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## Investigation Architecture and Environmental Planning in Prehistory for Designing an Ecologically Sustainable Tourist Resort

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### Abstract

Lepenski Vir is an archaeological site of extraordinary international significance; an area where exceptional culture and specific art, which took place within organized social and religious life, emerged as unique in Central and South-Eastern Europe (6800-5400 BC, according to the date C14). The methods and complexity of the architecture of these buildings, their sustainability and energy efficiency, as well as the treatment of the associated monumental sculptures, clearly define the stages of settlement over a period of at least two thousand years. Today, it is even possible to say that people in those ancient times were even more instructed in the issues of nature and her whimsicality than we are today. Today, the site is in a natural reserve in an extremely picturesque landscape. During the archaeological excavations of the 1960s, seven prehistoric settlements were unearthed, one after the other. These settlements contain the remains of 67 apparently planned dwellings, fireplaces, tools, instruments, and jewellery. The settlements also contain altars and sculptures, carved out of round limestone pieces that are of artistic and aesthetic, as well as ritual and symbolic importance. The paper elaborates on the harmony of architectural style and natural surroundings that has been considered since the earliest times. Its aim is to analyse Lepenski Vir, one of the most significant archaeological sites in the world, i.e., the technique and the conditions under which it was created. However, as the reality of the subject is quite elusive in today's time, this paper seeks to show the value of the principles on which ancient architecture rests, primarily using natural materials and specific simple forms in design and construction. The reason for this is the inextricable link between man and nature at all times, the very essence of their interconnectedness, as well as the creation of a healthy, aesthetically valuable, and quality living space. Based on these analyses, one specific conceptual solution will be attached, i.e., the proposal of a contemporary interpretation of the ancient Lepenski Vir settlement and houses that can meet the needs of modern man and age, where millennia-old tradition is implemented in contemporary Serbian architecture.

*Keywords:* Development; Further Use; Ancient Techniques; Nature; Time; Archaeology; Sustainability; Energy Efficiency; Tourism.

### 1. Introduction

Lepenski Vir and Vinča, both along the Danube River in Serbia, are just two of the many old European archaeological settlements found in recent history. Many archaeologists think that the meaning of prehistoric art, letters, signs, and religion is not possible to puzzle out. Nonetheless, the new evidence has fundamentally altered scientific perspectives on the European Mesolithic and Neolithic nations, their achievements, knowledge, religion, and

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lives. It seems that what we call "Old Lady Europe" is old, and many scientists believe that Old Europe was the place where the first phonetic letters, metallurgy, and many other skills appeared, not Mesopotamia, in the Near East. It is of central importance for the whole of Europe, and for Serbia in particular, that the writing system found in Vinča had at its disposal the entire corpus of 210 characters, of which about one third were symbols and were used throughout Europe. Similar signs were found around the Tisa River in Hungary, north-western Bulgaria, and Transylvania in Romania, and the assumption that they arrived from the Sumerian letter was wrong.

A calibrated radiocarbon chronology shows that this writing system appeared in the first half of the 6th millennium BC and that it was used without interruption for 2000 years. Of great significance is the fact that this writing system is several thousand years older than the Sumerian, Cretan, Cypriot-Minoan, and others that are known to us.

The Danube Valley civilization is one of the oldest civilizations in Europe. It existed from between 5,500 and 3,500 BC in the Balkans and covered a vast area, from present Macedonia to Slovakia (south to north), and Istria to the Danube Delta (west to east) (Figures 1 and 2). During the height of the Danube Valley civilization, it played an important role in south-eastern Europe through the development of copper tools, a writing system, advanced architecture, including two-story houses, and the construction of furniture, such as chairs and tables, all of which occurred while most of Europe was in the middle of the Stone Age. They developed skills such as spinning, weaving, leather processing, clothes manufacturing, and manipulated wood, clay, and stone; they invented the wheel. Of course, they had an economic, religious, and social structure.



Figure 1. Map of the Balkan regional groups in the 5<sup>th</sup> millennium BC [1].

