and protection of the coastal landscape. It is necessary to provide for advanced techniques, especially as the major aim of the surveys was delivery of spatial information of underwater sites with building structures. Following the conservation issues and non-destructive nature of the 2004-2006 research campaign, we decided to conduct test excavations as an extreme measure of improving our knowledge of particular sites only at the exact places of some older interventions in order to determine construction characteristics, procedures and age.

The research prior to the fieldwork consisted of collecting and evaluating older data at particular sites, analysis of historical maps and cadastral plans, as well as evaluation of aerial photographs. On-site methodology included geodetic survey by total station and prism equipped with water level, which was applied for measuring larger structures of stone blocks, as well as hand drawing of more delicate wall sections and section plans. The idea to photograph the whole structures equipped with reference markers was not feasible owing to the poor clarity of the shallow waters. Small depths also prevented complete measurement of sites with multi-beam sonar whose results - as it is evident from the figures below - remain unsurpassed in precision and speed of recording.

Fizine (Portorož)

During the evaluation of the archaeological potential of sites on the Slovenian coastline, a team of divers of the Underwater Archaeology Workgroup of the Institute for the Protection of Cultural Heritage of Slovenia, the Institute for the Mediterranean Heritage of the Science and Research Centre Koper, and the »Sergej Mašera« Maritime Museum Piran carried out two excavation campaigns of the underwater site in Fizine near Portorož in May and June 2004 and in May 2005. The research was a part of the project entitled »From Underwater to Public Attention«, co-financed by the EU Culture 2000 program (Gaspari et al. 2006).

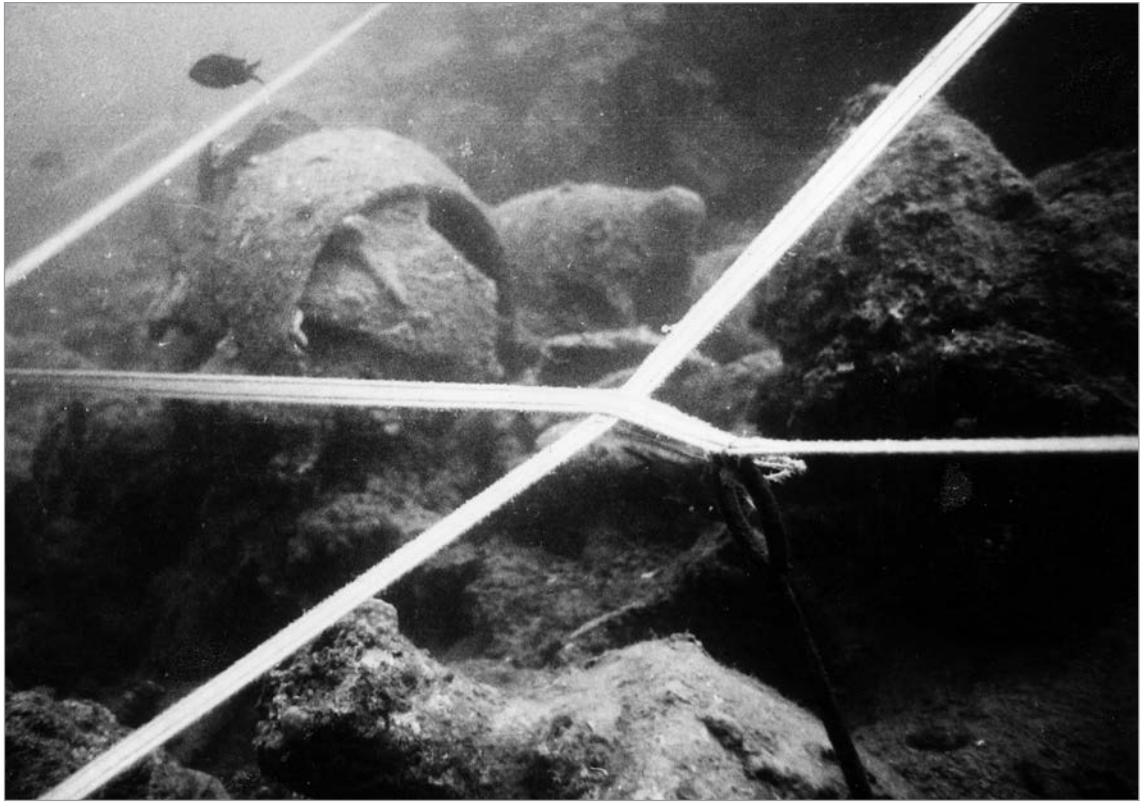


Fig. 1. The underwater excavation of the Late Republican wreck off Cape Oštro (Savudrija) by Underwater Exploration Centre (Ljubljana), Archaeological Museum (Pula), 1963 (photo: Marjan Rihter).



Fig. 2. Aerial photograph of the submerged structure at Fazine near Portorož (photo: Benjamin Jonathan).

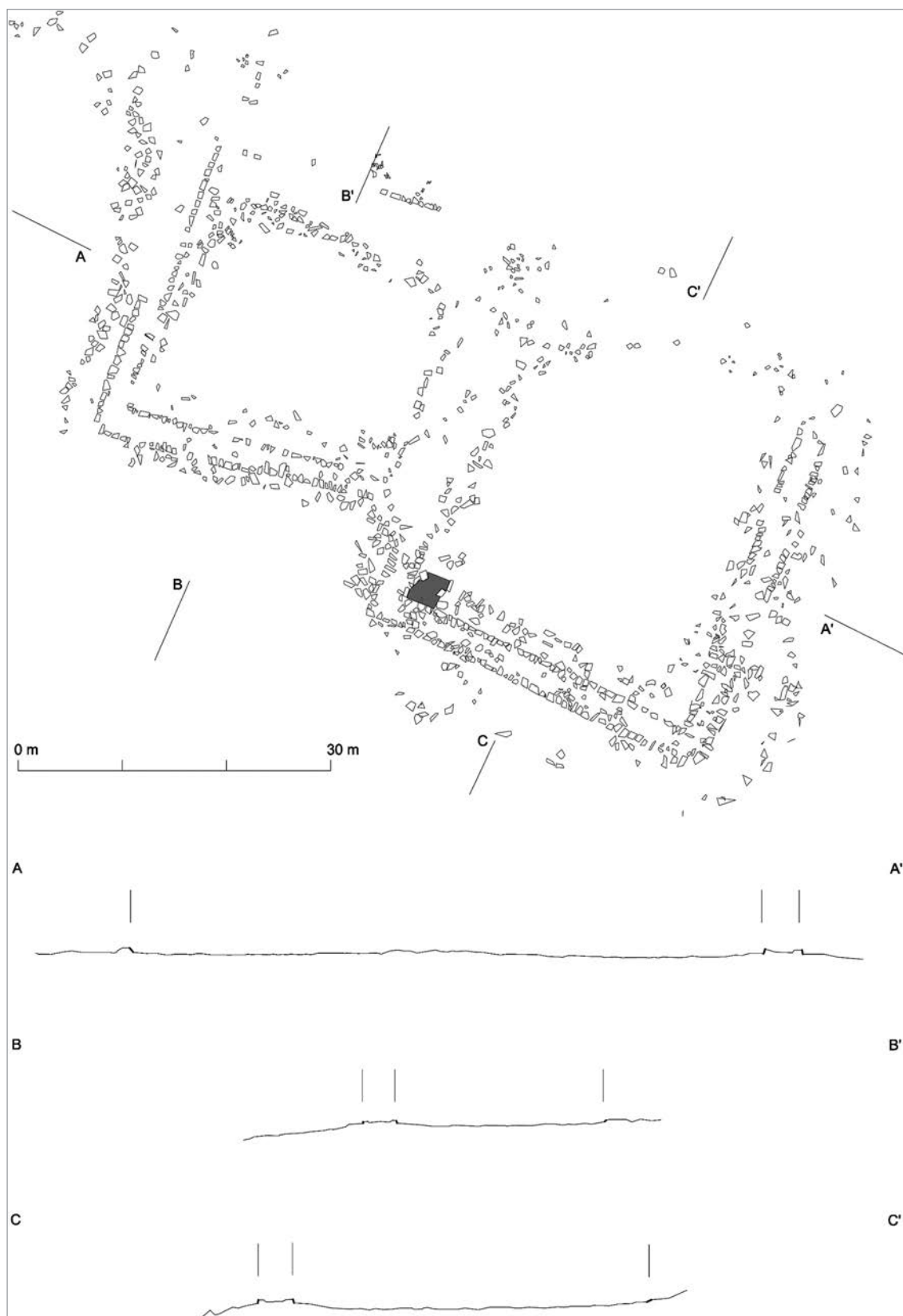


Fig. 3. Fizine. Ground plan of the blocks and walls of piscina vivaria. Total-station survey. Underwater archaeology workgroup, »Sergej Mašera« Maritime Museum Piran and Institute for the Mediterranean Heritage of the Science Research Centre Koper, 2004-2005 (execution: Miran Erič).

