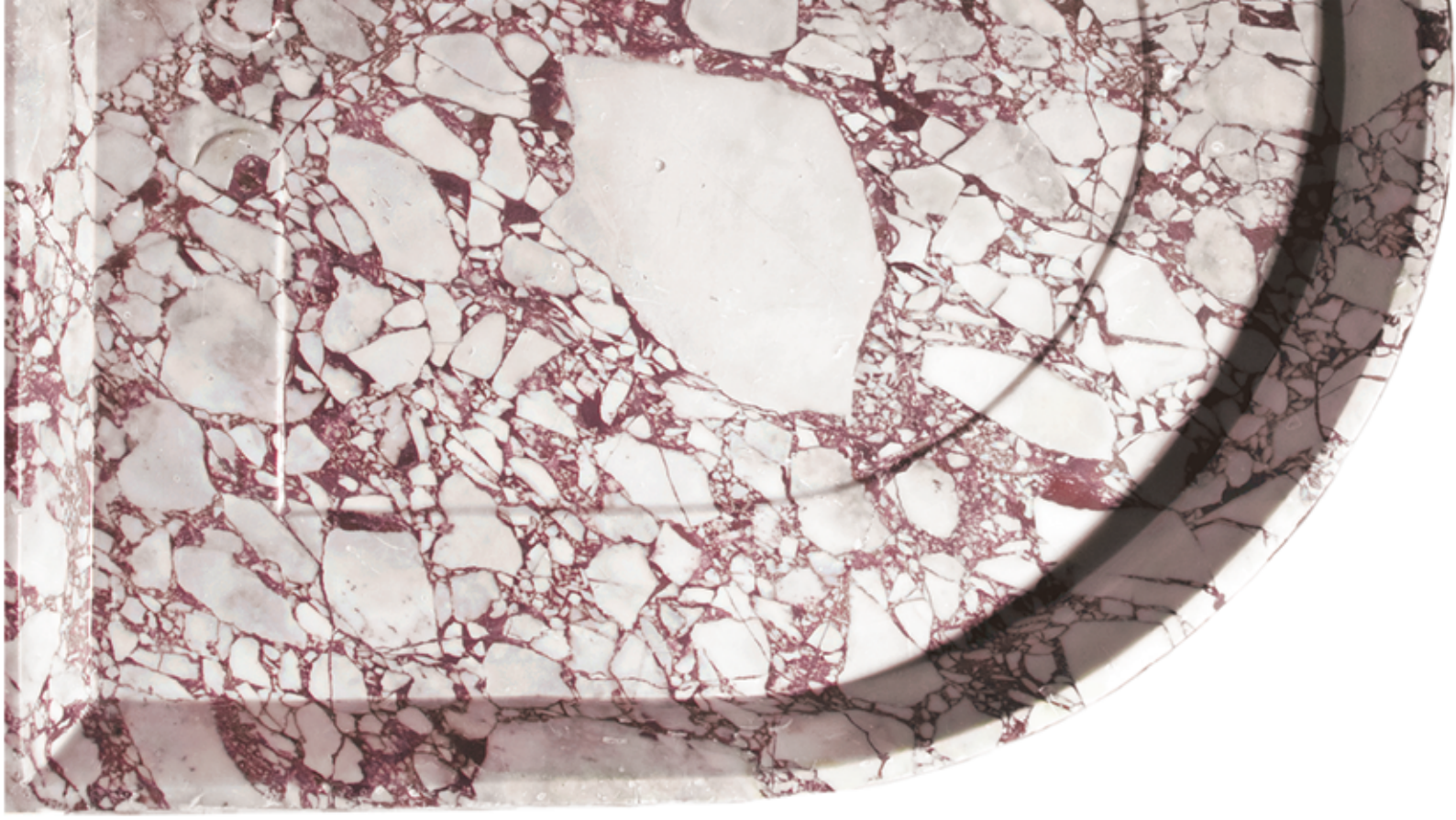
The Extraction and Use of Limestone in Istria in Antiquity

Buršić-Matijašić, Klara; Matijašić, Robert



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CONTENT

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THE EXTRACTION AND USE OF LIMESTONE IN ISTRIA IN ANTIQUITY

Klara Buršić-Matijašić and Robert Matijašić
Juraj Dobrila University of Pula, Pula, Croatia (kbursic@unipu.hr; rmatija@unipu.hr)