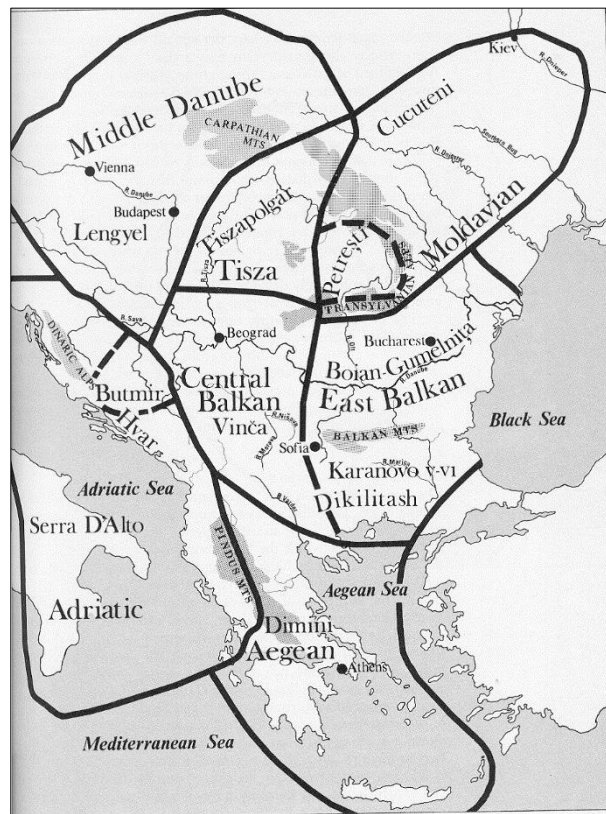


Figure 2. Map of Neolithic complexes on the Balkan Peninsula in the 7<sup>th</sup> and 6<sup>th</sup> millennium BC, and Map of the Balkan regional groups in the 5<sup>th</sup> millennium BC [1].

One of the more intriguing and hotly debated aspects of the Danube Valley civilization is their supposed written language. While some archaeologists have maintained that the writing is actually just a series of geometric figures and symbols (Figure 3), others have maintained that it has the features of a true writing system [2]. Second, which is actually very obvious, if this theory is correct, it would make the script the oldest written language ever found, predating the Sumerian writings in Mesopotamia and possibly even the wooden Dispilio Tablet, found near Castoria in north-west Greece, which has been dated 5260 BC.



Figures 3. Danube Valley civilization artifacts [2]

Harald Haarmann, a German linguistic and cultural scientist, currently vice-president of the Institute of Archaeomatology in Sebastopol, California, and leading specialist in ancient scripts and ancient languages, firmly supports the view that the Danube script is the oldest writing in the world. The tablets that were found are dated to 5,500 BC, and the glyphs on the tablets, according to Haarmann, are a form of language yet to be deciphered. The symbols, which are also called Vinča symbols (Figure 4), have been found in multiple archaeological sites throughout the Danube Valley areas, inscribed on pottery, figurines, spindles, and other clay artifacts.