Basic data on the extent and date of the remains on the sea-floor was collected during the measurement carried out in 1963 and salvage research implemented in the ensuing year, which was conducted prior to the building of the present-day embankment by the Maritime Museum's diving team. The research in 1963/1964 was led by Archaeology Curator Elica Boltin-Tome and the Museum's employee Mihael Huszar (Boltin-Tome 1970; id. 1979, 51). The site was re-measured in 1984 and 1985 by the team of the Department of Archaeology of the University of Ljubljana under the direction of Timotej Knific, when a number of small finds were recovered from the surface of the sediments (Knific 1993, 20, Fig. 9). The archaeological site at Fizine is located to the west of the former salt warehouses on the northern coast of Portorož Bay (Fig. 2). Not far away, remains of Roman architecture were discovered in 1998 during salvage research by the Institute for the Conservation of Natural and Cultural Heritage Piran, while ancient ruins and layers with finds were also reported on the slopes above the underwater site.

The main research goals in 2004 and 2005 were to document and measure the architectural remains found on the seabed, and to ascertain the building surface as well as the manner of construction of the structures and chronology of the related deposits. The first step in this direction was hydrographical measurement of the site by echo-sounder, enabling the construction of a digital model of the area. The second step was production of a three-dimensional topographical plan of the structural units, created by using two total stations (Fig. 3).

The Roman architectural remains are situated on the eastern half of an extensive stone jetty of rectangular shape, built in order to extend the landing shore. It measured around 100 meters in length and 60 meters in width. The surface of the western part of the jetty slowly sinks from 0.4 m along the present-day embankment to a depth of 3.5-4.5 m, where it sits on silted natural seabed. The walls positioned in the eastern part of the embankment formed two rectangular basins that today appear as two silted depressions; they measure 37 x 29 and 26 x 25 m and are separated by a poorly preserved wall. The depressions are around 0.5 m deeper than the fill along the interior face of the walls. The length of the entire structure measured ca. 67 m, while the established width was from 30 to 35 m. The 2.7 to 3.5 m wide walls consisted of two lines of massive blocks of flysch sandstone with an interior fill of an amorphous mass of stones without mortar. The fairly exactly built walls were primarily preserved at a height of two rows of stone and only sometimes of one only. The upper surface of blocks in the original positions extends from 0.9 to 1.6 m below the sea surface (Fig. 4).

The documented southern face of the structure or the handling space north of the western basin indicates that during the construction period the mean sea level at Fizine was at least 0.6 m below the present-day isobath 0.9 m. The more than 850 blocks outside their original position permit the evaluation that the structure during its period of use was at least one row of stones higher than the preserved situation. The easy accessibility meant that many blocks were probably exploited for the construction of salt warehouses or other later structures in the vicinity, so that a conjecture of 4 rows of blocks is probably more correct. On the basis of the enumerated hypotheses, the pier extended during the period of its use at least a good half a meter above the mean sea level. Hence it follows that the port function of the structure is not doubtful, but only shallow draft vessels could have docked directly at the pier.



Fig. 4. Fizine. Peripheral walls of the piscine vivaria were built on an extensive stone jetty (photo: Arne Hodalič).

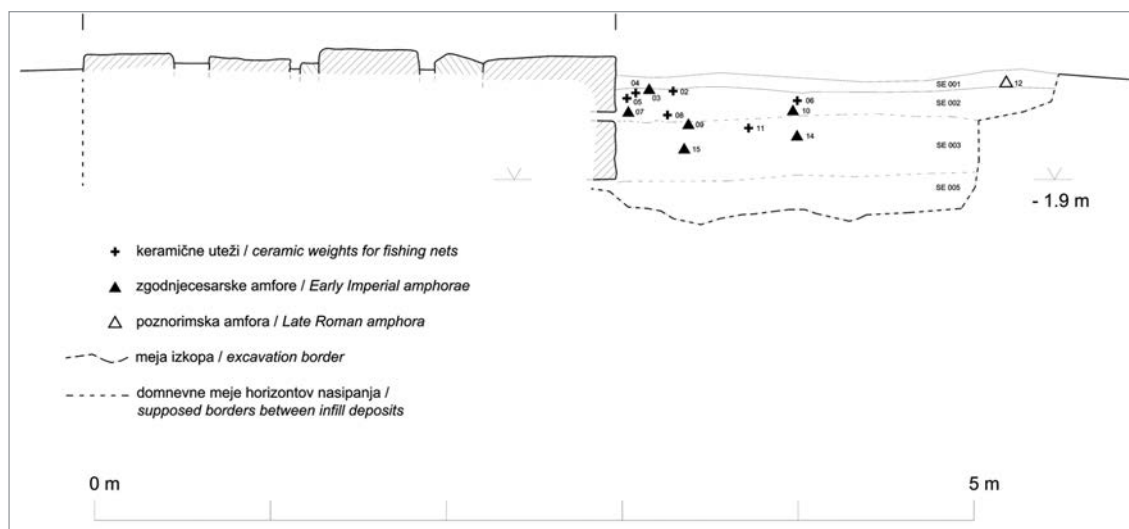


Fig. 5. Fazine. Section of the trench in the interior part of the southern pool (execution: Miran Erič).

Larger cargo ships with a draft exceeding 1 m, could dock only at high tide, as otherwise they would have had to anchor in the deeper waters off the pier.

The role of the above mentioned depressions within the structure, whose lower face borders the coastline, has still not been explained. It was probably not an area for mooring ships, but a closed pool for breeding or preserving sea creatures (*piscina vivaria*; cfr. Higginbotham 1997). Several similar structures are known from the Istrian coast, e.g. from the Jernejev zaliv and from the vicinity of Kupanja, not far from Loron (Tassaux, Matijašič, Kovačić 2001, 90, Fig. 36, 37). At Fazine, the massive walls kept the water calm even at the time of rough sea, while their permeability enabled the circulation in accord with the tides. Fresh water, required for cooling, elevating the oxygen level and moderating the salinity of the sea-water was provided by a spring, which has its source on a slope above the installation.

It is possible to date the construction of the structure from amphorae of Dressel 6B (Figs 5, 6) that were discovered in the fill of the interior of the eastern pool. The pottery finds from the area of the structure discovered during previous campaigns include fragments of amphorae and kitchen- and table-ware from the period between the 1st century BC and the end of the 5th century AD, with an emphasized predominance of Late Roman material (Karinja 2002, 268). A number of ceramic weights for fishing nets and a Late Roman oil lamp of African origin were found as well.