Abstract

Due to the presence of abundant and thick outcrops, several types of limestone were the main natural building materials until the emergence of modern technologies, and the quarrying of limestone was an important activity in Prehistory, Antiquity and the Middle Ages. The prehistoric population used stone blocks for building the drywall ramparts of the fortifications on hilltops. The Roman conquest in the 2nd century B.C., and particularly the establishment of the colonies in the mid-1st century B.C. prompted the introduction of new technologies of quarrying. Istrian limestone quickly established itself as an important building material and was transported by sea to centres along the north Adriatic coast. The stone blocks came from quarries along the coast, and could thus be transported by sea. Most of them bear traces of use in the Middle Ages, when historical sources confirm that Istrian limestone was extensively used in Venice and north Italian towns.

Keywords
Istria, limestone, quarry

The Istrian peninsula has been, owing to its geographical position, an ideal intersection between the Mediterranean and Central Europe, between the Dinaric Alps and the Northern Italian Plain, so that since prehistory, goods, people and ideas have circulated around and through it. But it is above all else the karstic nature of the Istrian environment that has deeply influenced the ways of life in the peninsula since the remotest times. Cretaceous limestone is the main geological substratum of the greater part of south and west Istria (Fig. 1),[1] and it did not affect only agriculture (as terra rossa is the main pedological feature)[2] and hydrology (lack of rivers and streams, reliance on ponds and rainwater for human supply; underground water flows),[3] but it was also the main building material since the earliest prehistoric and historical periods. In the Istrian Peninsula in the course of ancient times several types of limestone with different aspects (colour, compactness, composition etc.) and properties were exploited.

Karstic caverns and caves were inhabited by the earliest human groups,[4] while the first Neolithic villages in the open are poorly documented.[5] The few remains available to study, among which the site of Vižula near Medulin is the most important, show that the foundations of huts above the ground (there are no traces in Istria of pit houses) were built of roughly shaped stones as foundations, on which a construction of organic material (wood and straw) and clay was placed for walls and roofs.[6] Some caves continued however to be inhabited in the Neolithic, because they continued to offer a convenient shelter. In the bigger semi-caves the cattle could also be kept, and that was increasingly important with the development of agriculture and cattle-breeding.

The next radical cultural change documented archaeologically in Istria is the beginning of Bronze Age, with the arrival of new, more numerous human groups. Immigration profoundly changed the historical landscape of Istria, as settlements on hilltops began to appear, the *castellieri* (*gradine*), whose fortifications (the essence of their organization) had to be built largely of stone, with single buildings inside such a settlement covered with organic material (wood, twigs, branches and straw).[7] The use of hilltops for settlements continued after the Bronze Age, all through the Iron Age of Istria, i.e. until the Roman conquest (Fig. 2). More than 400 such sites have been identified,[8] but due to the erosion of