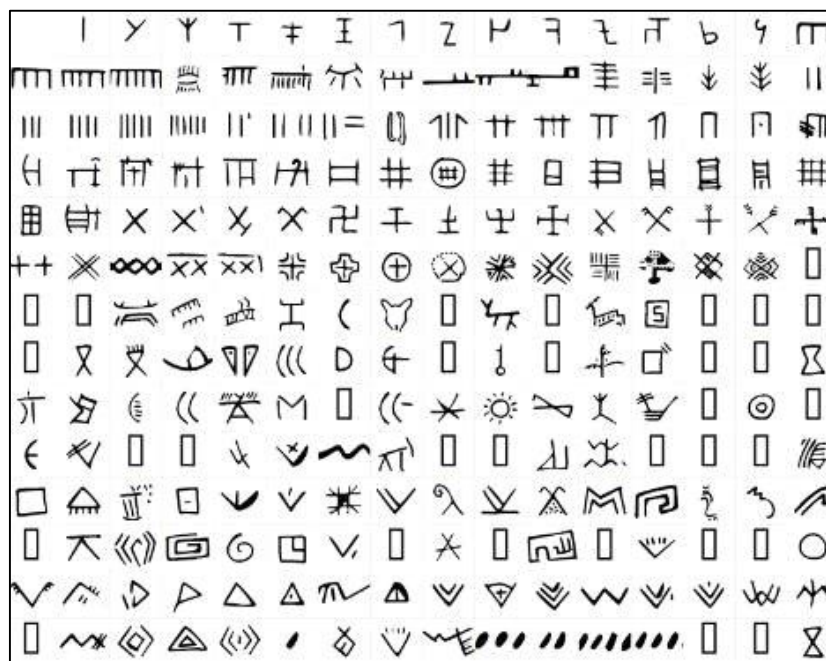


Figure 4. The Vinča Symbols [2]

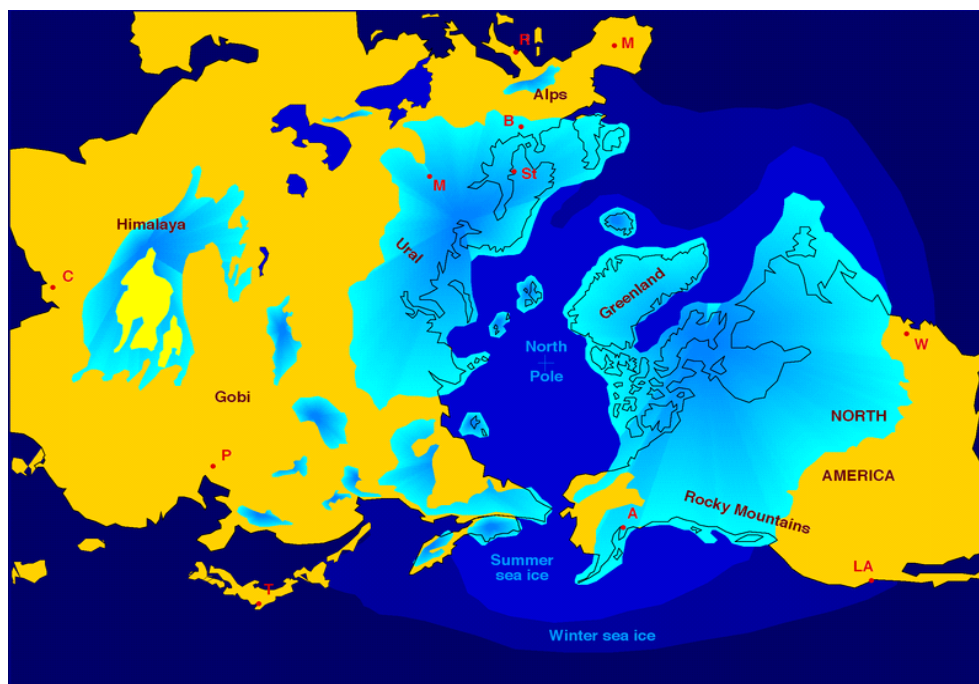
The implications are huge. It could mean that the Danube Valley Civilization predates all other known civilizations today. Evidence also comes from thousands of artifacts that have been found, such as the odd-looking figures displayed here, pretty like Greek-Cycladic sculpture but most probably older. However, most of the scholars in Mesopotamian history reject Haarmann’s proposal, superficially suggesting that the symbols on the tablets are just decoration. This is even though there are approximately 700 different characters, around the same number of symbols used in Egyptian hieroglyphs. Other scholars even suggested that the Danube Civilization must have copied signs and symbols from the Mesopotamian civilizations, even though some of the Danube tablets have been found to be older than the Mesopotamian ones.

It appears that this is another case of a theory based on solid research being outright rejected without appropriate consideration. Could this be because it conflicts with the accepted view of which nation holds claim to the ‘first civilization’? At the very least, Haarmann’s proposal deserves further research and serious analysis to confirm whether this is indeed the oldest known written language in the world.