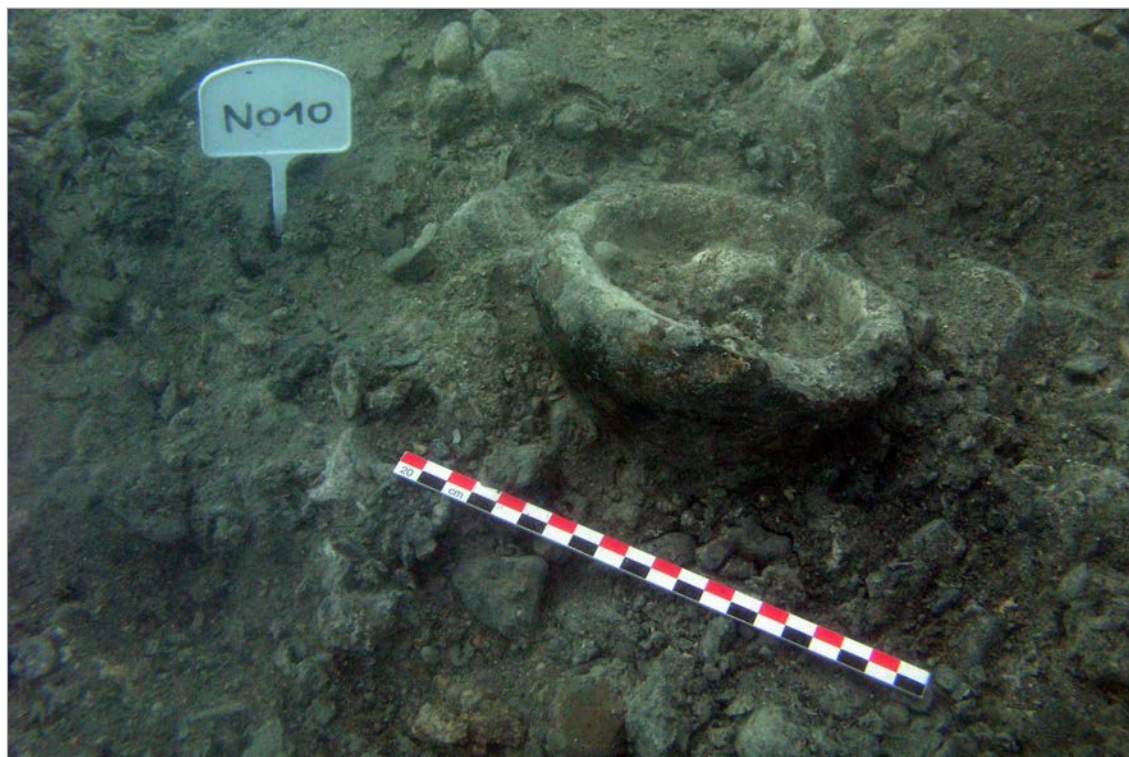


Fig. 6. Fazine. Rim of the Dressel 6B type amphora in the stone infill - SU 002 (photo: Andrej Gaspari).

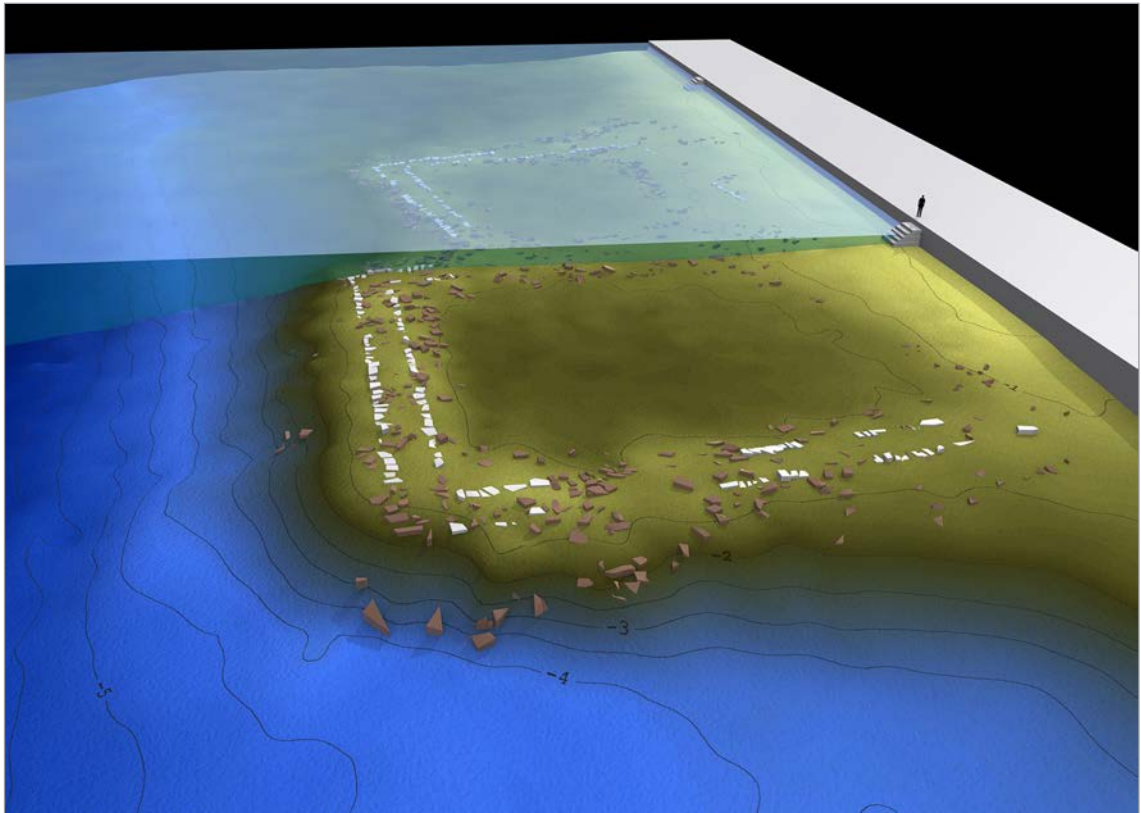


Fig. 7. Fizine. Visualization of the submerged remains at Fizine (execution: Sašo Poglajen).



Fig. 8. Fizine. The well preserved remains of the Roman buildings in the south-eastern part of the 1998 excavation area (photo: Andrej Gaspari).

The archaeological finds from Fizine speak of a port settlement that more or less continually existed at least from the mid-1st century BC to the second half or end of the 6th century AD (Gaspari et al. 2007b). The architectural remains of the buildings and the handling space on the coast and the fish farm by the pier on the western edge of the bay are situated at the foot of a valley, which has been greatly changed as a result of building the salt warehouses and the more recent walling of the sea embankment. In the Roman period, the lower part of the valley probably ended in a shallow bay, which due to its sheltered position was highly suitable as a harbour, while the small flat area at the base offered adequate possibilities for establishing an accompanying settlement.

The walls destroyed during the construction of the old petrol station and the remains excavated in 1998 show that the architecture spreads in all directions, and particularly towards the valley head to the north (Fig. 8).

The material from the lowest deposits shows that the earliest documented phase at Fizine was somewhat later than the majority of the remains at the nearby Fornace (Stokin 1992). Fizine reached its first peak in the late 1st and 2nd centuries. The architectural remains include a perfectly built object with a rectangular plan, wooden partition walls, and a narrow entryway, which is conjectured to have led into the interior of the complex. Judging

by the finds, the structure was intended for economic activities. Indeed, for this as well as later phases, cast bronze nails used in ship-building were characteristic, along with fishhooks and ceramic weights for fishing nets, which together with the numerous sea shells additionally confirm the maritime character of the settlement (Fig. 9).

Fizine experienced its greatest prosperity, as demonstrated by numerous coins and African products, in the period of the second half of the 4th and first half of the 5th centuries. This phase of the site is marked by a larger walled structure, where earlier architecture was used as the foundations. Certain finds could even indicate that the settlement continued to exist even in the second half of the 6th century. At this same time or slightly later, a church was built in the broader area of the bay, which matches well with features of the urban development of Istria, where after the decline of Roman seaside settlements religious structures were built on their ruins (e.g. Jernejev zaliv, Simonov zaliv).

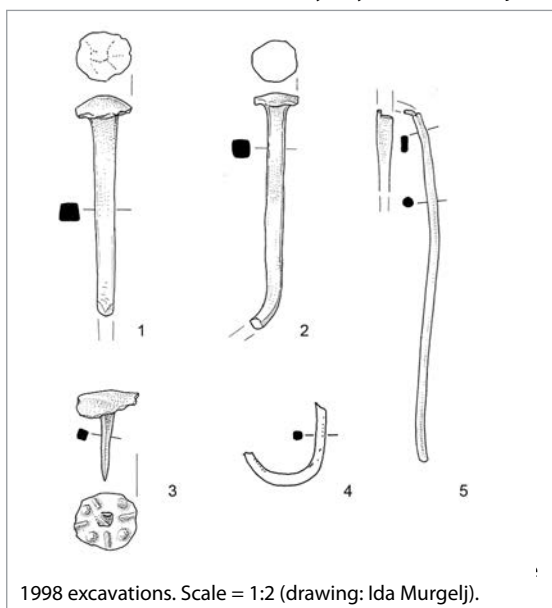


Fig. 10. Roman port in Simonov zaliv during low tide in 1968 (Archive of Maritime Museum).