1 VLAHOVIĆ *et al.* 2005, 333-360.

2 BENAC, DURN 1997, 7-17; MERLAK 2014, 5-20.

3 BONACCI 1996, 45-56.

4 KOMŠO 2008, 60-72.

5 MIHOVILIĆ 1986, 49-50.

6 ZLATUNIĆ 2002, 38-48.

7 BURŠIĆ-MATIIJAŠIĆ 2012, 16-19.

8 BURŠIĆ-MATIJAŠIĆ 2007; MIHOVILIĆ 2013, 32-57.

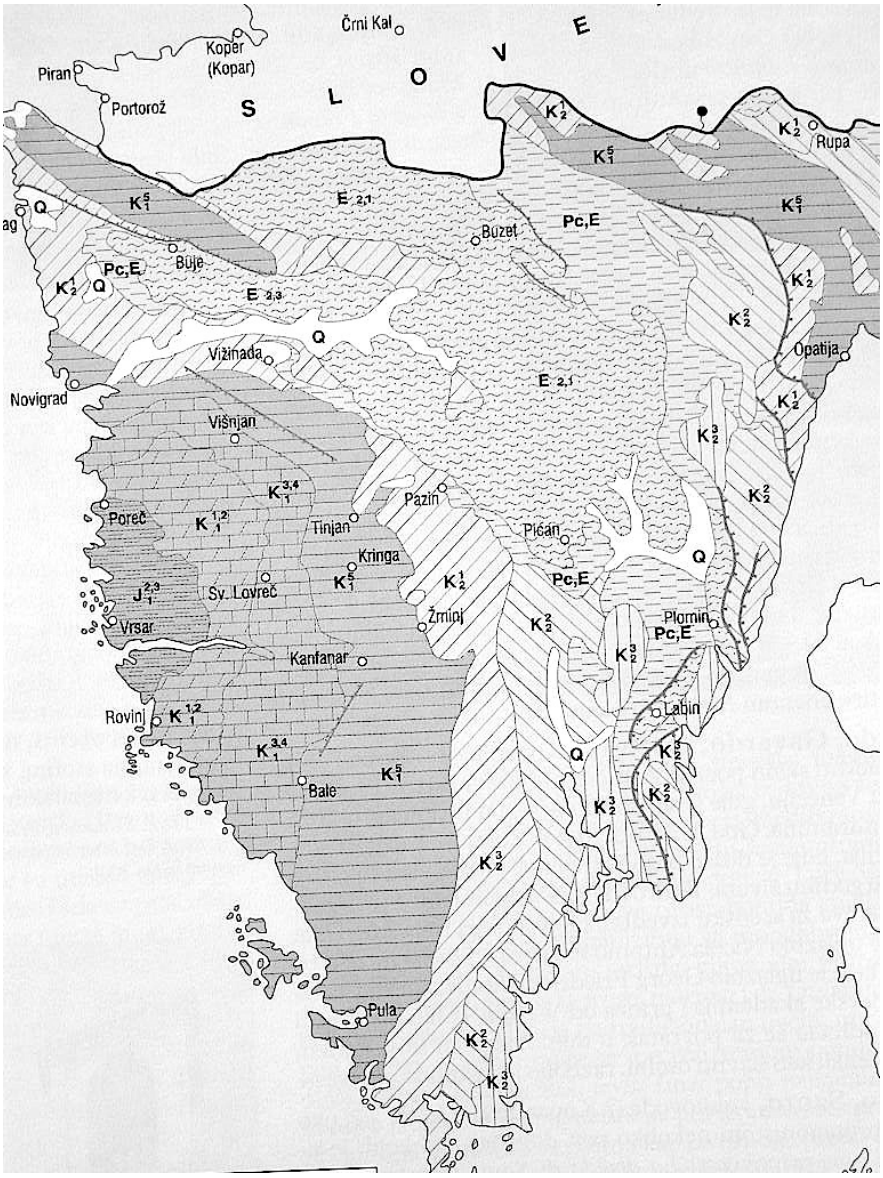

Fig. 1.
Geological map of Istria (adapted from CRNKOVIĆ 1981):
E – Eocene,
P –Palaeocene;
K – Cretaceous,
J – Jurassic

hilltops it is difficult to reconstruct an exact chronology of their use within that period, except in a few cases of better explored sites, such as Monkodonja near Rovinj.[9] Only in the Iron Age can we identify the ethnic name of the community living in Istria: the Histri gave the name to the peninsula, and they are mentioned by the earliest Greek written sources in the 6th-5th century B.C., such as Hecataeus of Miletus.

In the majority of cases the main source of stone was of course the hilltop itself. The builders did not have to go far, as they could easily use the limestone layers on the top of the hill, and so besides obtaining the necessary stones they also levelled the area protected by the walls. The ramparts were built in the dry-stone technique, using medium sized stones for the visible surfaces of the fortification wall, filling in the interior with small stones. Due to the dry-stone technique used, the prehistoric walls are generally preserved as heaps of stones, so that the lines of the walls are visible, but the structure has disintegrated. The stones were worked only very roughly, so that a very rustic *opus incertum* was the result.

Bigger blocks were used only in a few known cases in Istria, generally – it seems – in sacred and/or burial contexts (Sveti Anđeo, Karaštak), and they are also only roughly shaped. Only towards the end of prehistory, under the influence of Hellenistic architecture, known also from other sites along the eastern Adriatic coast (Osor, Asseria, Ošanići) do finely worked and arranged big stone blocks appear in the fortifications (*Nesactium*, Mutvoran, Plomin and some other). Stonecutting craftsmanship was anyway needed throughout the prehistoric period for the slabs used to form tombs for the deposition of the body (in the Bronze Age) or cinerary urn (in the Iron Age),