This oldest European letter did not disappear at the time of the disintegration of the Vinča culture, around 4300-4000 BC, as Dispilio Tablet shows, in as much as Phoenician and subsequent Greek Alphabets. Etruscans used very similar writing system. Scientists believe that the horsemen tribes from the steppe of southern Russia reached into these parts of Danube Valley and destroyed the Vinča and Karanovo culture in present-day Bulgaria. The peoples of the Balkans then became part of the Indo-European language world, and the old culture survived only in the Aegean region, being clearly a successor of its ancestors from Vinča, who inherited achievements of the people of Lepenski Vir.

## 2. Nature, Time, and People

Lepenski Vir is a prehistoric archaeological site and settlement in the Danube region, in the Balkans, in South-East Europe, which got its name by a large vortex, a whirlpool very convenient for fishing nets, in that part of the great river Danube (Figure 5). It is one of several settlements in the Iron Gate, in the middle of the 130 km long Đerdap Gorge, located on a subterranean terrace between the banks of the river and the steep slopes of the Koršo Mountain. Now very well known for its sculptures, architecture, and graves, it was fully discovered in the 1960s on the right, Serbian side of the Danube River, 15 km upstream from Donji Milanovac and about 160 km downstream of Belgrade, since the Romanian and the Yugoslav authorities started construction of the hydroelectric power plant and dam Đerdap I, in the Đerdap Gorge, at the Iron Gate [3]. Settlements belong to the Mesolithic and early Neolithic culture, that is to the middle and younger Stone Age, and there were between 9500 BC and 6200 BC, when melting of ice began in the glaciers, which until then covered a large part of the northern Earth's hemisphere. They are located in open locations, not as shelters in the walls. Contrary to usual understanding in science, at that time young teaching assistant in the Department of Archaeology at the Faculty of Philosophy in Belgrade Dragoslav Srejović was not the one who discovered and first performed the excavation of Lepenski Vir. Traces of Neolithic settlement near the village of Lepena were found in fact five years before Srejović's excavations [4, 5].



**Figure 5. The Last Ice Age, completed 10,000 years ago, precisely at the time of the birth of Lepenski Vir culture**

Archaeologist's diary of Obrad Kujović, that time researcher at Archaeological Institute of the Serbian Academy of Science and Arts, whose documentation is now inherited by architect Hristivoje Pavlović, confirms exactly this truth about one of the most important world prehistoric sites. Namely, in Kujović's daily from the scouting of the right bank of the Danube River at Đerdap Gorge, on August 30, 1960, he and the then final year student of the Faculty of Architecture in Belgrade Ivica Kostić near the village of Lepena first discovered the traces of Neolithic settlement. This was also confirmed by Dr Dušanka Vučković Todorović from the Archaeological Institute, who in due time led the first phase of the research of Lepenski Vir. Exploring the terrain from the town of Donji Milanovac to the village Dobra, they discovered the Neolithic settlement Lepenski Vir. When they returned from Lepenski Vir and showed at the Archaeological Institute their own sketches of a new site, ceramic pieces and films, this discovery was recorded in the Diary of Archaeological Research of this Institute as part of the Starčevo culture, named after a village in South Banat nearby Belgrade. Few years after discovery made by Kujović, Srejović begun to excavate and scientifically process the same site, all but entirely based on the data obtained from Kujović (Figures 6 and 7).

The site was then called the Lepenski Vir. It turned out that just about 8,000 years ago its inhabitants performed a "Neolithic Revolution", created the first European architecture and urbanism, the first European monumental art, performed the division of labour, and tamed the first domestic animals and plants. Lepenski Vir was and remains evidence that European civilization was born in the Danube bay in Đerdap Gorge. This true event of Kujović's discovery in 1960 was then followed by the official untrue version, still prevalent today, according to which Dragoslav Srejšević discovered this extraordinary prehistoric settlement in 1965, and then, after unusually short time, he himself excavated the remains of incredible civilization. He was subsequently unethically starved into a star, in fact completely unjustified, because he who discovered this archaeological site was not him, but for five years before him it was archaeologist Obrad Kujović.