Fig. 11. Simonov zaliv. Aerial photograph (photo: Darja Grosman).

Simonov zaliv (Izola)

The spreading of Roman culture in north-western Istria was based on urban settlements and large estates strewn along the coast and in fertile hinterland. It is not surprising, therefore, that the ruins of rustic and littoral Roman villas are among the most frequently discovered archaeological structures of this period. In the 1980s, when the Institute for the Protection of Cultural Heritage, Regional Office Piran, carried out a research in Simon Bay into a Roman villa, its trade and commercial part was discovered. The construction of the villa is dated to the end of the Republic, i.e. the beginning of the Augustan period, on the basis of the analogies of mosaic, fresco remains and Corinthian capital. In the vicinity of the villa, a port is situated, which with its 8,000 m² constitutes one of the largest Roman ports in Istria (Karinja 1997). The port consists of a pier, embankment and breakwater. In spite of the fact that the pier and the embankment were cemented in 1968, their original structure is still visible under the sea surface. The pier is 55 m long and 5.1 m wide, and is lying in a west-east direction. The huge blocks were set up in two lines. In places, three lines of blocks lying upon each other have survived. The embankment, which was built perpendicularly to the pier, consists of a single line of blocks of up to 3 x 1 x 0.5 m in size. Additionally, a 19 m long structure was built, although with inferior construction techniques and of smaller stone blocks. To the west of the pier, currently sunken foundations of a smaller structure have survived, which in the Roman period most probably stood along the coast or constituted part of the port (Figs. 10, 11).

At low tide, the breakwater's ridge can be seen some 50 m from the coast, which protected the harbour from the prevailing winds, i.e. the *bora* and *tramontana*. Here the depth varies from 3 and 4 m, the height of the preserved breakwater is 2 m. The outer side-face is 110 m long, the inner side-face 84.2 m. The width at the entrance is 6.40 m. For all structures, sandstone was used.

Until 1994, the archaeological research into the port had been limited to the measurement and drawing of the pier, shore and the building in the sea to the southwest of the pier. The breakwater, the largest port object that stretches the furthest into the sea, was subject to thorough geodetic survey in 1994 and, in 2007, to multi-beam echo-sonar measurements (Poglajen 2008; Fig. 12).

Rescue underwater archaeological excavations were carried out in 1994 by a wider team of experts (Karinja 1997; Karinja, Čerče in print). During the excavations next to the base of the pier, six different stratigraphic units were determined.

Most of the finds was Roman building material: fragments of tiles, bricks, plaster, clay pavement cubes, black and white mosaic stones. Four of the tiles bear the imprint of L. Quintus Thallus. Other finds included ceramic kitchenware, fragments of early Roman amphorae and other finds (Karinja 1997, 182, 186). Most of the ceramic finds had smooth edges, as a result of constant friction. This could be waste material thrown into the sea or simply deposited on the shore.

A fragment of wood found in the antique layer, discovered during the excavations in 1994, was analysed with the ^{14}C method. It was dated to 2098 ± 97 BP, i.e. 150 ± 124 BC (Karinja, Čerče, in print). The ceramic finds indicate that this part of the port was used at least from the 1st century BC until the 3rd century AD, which confirms the results obtained ashore.

During the rescue excavations, Miran Erič and Peter Čerče explored the seabed inside the port. They found 15 wooden piles and a few small archaeological finds (near the breakwater). Subsequent overviews showed that there were other piles, but the exact number has not yet been determined.

The age of the piles found in 1994 (Karinja 1997b, 155) was determined with the ^{14}C method. They are 1250 ± 30 BP, which means that they date back to 670-860 AD. It has therefore been concluded that the port was still used between the 7th and 9th centuries. The recent study indicates that the sea level may have risen for about 1.6 m since the construction of the pier in Simonov zaliv (Antonioli 2007, 10, 11).

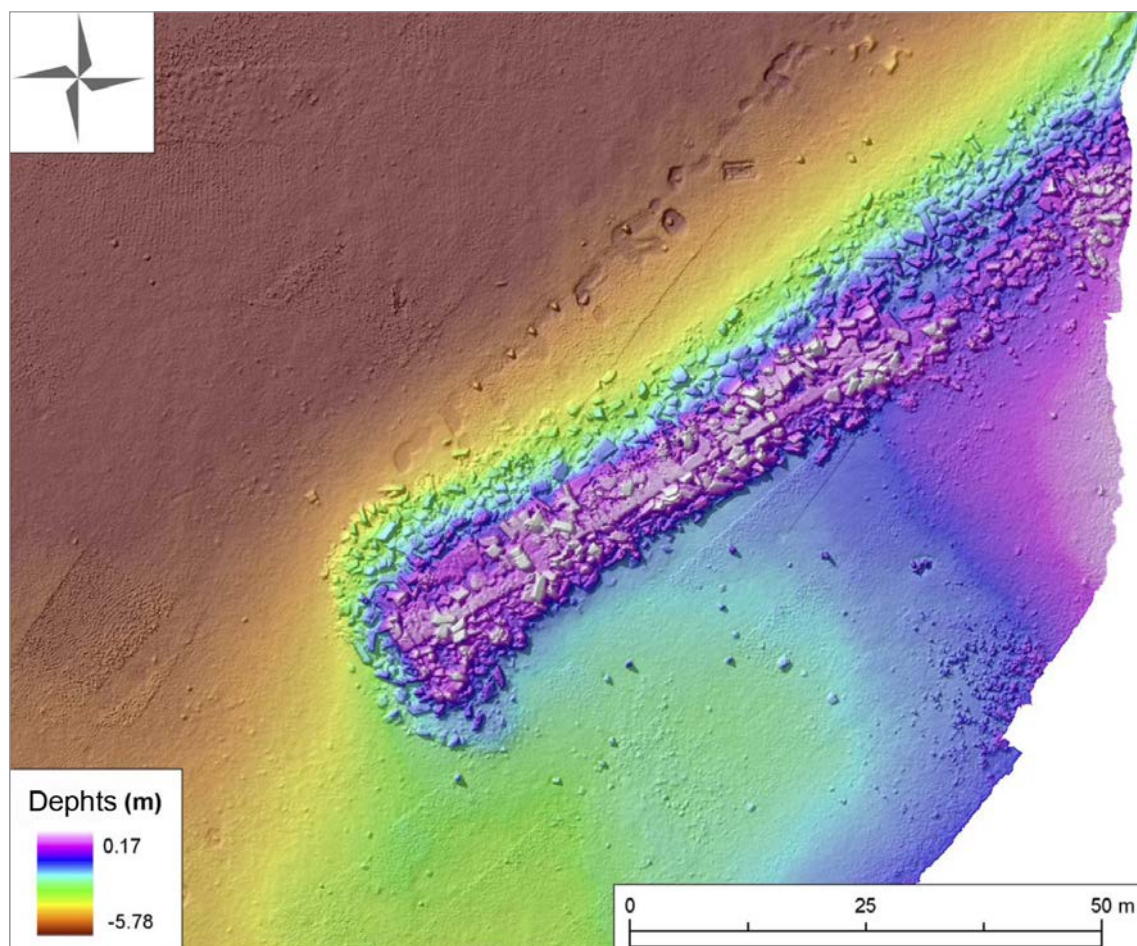


Fig. 12. Simonov zaliv. The breakwater of the Roman port. Multi-beam sonar survey. HarphaSea, 2007 (execution: Sašo Poglajen).



Fig. 13. Viližan near Izola (photograph: Andrej Gaspari)



Fig. 14. Roman port structure at Viližan, 23 Feb 2008, 16.00 hours, 65 cm below mean sea-level (photograph: Andrej Gaspari).