9 HÄNSEL *et al.* 2015.

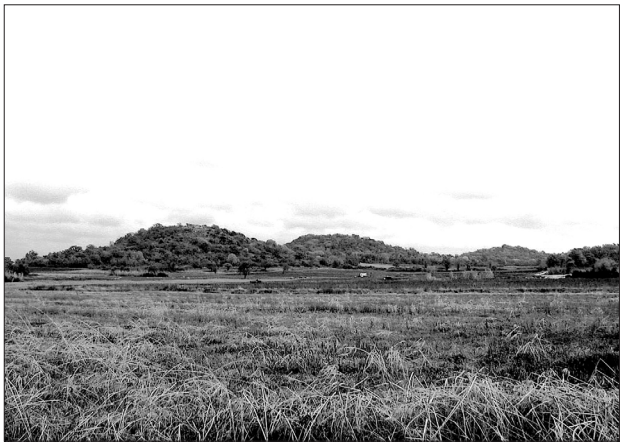

Fig. 2. The three Picugi hilltops, from the west

Fig. 3. Horseman, with naked woman nursing a child, from Nesactium (from MIHOVILIĆ 2013, 332-333)

but decoration is generally absent, as the tomb itself was covered with a heap of small rough stones.

The only Istrian examples of possible prehistoric funerary stone monuments come from *Nesactium*, where fragments of 6th century B.C. sculptures may belong to the decoration of tombs: slabs with spirals and meanders, a block with a roughly shaped figure of a naked woman nursing a child on the front and the figure of a horseman (Fig. 3). There is also a series of fragments of kouros-like sculptures. This group of sculptures was once dated to the 12th century B.C., but its belonging to the 6th century[10] is today generally accepted. They were however found within the ruins of the Roman period walls, so that their original position and use cannot be established. The stone came from a nearby quarry of excellent limestone (Marčana), which was also used in Roman and modern times.

The use of stone in prehistory was thus quite extensive, but we cannot speak of quarrying in the full sense of the word. Stones were collected from the surface, with only limited digging, and only where suitable layers of limestone were visible and at hand. We cannot deny that the Histri had the ability to work the stone in more sophisticated ways as well, but there are no traces of prehistoric extraction of stone blocks in sites where ancient quarrying activity can be presumed. Of course, the main reason might be the fact that Roman quarrying has obliterated the remains of earlier traces, just as early modern and modern exploitation of stone layers has destroyed traces of Roman use.

Nevertheless, Roman age quarrying is much more visible, although chiefly along the coast, where marine erosion maintains a clean profile. There are at least 20 sites along the coast, from Premantura to the mouth of the Mirna, where traces of ancient quarrying are evident, although there can be no absolute certainty that all of those belong to Roman times and not to the medieval and/or early modern period.[11] There are two obvious reasons why Roman quarries are known almost only from the coast. One is that those in the interior are difficult to identify today because of soil sediments and vegetation. The other is that it was most convenient, given the ancient transportation technology level, to load the stone blocks directly onto the ships or barges, so most quarries were along the coast. Having them pulled by oxen on wood sleds along a road, which also had to be prepared, was time- and energy-consuming so that other good reasons had to exist, such as for example the exceptional quality of the stone. The quality of Istrian limestone was almost uniform in western and southern Istria, there were no deposits of marble or other types of stone, so that the dependence on coastal sites is understandable.

There are only a handful of sites with traces of quarrying in Roman times away from the sea. The quarry on the western slopes of the Draga near Marčana, away from the coast, can be explained by the vicinity of *Nesactium* (3 km as the crow flies), and the need to provide good quality stone for the prehistoric sculptures of *Nesactium*, and for the decorations of Roman buildings in the ancient town. The quarry was last used at the beginning of the 20th century, but – interestingly – there are plans to reopen it. Nearer to Pula, on the slopes of the hill of San Daniele (Šandalja), about 3.5 km east of the Roman colony of *Pola*, there are, in a quarry that is still in use, the remains of unfinished stone blocks, and there are clear traces of ancient extraction visible on the walls of the quarry. An exception that proves that quarries were active on a smaller scale also in the interior for practical purposes, is the site of Skačota (Skvačota, Squaciotta), a small hill about 6 km from the sea, halfway between Bale (Valle) and Golaš, where there are clear traces of the