### Danube River Basin



Figure 6. The Danube River Basin, with the Pannonia Plain at its centre, whose climate and relief were unfavourable for the development of culture, under the influence of cold from the north during the Ice Age 10000 years ago. At the transition between the yellow-green and the bright green circle, the culture of Lepenski Vir was created. On this part of the stream, the river was calm, and considerably warmer than in the north, where its tributaries were cold rivers from the Tatras and the Carpathian Mountains.



Figure 7. The Danube River Basin in Europe. The relief of the area with the forested hills and mountains mitigates cold winds. Within the Carpathian Mountains, evidence of Neolithic culture has been found. The most logical place for the emergence of this culture is Lepenski Vir, whose position on the Danube's middle waterway during the Ice Age was optimal for expansion, with numerous tributaries coming from the Carpathians. The river is water. Water means life. In addition to the river, the land is usually fertile, the power of the river can be used for watermills, and there are also shops for trade among peoples.

Đerdap Gorge has specific microclimate conditions. A stable climate preserved and developed an old-age culture in the post-Pleistocene period. Lepenski Vir is located on the steep slope of the Koršo hill facing the river and eastern sun. The Đerdap region is exposed to steppe climate from the east and continental climate from the west [6]. Precipitation is there uniform, passages between the seasons are moderate, and there are four seasons, no strong winds and extreme temperature variations (Figure 8).

The people of Lepenski Vir lived in almost ideal conditions during this time: close to the river and surrounded by diverse vegetation, scattered forests, with walnut, sweet berry, which made it easier to survive in that area and created the opportunity for gathering and fishing. Lepenski Vir is in the middle of the forest and along the coast of the Danube, which is very steep. It is possible to walk along the water, but only when the water level is low. The first inhabitants probably did not have the need to go and wander far from that place. At their isolated place they developed their own culture and architecture [7].

The harmony between ambient and architectural forms in Lepenski Vir was achieved, however, by means of measures and proportions that are not found anywhere in nature. The architecture of Lepenski Vir has something markedly mathematical, that is, in all its forms, the presence of specific lengths and certain numbers is felt. Architectural forms are blatant with numbers, but the basic unit of measure cannot be translated into the language of our mathematics. It is not a certain number, nor an anthropological measure, and although the module is certainly obtained by a rational process, it nevertheless acts as a mystical size by which all the microcosm and all the macrocosm of the ancient culture, art, and architecture of Lepenski Vir are built.



Figure 8. The physical map of Serbia showing major geographical features like elevations, mountain ranges, seas, lakes, plateaus, peninsulas, rivers, plains, landforms and other topographic features (Source: Ezilon Maps, <https://www.ezilon.com/maps/europe/serbia-physical-maps.html>).

On both banks of the Danube River there were many settlements, based on hunting, fishing and food collection. The accumulation lake should have been created in the Đerdap Gorge and archaeologists intensified their archaeological research from the 1960s to the late 1970s. The Romanian coast was already under water in 1968, so the Yugoslav-Serbian side intensified its archaeological work. Scientists have therefore decided that the entire settlement of Lepenski Vir, estimated to be 8,000 years old, be moved to a high location and the Lepenski Vir Museum built. The construction of the dam originally found the rest was sunk, the Danube level was raised about 12 meters, while the current location was moved from the original by about 150 m, but the original settlement setting was kept. After two campaigns in the 1970s, Padina A was discovered (the radiometric date is about 9300 BC) and the excavation started at Vlašac. Archaeologists discovered Schela Cladovei on the Romanian side in 1971, and much more (Figure 9 to 11) [8].