Viližan (Izola)

At Viližan, not far from St. Simon Bay's Roman port, lie the remains of two antique Roman piers that are still visible during low tides (Figs 13, 14). The first person taking notes about the Roman port was Attilio Degrassi (Degrassi 1962, 834) who also considered its form to be unique. The pier facing Koper is worst preserved due to its north position with consequent exposure to *tramontana* and northerly winds. Both piers were made from 0,50-1 m large, 1-2 m long and 0,40-0,80 m high blocks of autochthonous sandstone. The space between the two is filled with gravel. The better preserved pier, which lies in N-NW direction, is 4,65 m wide and 75 m long. Many stone blocks that previously belonged to Roman piers were used in the course of railway construction works back in 1900.

According to A. Degrassi, the port covered the surface of 5,300 m². Construction works for the narrow gauge railway Trieste-Poreč and the main road caused a split of it and deleted precious information about its original ground plan. Today's ground plan makes it hard to establish the entrance location of the port. In 1966, the research carried out at Viližan was already led by E. Boltin-Tome from the "Sergej Mašera" Maritime Museum Piran, who guided these activities in the ensuing years as well. In 1976, a geodetic plan of the piers has been elaborated due to incoming road constructions. The discoveries on mainland included remains of a Roman house, a stove (in 1956) and brick- and lead-pipes. In spring 1979, the "Sergej Mašera" Maritime Museum Piran began to carry out rescue archaeological excavations on the mainland, 5 m from the inner margin of the present-day road. The 3 m large excavation trench revealed a retaining wall, made of 2 m long blocks. Attached to this wall were 1 x 2,5 m large stone slabs, for which E. Boltin-Tome believes to be the remains of a pavement. All of the findings were lying 2-3 m below the present-day level (Boltin-Tome 1991, 54).

Sermin

Prehistoric sites at the foot of Sermin hill, on the Piran peninsula and especially at hillforts, located higher above the coastal belt, constitute the first significant settlement pattern in this region. Major changes occurred after the establishment of early Roman settlements with large villas, roads, ports and other infrastructure (Fig. 15).

Sermin is situated at the mouth of the Rižana, although the hill is not particularly high (84 m), while the surrounding area is relatively flat. The formation of the coastline around Sermin has further been influenced by the subsidence of the eastern Adriatic coast. The Sermin hill is composed of flysch and the natural erosion has also contributed to the modification of the local landscape. The shallows were suitable for the construction of salt-pans in the 12th century, the first canalization of the Rižana took place in the 18th century, the decline of salt-pans begun in the 19th century, the intensive (agricultural) modification of the area started after 1939, and eventually the harbour extension, railway station, oil and gas terminals were built beside the hill.



Fig. 15. Sermin from the north-west (photo: Jaka Jeraša).



Fig. 16. Jernejev zaliv. Aerial photograph (Regione FVG- volo Trieste 2003, lotto 15, strisciata 44, fotogramma 3).

Intensive natural and anthropogenic changes had a great impact on the environment, the suburb landscape and urbanization of this part in Istria. The latest archaeological rescue excavations carried out in the Sermin area, especially near the ancient channel of the Rižana river (Stokin 2006, 11, 12) and Školarice/Valmarin (Novšak, Trenz 2003, 258, 259) disclosed large Roman settlements, like warehouses with their production parts, thermal baths, crossroads with cemetery and warehouse with mill and well, ovens and other remains from the 1st century BC until 5/6th century AD (Stokin 2006, 11). All these sites were interconnected with the river communication, were at least piers or other similar structures were functioned until the 17th century, like Carrigador close to the Church of Madonna della Ruota (Alberti 1997, 405). The underwater survey conducted along the flat western ridge of Sermin, close to the mouth of the Rižana river and very likely the site of Graeco-Roman *emporion*, revealed stone rubble

and fragments of amphorae, probably their remains of the 1st century AD settlement structures, while the ancient port of Sermin from prehistoric, Roman and Early Mediaeval periods has still not been located.

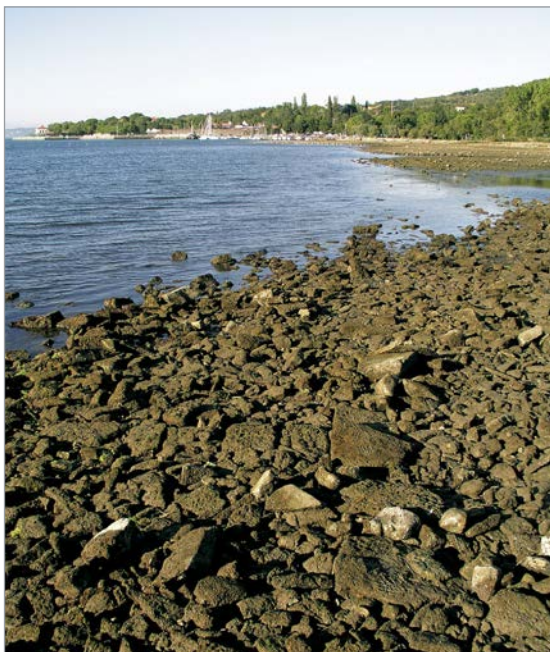


Fig. 17. Jernejev zaliv. Outermost wall of the structure, most probably Early Modern fishery in the eastern part of the bay, 2007 (photo: Andrej Gaspari).

Jernejev zaliv (Ankaran)

Bay of sv. Jernej (also Jernejev zaliv/Jernejeva draga/zaliv sv. Jerneja/ Valle s. Bartolomeo) was probably given its name after the Church of St. Jernej/San Bartolomeo that once upon a time stood in the immediate area of the bay (Fig. 16). The older reports refer to Roman finds from the bay's entire area. These are fragments of pottery, *tegulae* and *imbrices*, white and black mosaic cubes and earthen fishing weights (Benussi 1927-1928, 260; Boltin-Tome 1979, 47, 48), which testify to a yet unidentified Roman estate.

Completely or occasionally submerged architectural remains have so far been found in three places. The remains of a larger structure are situated in the tidal area along the international border crossing at Lazaret/Lazzaretto (Fig. 17), the second complex in the extreme inner part of the bay with narrow peninsula (»Molere di S. Hilario«), while the third larger complex lies on the

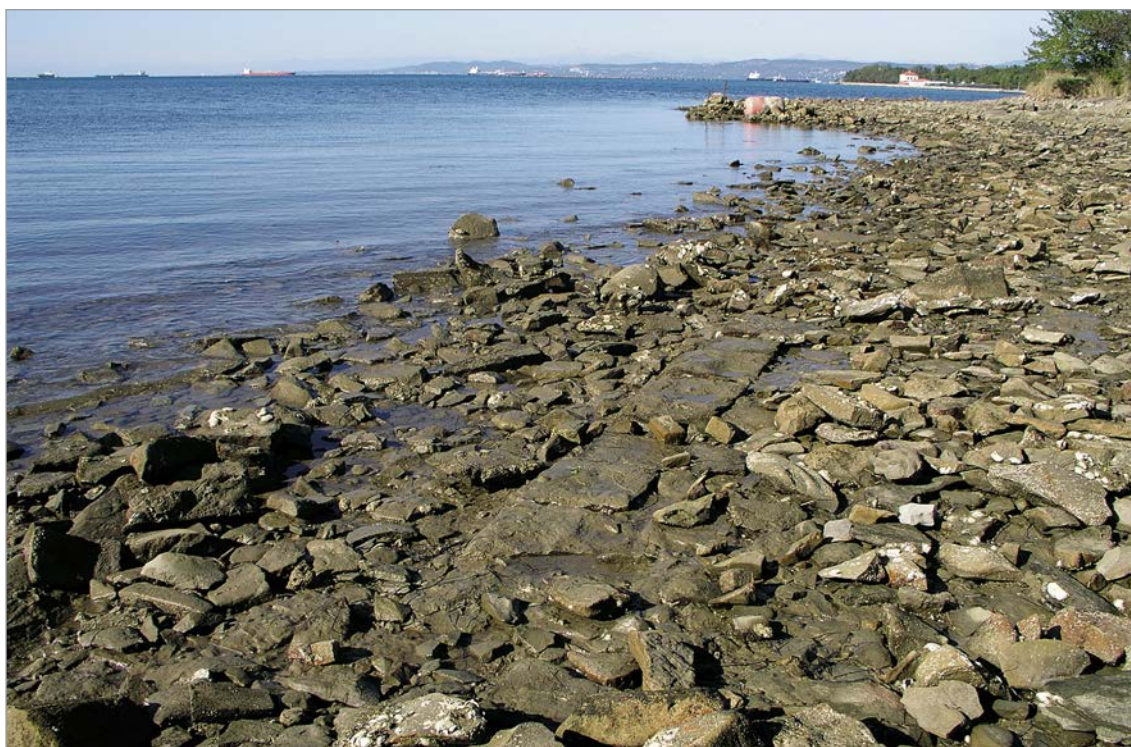


Fig. 18. Jernejev zaliv. Presumably Roman wall and/or pavement on the western shore of the peninsula, 2007 (photo: Andrej Gaspari).

sea floor along the western edge of the bay. All three complexes are indicated on the topographic drawing by A. Visconti from the 18th century (cfr. Auriemma 2004, 12).