10 FISCHER 1986.

11 MATIJAŠIĆ 1998, 395-401.

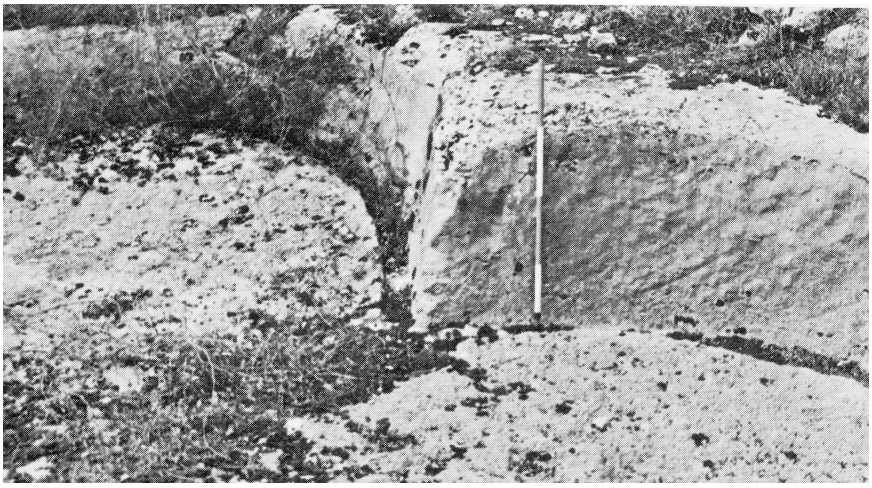

Fig. 4.
Skačota near Bale / Valle, negative imprints of two extracted stone blocks (from MARUŠIĆ 1990, 415)

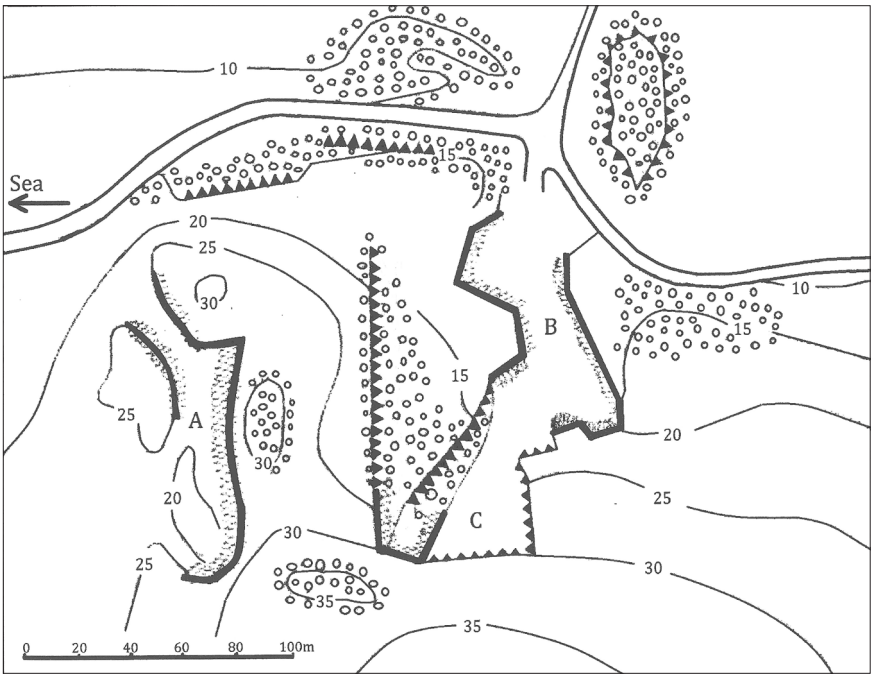

Fig. 5. Topographical sketch of the Vinkuran quarry, the bold black line indicates the surfaces quarried in Antiquity (adapted from CRNKOVIĆ 1991)

extraction of round shaped blocks (Fig. 4) which were used for the manufacture of stone vessels used in the production of olive oil for the decantation of the freshly pressed juice.[12] The dimensions of the negative imprints of the two extracted stone blocks whose shape is visible today (diameter 2 m, height 75 cm) correspond to such vessels, or to the bases of olive-mills, for even millstones were made of limestone, and have been found in a number of Roman rural sites with production facilities.[13] Given the considerable distance to the coast (almost 6 km), it was probably used for local purposes, for supplying stone blocks to nearby estates. The local production of these vessels and other stone components of oil and wine presses is of course logical: they would not have been carried from far away. Cato the Elder, in his treatise on agriculture in the 2nd century B.C., suggested that the transport of a millstone 10-20 km could add up to 40% to the purchase price, while moving it up to 100 km could add 70% to the original price.[14] It is obvious that, given the geological conditions, a lot of small quarries would exist in the territory, for extracting stone for local use.