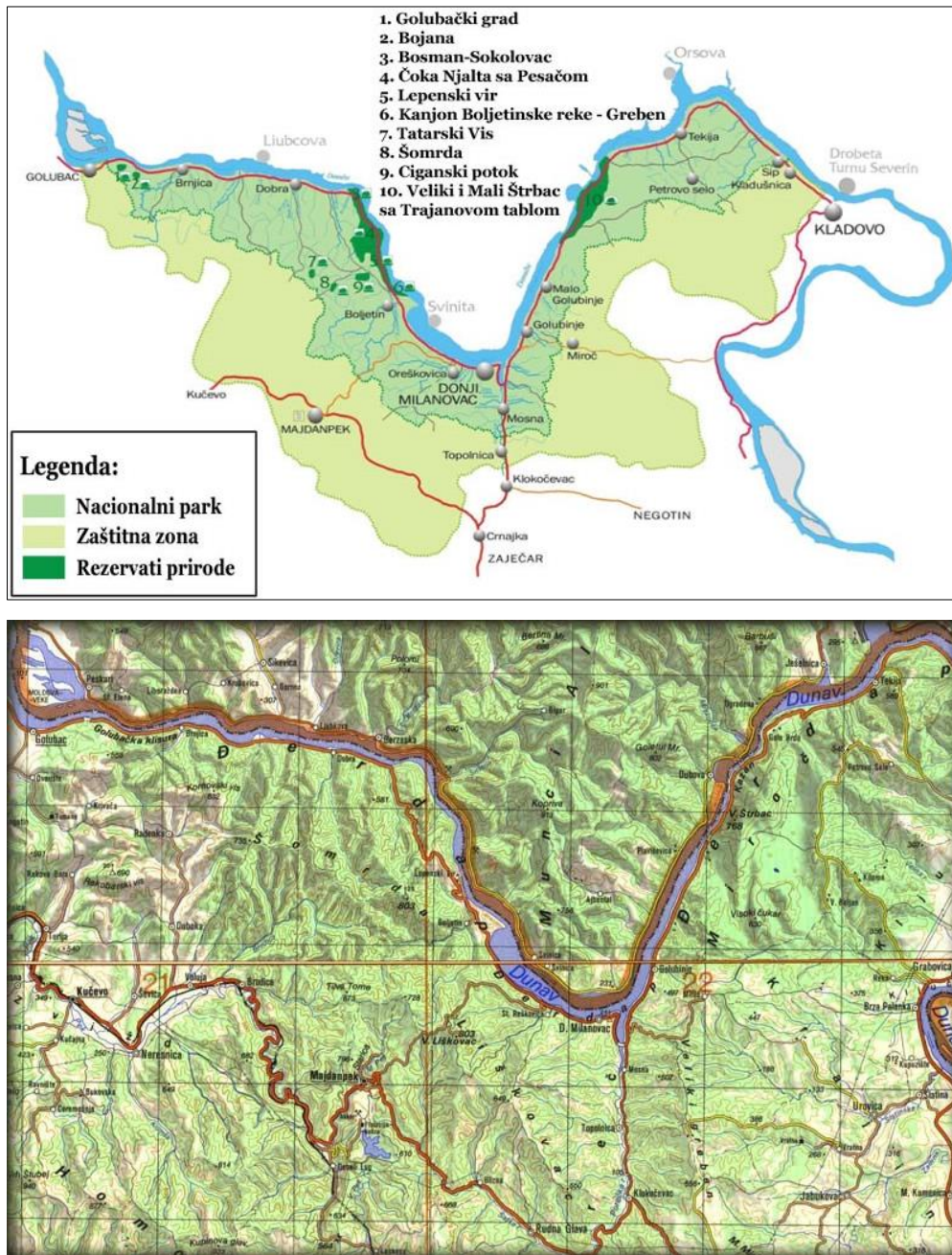


Figure 9. Location of the archaeological site and tourist settlement Lepenski Vir in the mountainous region of eastern Serbia placed on the banks of the Danube and the border with Romania 120 km east of Belgrade by air. The Đerdap Gorge consists of several distinct parts, with the extended parts regularly reappearing downstream, where the Danube is several kilometres wide, and the narrowing parts where there is less than 500m between two shores. Lepenski Vir is located at the place where the river is very narrow, about 600m. By the river, next to the site, the main road 34 leads, as well as the European mountaineering route E4. These modern roads certainly existed as logical connections even 8000 years ago, when the Lepenski Vir man just built a settlement here, and then in the time of the Romans (today's Dobra village, once the town of Gratiana, is listed as one of the towns on the Roman road Via Militaris). Circles on the map show the site and the proposal of the location of the new tourist resort.