Submerged Roman structures in Jernejev zaliv, referred to by M. Peracca (Peracca 1974; id. 1975-1976), were recorded as early as 1939-1950, when Italian amateur archaeologist Vasari Carlo drew relatively exact sketches of both piers along the eastern side of s. c. Carrigador and noted also larger objects along the western border of the bay. Both complexes were re-visited in the 1970s and in the early 1980s, when evaluation of aerial photographs by M. Župančič from the Regional Museum of Koper actuated subsequent underwater surveys (Župančič 1989, 18). Archaeologists N. Logar and M. Župančič published short reports with measurements and interpretation (Logar, Župančič 1981; Logar, Župančič 1982; Logar 1984, 36). During the coastal topography, conducted by the diving group of the Department of Archaeology of Ljubljana University and "Sergej Mašera" Maritime Museum, both mentioned sites were geodetically and photographically documented under the direction of Timotej Knific between 1983 and 1985 (Ravnik Toman 1986; Knific 1993, 14-16).

The structures on the western side of the bay were the objective of survey conducted by an international team, comprising archaeologists-divers from the Underwater Archaeology Workgroup of the Institute for the Protection of Cultural Heritage, the Maritime Museum »Sergej Mašera« Piran, and Dipartimento di Scienze dell'Antichità dell'Università degli Studi di Trieste. The research was part of the European initiative project Interreg IIIA Italy-Slovenia 2000-2006 and was carried out in November 2005 (Gaspari et al. 2007a; Antonioli et al. 2007). The Underwater Archaeology Workgroup re-measured the piers and walls along "Carrigador" in March 2006. A 1 m grid digital elevation model of the area of the peninsula and surrounding sea-bed with underwater structures was also produced with the total-station and DGPS. The results were subsequently supplemented and enhanced by multi-beam sonar measurements, conducted by HarphaSea Company. During the 2006 survey, the team documented large installation with embankments, basins and channels in the tidal area along the former border crossing between Italy and Slovenia. The remains that probably belong to the Early Modern fishery, as may be concluded from the absence of characteristic Roman material, are still awaiting proper recording.

The mentioned peninsula on the innermost part of the bay, for which characteristic denomination Carrigador is in use, acquired the current extent during Early Modern interventions as testified by a layer with pieces of glass, porcelain vessels and iron incorporated in the embankment. It perhaps served as a loading platform for a nearby quarry. The deeper lying sediments of the peninsula (2.2 m a. s. l) undoubtedly hide Roman architecture (Župančič 1989, 18). This is indicated by the remains of three walls and pavements up to 0,8 m in width, two of which were recorded on the western and northwestern shore and 18 m long one on the central part of the peninsula during the research in 1983 (Knific 1993, 15, 16). Only the eastern wall/pavement (l. 8.4 m) made of sandstone blocks and a similar structure at the tip of the peninsula are visible today (Figs 18, 19), while the 5.5 m long and 0.7 m wide wall could not be detected during the 2006 survey as the result of recent levelling.



Fig. 19. Jernejev zaliv. Presumably Roman wall and/or pavement on the northern tip of the peninsula during low tide, 23 Oct 2007, 16.30 hours, 65 cm below mean s. l. (photo: Andrej Gaspari).

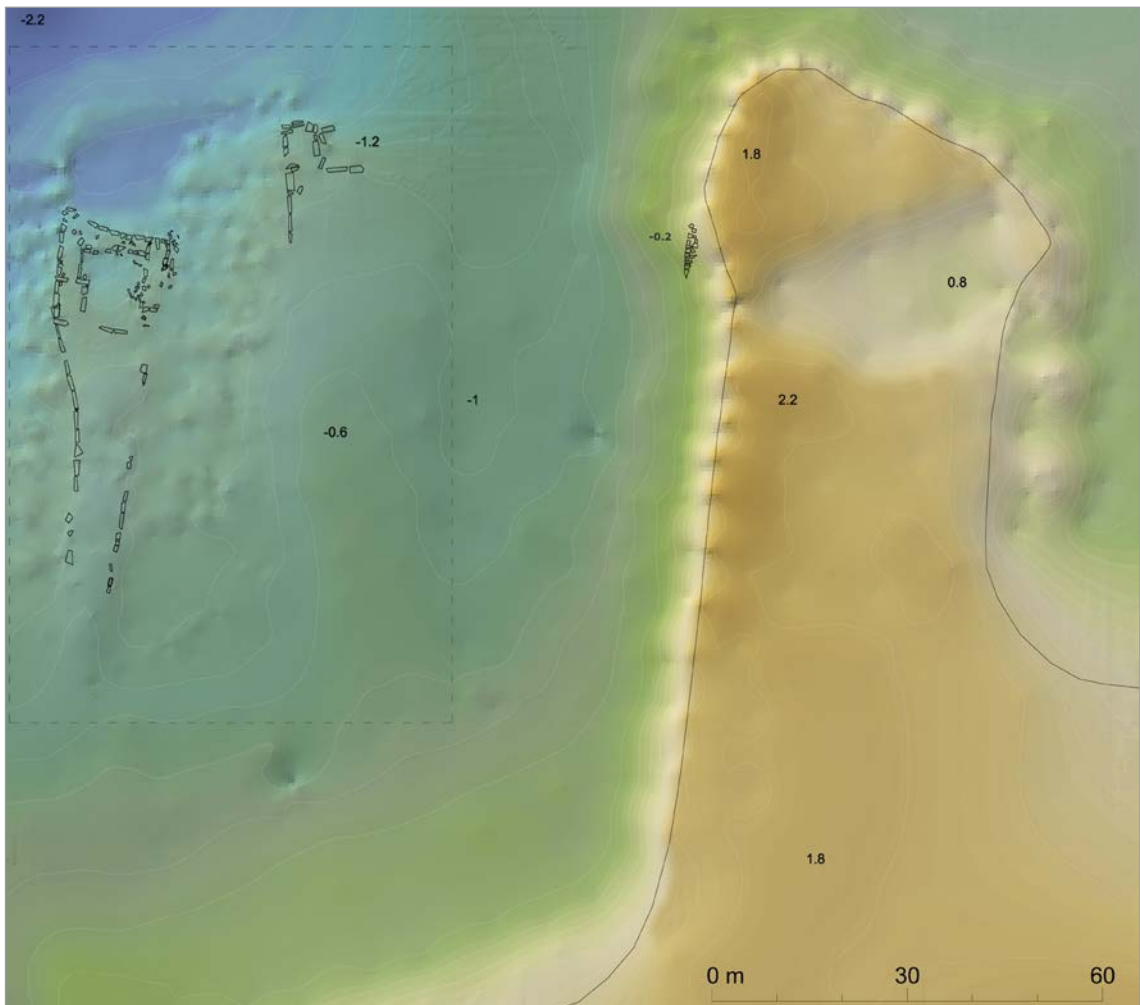


Fig. 20. Jernejev zaliv. Roman structures (»Molere«) next to the Carigador in the central part of the bay (Underwater archaeology workgroup, 2007) (execution: Miran Erič).

Two large structures have been preserved on the sea floor west of the peninsula (Figs 20, 22). Both consist of approach ramparts of disconnected stones and outer walls of large flysch blocks (max. 2.8 x 1.2 m), occasionally preserved in two rows with vertical outer faces. The western pier is characterized by a narrow embankment with 69.5 m (54.6 m) long straight eastern wall, 16.8 m wide square head on the sea-side and curved western wall (Fig. 23). Particular is the arrangement of the pier's square head with inner basin or dock of 10.6 x 10.5 m, which perhaps had an opening at the eastern side, where the outer wall has been poorly preserved. The upper surfaces of blocks in original positions are lying between 0.8 and 1.4 m below mean sea-level, while a number of collapsed blocks cover deeper ground in the immediate proximity of the walls.