The most interesting, famous and monumental ancient quarry is that near Vinkuran, about 3.5 km south of Pula, but 1 km from a bay that could have been used for loading ships and barges. The interesting thing is that it is known locally as Cave Romane (Roman quarries), a name which stems from the correct popular tradition

12 MARUŠIĆ 1990, 415.

13 MATIJAŠIĆ 1998, 151-219.

14 *Cato*, *Agr.*, 22, 3-4.

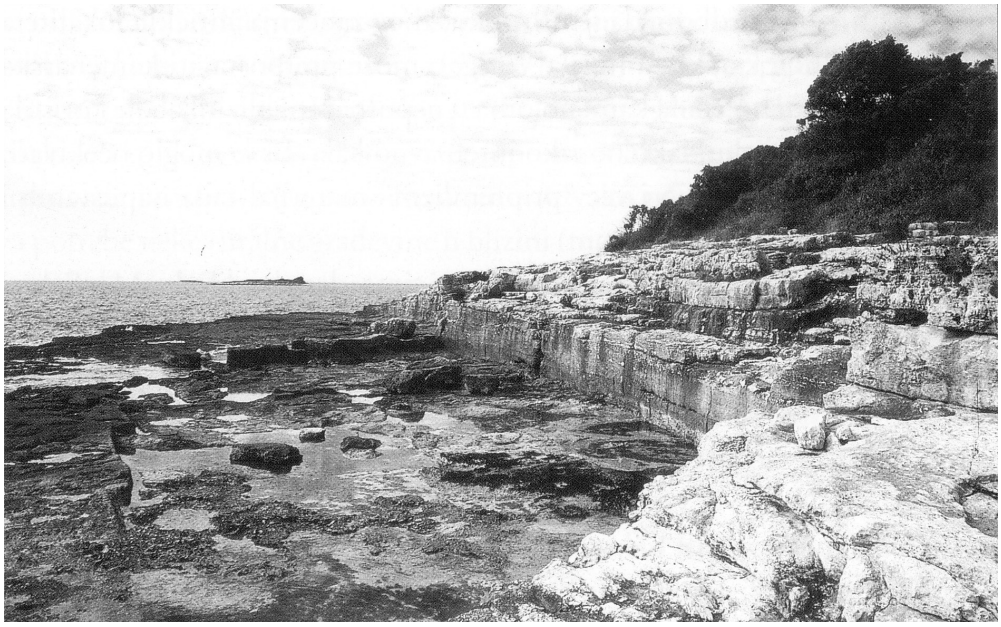

Fig. 6.
Remains of an ancient quarry in San Polo Bay near Rovinj (MATIJAŠIĆ 1998, 397)

that it was used in Roman times. It is believed that the Pula Amphitheatre was built of stone blocks from this quarry.[15] Of course, most other ancient buildings in Pula were built with this stone.[16] The effort needed to transport the blocks to the sea was compensated by the exceptional quality of the stone. The site was used in the Middle Ages and in modern times until recently, and it certainly was one of the most important Istrian quarries (Fig. 6). High on the face of the cut there are traces of ancient exploitation, but it is since been excavated down to the level of the base of the hill.

An abandoned quarry near the village of Banjole, not far from Vinkuran, is situated on a hill directly above the sea.[17] It was used in Roman times, as confirmed by finds of unfinwished monumental blocks, of a small female head and recently of a yet unpublished female sculpture in full size. Both were discarded during the process of carving, so they remained among the rubble. The quarry has been used in medieval times, but all the quarries around Pula were extensively used also by Austrian builders of military fortifications between 1856 and 1914, so that they added to the disfiguration of ancient traces.[18] The same is true for the quarries on the island of Brijuni, exploited in antiquity, in the Middle Ages and in the early modern period, until in the 19th century two big forts and some smaller ones were also built of stone from the same quarry.