The second pier is similar in construction, but different in alignment, dimensions and shape. The remains of more north-easterly oriented structure, which enclose all sides but towards the coast, consist of 18.1 m long western wall, 5.6 m wide sea-side termination with stepped transition to 13.3 m long extension and 10.1 m long eastern wall. The latter were not visible during the 2006 survey. The blocks *in situ* are situated at 0.8 - 1.2 m below mean sea-level. The in-fill of the terminal landing platform is missing due to erosion, but its original presence is testified by an approach embankment. The finds from the area of the piers include pieces of Roman tiles and a rim of an amphora, collected in 1983.

The directions of the structures, their construction and elevation above the surrounding sea floor indicate that we are probably dealing with piers with landing platforms and basins for marine animals, which relate to the architecture on the peninsula and presumably constitute the maritime infrastructure of the yet unidentified Roman estate. The second complex of the submerged ancient remains lies on the western edge of the bay, not far from Debeli rtič/ Punta Grossa, and consists of a large structure with two basins, breakwater and a pier (Figs 24, 25). The remains of the structure are 135 m long and 50 to 80 m wide. Originally, the structure had a rectangular ground plan, whereas the once narrower embankments have acquired, due to the destructive working of the sea, more oblong ground plans. In all parts of the external embankment, as well as on the jetty that separates

the structure in two closed pools, some up to 3 m long and 0.4 m thick blocks of sandstone can be seen, which used to constitute the structure's former superstructure. Apart from the blocks, which are mostly situated outside their original positions, 8 and 25 m long wall segments made of somewhat smaller stones were documented in the western and northern parts of the jetty (Fig. 26). At the east, the structure is limited by a pier made of two fronts of blocks with fill composed of amorphous mass of stones in between. The pier continues into approx. 30 m long arched end, in the vicinity of which numerous massive blocks of the collapsed superstructure are situated. The shape of the pier imitates the shape of stone fill immediately along the coast, where a semicircular wharf stands today. The actual pier surface seems to have lost one or two rows of blocks, which allow reconstruction of the ancient walking surface at 0,7 m (0,8 m with respect to tidal correction) below the present day sea-level. Assuming from the functional height of Roman piers, which is estimated at 0.6 m or more, the relative sea-level has risen by 1.4 ± 0.6 m since its construction (Antonioli et al. 2007, Fig. 5, Site 3).

On the basis of constructional characteristics and analogies, the entire structure can be specified as an ancient fish farm with a quay and landing pier, while both basins can be denoted as pools for storing or breeding fish.



Fig. 21. Jernejev zaliv. Detailed view of the piers. Total-station survey of the visible sandstone blocks. Underwater archaeology workgroup, 2007 (execution: Miran Erič).



Fig. 22. Jernejev zaliv. Aerial photograph of the peninsula and the heads of the Roman piers (photo: Alfred Zajič).



Fig. 23. Jernejev zaliv. Western face of the outer pier. Blocks are delimiting deeper surrounding area of silty bottom, overgrown with sea-grass, from almost bare stone in-fill of the approach ramps, 2007 (photo: Andrej Gaspari).

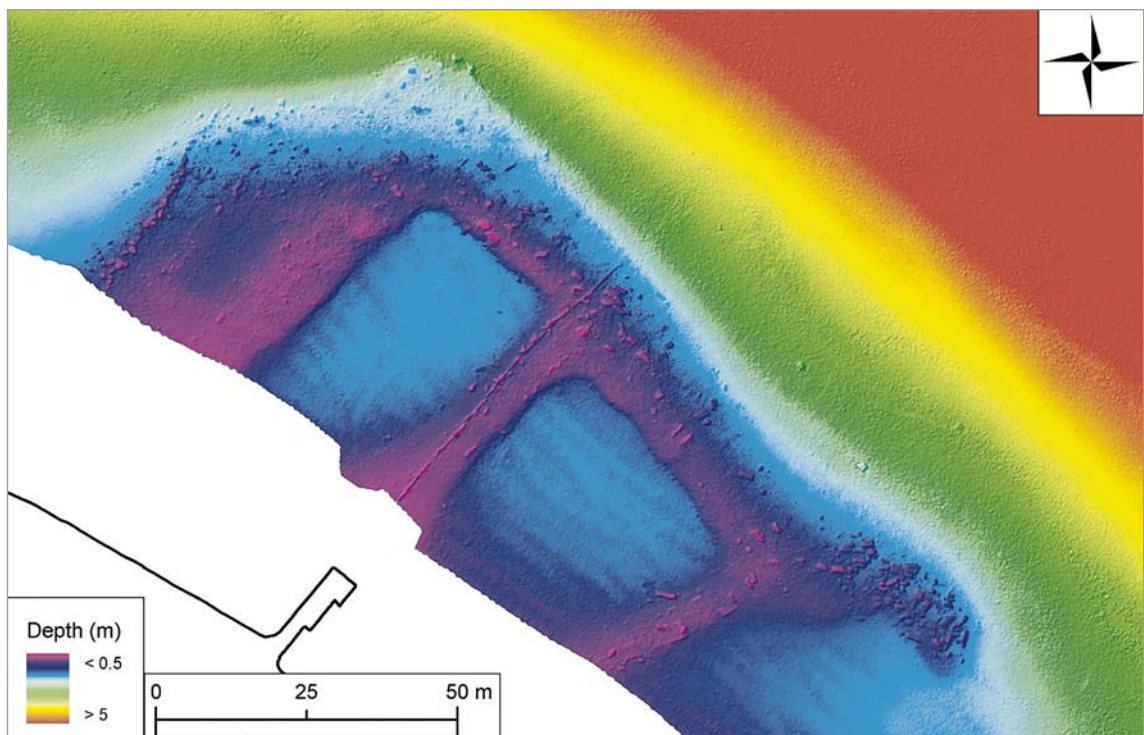


Fig. 24. Jernejev zaliv. The large piscina vivaria on the western border of the bay were probably built in the Early Imperial period. Multi-beam sonar survey. HarphaSea, 2007 (execution: Sašo Poglajen).

The selection of the place for the building of this structure was dictated by sufficient depth of the sea and the exposed position along the outer edge of the bay, which together with the outlets in the jetty provided for natural circulation of water in the pools. The small finds from the embankment include scarce pieces of *tegulae*, earthenware fishing weights and fragments of *amphorae*, including the handle of Dressel 2-4 type. The manner of construction and general arrangement of the pools correspond to the structure with presumably the same function as at Fazine near Portorož. Scarce information, provided by Vasari, speaks of Roman villa on the above-lying slopes of the peninsula that have been partly built-up by various camping facilities.



Fig. 25. Jernejev zaliv. A plan of individual sandstone blocks and walls. Total-station survey, combined with geo-rectified drawings. Underwater archaeology workgroup, »Sergej Mašera« Maritime Museum Piran and Dipartimento di Scienze dell'Antichità dell'Università degli Studi di Trieste, 2006 (execution: Miran Erič).

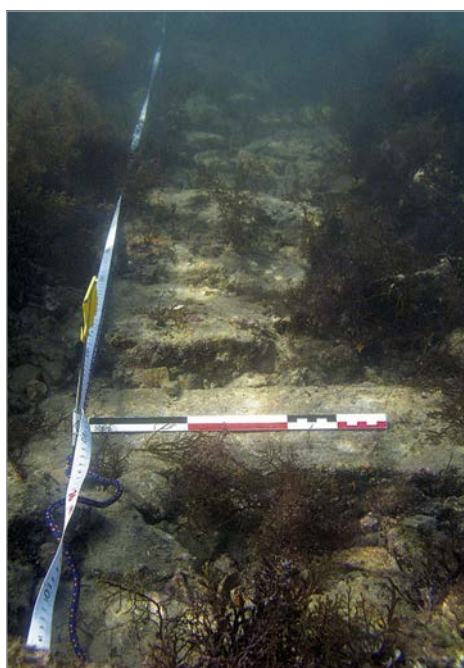


Fig. 26. Jernejev zaliv. Interior face of the wall imbedded in the outer jetty of the western pool, 2007 (photo: Andrej Gaspari).