Along the coast, there are several smaller quarries, which were used as long as they could yield sufficient material, and then abandoned. Such sites are known in southern Istria, around Premantura (Porto Rosso, Pomerski školjić and Ližnjan along the southernmost tip of Istria).[19] The specialists in stone extraction were looking for sites with sufficiently thick, solid and compact layers of limestone, and such places were easily visible on the coast line. One such example can still be seen, in the Bay of St. Paul (San Polo), south of Rovinj, where it can be seen that the extraction was abandoned as the interesting layer was exhausted, and the quarry was not enlarged towards the interior (Fig. 6).[20]

The area between Rovinj and Poreč, where the limestone is of Jurassic origin, was also extensively exploited for quarrying in antiquity. Besides San Polo, four other ancient quarries are located around Rovinj (Montauro, Monte delle Arni, Valsaline, Santa Eufemia near Rovinj),[21] three around Vrsar (Montraker, Monte Ricco and San Giorgio),[22] and three around Poreč (Sveti Nikola, Vabriga and Tarska vala).[23] Traditionally it was believed that the monolithic stone that covers the Mausoleum of the Ostrogothic king Theodoric in Ravenna (300 tons) came from Istria, and it was thought that the quarry was one near Poreč (Sveti Nikola),[24]

15 CRNKOVIĆ 1991.

16 FISCHER 1996; LETZNER 2005.

17 ŠONJE 1980, 151.

18 BEGOVIĆ, SCHRUNK 2007, 147-154.

19 MATIJAŠIĆ 1998, 395-397.

20 MATIJAŠIĆ 1998, 397.

21 MATIJAŠIĆ 1998, 397-398.

22 MATIJAŠIĆ 1998, 399.

23 MATIJAŠIĆ 1998, 399.

24 ŠONJE 1980, 153.

but recent laboratory analysis definitely proved that it was from Aurisina near Trieste that the stone came from.[25]

The Istrian limestone is of very good quality, and we know from medieval and early modern sources that stone was extracted for buildings in Venice, where most decorative artwork is of Istrian white limestone,[26] and in other North Italian towns, like Rimini, Ravenna, Palmanova, Padua, Ancona, Loreto and Fermo, where it is known as "pietra d'Istria" (Istrian stone).

Today the Istrian limestone, extracted from four main quarries (Kanfanar, Selina, Kirmenjak and Valtura) is still exported mainly for building purposes, in a continuity that has persisted since Roman times, although adapted to new requirements and means of transport.

25 LAZZARINI 1981; BEVILACQUA, FABBRI, GRILLINI 2003, 572-580, see also the recent PREVIATO 2015, 415-445.

26 LAZZARINI 2008; LAZZARINI 2012.

BIBLIOGRAPHY

BEGOVIĆ V., SCHRUNK I. 2007: The Brioni Islands. Past, Architecture and Cultural Heritage, Zagreb.

BEVILACQUA F., FABBRI R., GRILLINI G. C. 2003: "Il mausoleo di Teodorico. La pietra di Aurisina. Tecniche e strumenti di lavorazione", in F. LENZI (ed.): L'archeologia dell'Adriatico dalla preistoria al medioevo. Atti del convegno internazionale, Ravenna 7 - 8 - 9 giugno 2001, Firenze, 572-580.

BENAC Č., DURN G. 1997: "Terra rossa in the Kvarner area. Geomorfological conditions of formation", Acta Geographica Croatica 32, 7-17.

BONACCI O. 1996: "Hydrology of the Gradole Karst Spring (Istria – Croatia)", Acta Karstologica 25, 45-56.

BURŠIĆ-MATIJAŠIĆ K. 2007: Gradine Istre – povijest prije povijesti, Pula.

BURŠIĆ-MATIJAŠIĆ K. 2012: "Neki aspekti naselja i nastambi u Istri u prapovijesti (Alcuni aspetti degli insediamenti e delle abitazioni in Istria durante la preistoria)", Tabula 10, 7-38.

CRNKOVIĆ B. 1981: "Geološka građa Istre", Liburnijske teme 4, 34-62.

CRNKOVIĆ B. 1991: "The origin of the dimension stone of the Arena in Pula", Rudarsko-geološko-naftni zbornik 3, 63-67.

FISCHER G. 1996: Das römische Pola. Eine archäologische Stadtgeschichte, Bayerische Akademie der Wissenschaften, Philosophisch-historische Klasse, Abhandlungen, Neue Folge, Heft 110, München.

FISCHER J. 1986: "Die vorrömischen Skulpturen von Nesactium", Hamburger Beiträge zur Archäologie 11, 9-98.

HÄNSEL B., MIHOVILIĆ K., TERŽAN B. 2015: Monkodonja. Istraživanje protourbanog naselja brončanog doba Istre, Knjiga 1. Iskopavanje i nalazi građevina / Forschungen zu einer protourbanen Siedlung der Bronzezeit Istriens, Teil 1, Die Grabung und der Baubefund, Monografije i katalozi 25, Pula.

KOMŠO D. 2006: "Mezolitik u Hrvatskoj / The Mesolithic in Croatia", Opuscula Archaeologica 30, 55-91.

LAZZARINI L. 1981: "I materiali lapidei delle vere da pozzo di Venezia e la loro conservazione", in A. RIZZI (ed.): Vere da pozzo di Venezia, Venezia, 371-377.

LAZZARINI L. 2008: "Pietra d'Istria: uso, genesi, proprietà, cavatura e forme di deterioramente della pietra di Venezia", Terra Histria 9, 2008, 7-43.

LAZZARINI L. 2012: "Pietra d'Istria: Quarries, characterisation, deterioration of the stone of Venice", 12th International Congress on the Deterioration and Conservation of Stone, Columbia University, New York, http://iscs.icomos.org/pdf-files/NewYorkConf/lazzarin.pdf (accessed 21. 5. 2016).

LETZNER W. 2005: Das römische Pula. Bilder einer Stadt in Istrien, Zaberns Bildbände zur Archäologie, Mainz.

MARUŠIĆ B. 1990: "Še o istrski Kisi (Cissa) in kesenskem škofu (Episcopus Cessensis) (Noch einiges über das istrische Cissa und das kessensche bistum (Episcopatus Cessensis)", Arheološki vestnik 41, 403-429.

MATIJAŠIĆ R. 1998: Gospodarstvo antičke Istre, arheološki ostaci kao izvori za poznavanje društveno-gospodarskih odnosa u Istri u antici (I. st. pr. Kr – III. st. posl. Kr.) (Storia economica dell'Istria antica; Die Wirtschaftliche Istriens in der Antike; The Economic History of Istria in Antiquity), Pula.

MERLAK E. 2014: "Una bibliografia selezionata delle bauxiti carsiche e terre rosse (Carso classico italiano, Slovenia, Croazia, Paesi dell'ex Yugoslavia, Albania, Ungheria, Romania)", Atti dei Musei Civici di Storia Naturale di Trieste 57, 5-20.

MIHOVILIĆ K. 1986: "Pregled prahistorije Isgtre od starijeg neolitika do početka romanizacije (Considerazioni sulla preistoria dell'Istria dal primo periodo neolitico all'inizio della romanizzazione)", in V. JURKIĆ (ed.): Arheološka istraživanja u Istri i Hrvatskom primorju, Pula, 49-63.

MIHOVILIĆ K. 2013: Histri u Istri. Željezno doba Istre / Gli Istri in Istria. L'età del ferro in Istria / The Histri in Istria. The Iron Age in Istria, Katalozi i monografije 23, Pula.

PREVIATO C. 2015: Aquileia. Materiali, forme e sistemi costruttivi dall'età repubblicana alla tarda età imepriale, Padova.

ŠONJE A. 1980: "Iz kojeg istarskog kamena potječe kupola Teodorikova mauzoleja u Ravenni (…)", in M. SUIĆ, M. ZANINOVIĆ (eds.): Materijali, tehnike, strukture predantičkog i antičkog graditeljstva na istočnom jadranskom prostoru, Zagreb, 149-159.

VLAHOVIĆ I., TIŠLJAR J., VELIĆ I., MATIČEC D. 2005: "Evolution of the Adriatic Carbonate Platform: Palaeogeography, main events and depositional dynamics", Palaeography, Palaeoclimatology, Palaeoecology 220, 333-360.

ZLATUNIĆ R. 2002: "Arheološka interpretacija i rekonstrukcija načina života u neolitičkom razdoblju Istre (Archaeological interpretation and reconstruction of the way of life in the Neolithic period of Istria)", Histria Archaeologica 33, 3-141.