Conclusion

If we wish to sustain the seaside cultural landscape heritage, one of the most important question we must address is that of how, in practice, can policy makers, planners, designers, managers and all the other people whose actions significantly affect the landscape, deal with this complex phenomenon in a structured, rational and well informed way when making decisions that affect landscape and the heritage (Goodchild 2005). Without political and other interests, the managing of cultural heritage, especially the maritime archaeology, cannot be suitably effective unless the tourism, industry and economy recognize the importance and the needs for better protection, display and management of cultural resources. But it is not enough for the state or municipality alone to produce the programme and provide than the impetus, maritime archaeology is beset by a variety of long standing issues and problems that bedevil the discipline while pressure on underwater archaeological resources continues to mount as more divers enter the water every year, beside urbanization and other intensive impact on heritage. The regional and international collaboration is today a widely excepted practice and approach an important factor for future research, common efforts for preservation of our common heritage and in the end this collective choice is explicitly expressed in the wording of many articles of international conventions, charters and recommendations.

REFERENCES

- ALBERTI, D. 1997, *Istria: storia, arte, cultura*. - Trieste.
- ANTONIOLI, F. ANZIDEI M., LAMBECK K., AURIEMMA R., GADDI D., FURLANI S., ORRU P., SOLINAS E., GASPARI A., KARINJA S., KOVAČIĆ V., SURACE L., 2007, Sea-level change during the Holocene in Sardinia and in the northeastern Adriatic (central Mediterranean Sea) from archaeological and geomorphological data. - *Quaternary Science Review*, 26, 2463-2486.
- AURIEMMA, R. 2004, I porti romani dell'Istria. - *L'archeologo subacqueo* 10/2, 8-14
- BAČIĆ, B., J. ŠTIRN 1963, *Antični brodolom v Savudriji*. - Arheološki muzej Istre in Center za podvodna raziskovanja SRS, Ljubljana.
- BENUSSI, B. 1927-1928, Dalle annotazioni di Alberto Puschi per la Carta archeologica dell'Istria. - *Archeografo Triestino* 3/14, 243-282.
- BOLTIN-TOME, E. 1975, Pregled dosedanjih hidroarheoloških raziskav ob slovenski istarski obali. - *Pitanja istraživanja i zaštite hidroarheoloških spomenika u podmorju istočne obale Jadrana*, 123-129, Split.
- BOLTIN-TOME, E. 1979, Slovenska Istra v antiki in njen gospodarski vzpon. - *Slovensko morje in zaledje* 2-3, 41-61.
- BOLTIN-TOME, E. 1986, Arheološke najdbe na morskem dnu Slovenske obale. - *Kronika* 37, 6-16.
- BOLTIN-TOME, E. 1991, Arheološke najdbe na kopnem in na morskem dnu v Viližanu in Simonovem zalivu v Izoli. - *Annales* 1/91, 51-58.
- COPPO, P., 1830, Del sito dell'Istria, 1540. - *Archeografo Triestino* 2, 26-44.
- GASPARI, A. 2005, Portorož - arheološko najdišče Fizine. - *Varstvo spomenikov* 39-41, 151-153.
- GASPARI, A., S. POGLAJEN, P. ČERČE, S. KARINJA, M. ERIČ 2006, Rimski pristaniški objekt z ribogojnico v Fizinah pri Portorožu. Poročilo o raziskavah podmorskega najdišča v letih 2004 in 2005 (Summary. Roman harbour complex with farm fishing infrastructure in Fizine near Portorož. Report on the research of the underwater site undertaken in the years 2004 and 2005). - *Annales. Series Historia et Sociologia* 16, 2, 421-442.
- GASPARI, A., S. KARINJA, M. STOKIN, M. ERIČ 2007a, Ankaran - arheološko najdišče Zaliv sv. Jerneja. - *Varstvo spomenikov* 43, 13, 14.
- GASPARI, A., V. VIDRIH PERKO, M. ŠTRAJHAR, I. LAZAR 2007b, Antični pristaniški kompleks v Fizinah pri Portorožu - zaščitne raziskave leta 1998 (Translation. The Roman port complex at Fizine near Portorož. Rescue excavations in 1998). - *Arheološki vestnik* 58, 167-218.
- HIGGINBOTHAM, J. 1997, *Piscinae. Artificial Fishponds in Roman Italy*. - Chapel Hill, London.
- KARINJA, S. 1997, Dve rimski pristanišči v Izoli (Riasunto. I due porti romani ad Isola). - *Arheološka istraživanja u Istri*, Izdanja Hrvatskog arheološkog društva 18, 177-192.
- KARINJA, S. 2002, Antična pristanišča ob Slovenski obali. - V: S. A. Hoyer (ur.), Zbornik. Kultura narodnostno mešanega ozemlja Slovenske Istre, Razprave Filozofske fakultete, 259-276, Ljubljana.
- KARINJA, S., P. ČERČE, Antique Port at the St Simon Bay at Izola. Rescue excavations of 1994. In: I. Radić Rossi, A. Gaspari, A. Pydyn (Eds), *Underwater archaeology: Past, Present, Future*, Proceedings of the Session at 13th Annual Meeting of the European Association of Archaeologists, Zadar, 18-23 September 2007, in print.
- KNIFIC, T. 1993, Arheološki pregled morskoga dna v Sloveniji (Sommario. Esame archeologico del fondo marino in Slovenia). - *Zbornik. Kultura narodnostno mešanega ozemlja slovenske Istre*, Razprave Filozofske fakultete, 13-27, Ljubljana.
- LOGAR, N. 1984, Podvodna arheologija v Sloveniji in njena problematika (Summary. Underwater archaeology and its problems). - *Podvodne raziskave v Sloveniji, Podvodna arheologija v Sloveniji* 2, 35-40.
- LOGAR, N., M. ŽUPANČIČ 1981, Ankaran. - *Varstvo spomenikov* 23, 299.
- LOGAR, N., M. ŽUPANČIČ 1982, Ankaran. - *Varstvo spomenikov* 24, 165.
- NOVŠAK, M., A. TRENZ, 2003. Školarice pri Sp. Škofijah. - In: B. Djurić (ed.), *Zemlja pod vašimi nogami*, 258, 259, Ljubljana.
- PERACCA, M. 1974, L'origine del nome di Muggia d'Istria. - *Borgolauro* I/1,
- PERACCA, M. 1975-1976, Nova epigrafe romana a Muggia d'Istria. - *Borgolauro* II-III/2-3, 3-19.
- POGLAJEN, S. 2008, Comparison between using a single-beam echosounder and a multi-beam echosounder in archaeological fieldwork. - In: V. I. Radić Rossi, A. Gaspari, A. Pydyn (Eds), *Underwater archaeology: Past, Present, Future*, Proceedings of the Session at 13th Annual Meeting of the European Association of Archaeologists, Zadar, 18-23 September 2007, in print.
- RAVNIK TOMAN, B. 1986, Jernejeva draga. - *Varstvo spomenikov* 28, 267, 268.
- ŠIFRER, M. 1965, Nova geomorfološka dognanja v Koprskem Primorju. - *Geografski zbornik* 9, 7-58.
- STOKIN, M. 1992, Naselbinski ostanki iz 1. st. pr. n. š. v Fornačah pri Piranu. - *Arheološki vestnik* 43, 79-92.
- STOKIN, M. 2006, Sermin. - *Varstvo spomenikov* 39-41, 10-12.
- TASSAUX, F., R. MATIJAŠIČ, V. KOVAČIĆ 2001, *Loron (Croatie). Und grand centre de production d'amphores à huile istriennes*. - Ausonius publications. Mémoires 6, Bordeaux.
- UHAČ, M. 2003, *Brodolom na rtu Savudrija* (Cape Savudrija shipwreck). - Graduate thesis at the University of Zadar, Zadar.
- ŽUPANČIČ, M. 1989, Prispevek k topografiji Miljskega polotoka (Sommario. Un apporto alla topografia della costa sulla penisola Muggesana). - *Kronika. Časopis za slovensko krajevno zgodovino* 37, 16-20.