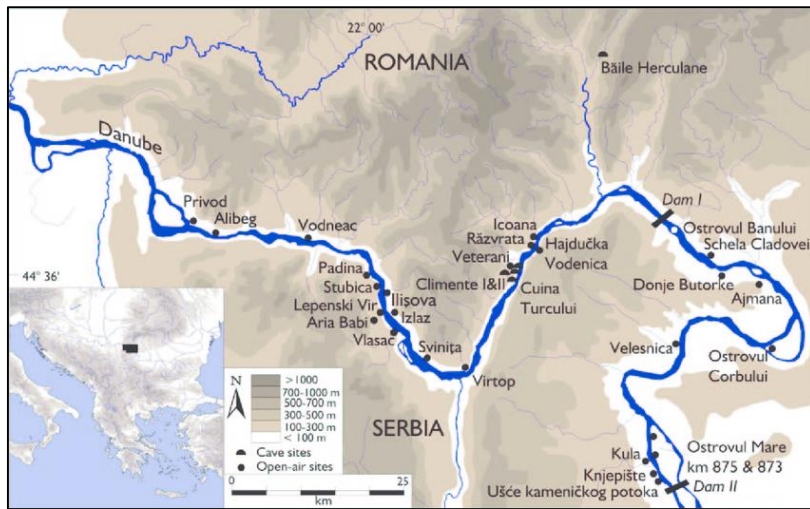


Figure 10. A map that best illustrates how water flows have had a decisive influence on the development of human settlements and more permanent character settlements. Even today, nomadic tribes, whenever possible, move during the migration along the river. All the sites on this map are on the bank of the strong river, Danube, and Lepenski Vir is slightly more upstream, which could have more easily impacted its downstream neighbours.

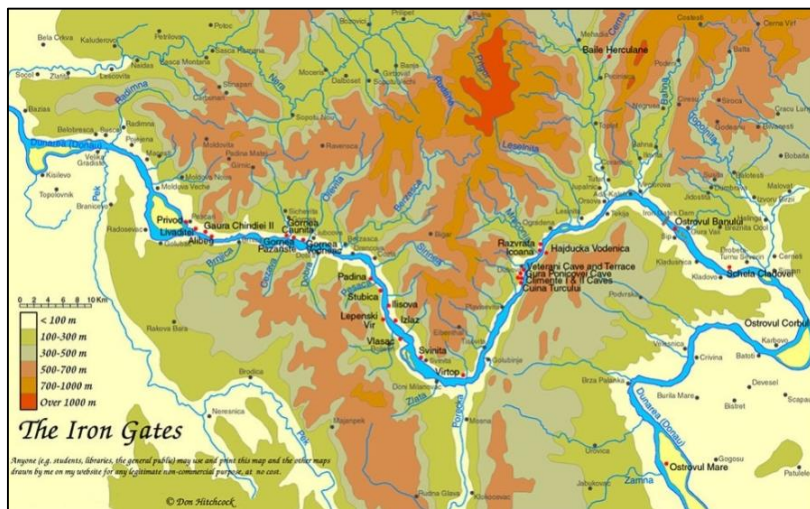


Figure 11. Places of Culture of Lepenski Vir

Some of the settlements in the area are older than Lepenski Vir itself, such as Cuina Turcului I, in Romania. These settlements, according to radiometric dating [9] from 12600 + -129 BP, are about the same years back [10]. Not far from the remote Neolithic archaeological site of Vinča from the 6th millennium BC, upstream the Danube in Serbia, in a more fertile area, along with Lepenski Vir, Padina and the Romanian archaeological site Cuina Turcului I, all of them belong to Starčevo group, named so by the place on the opposite the Danube coast in relation to Vinča, in Banat, and all developed and expanded in a common configuration [11].

Research in the last few decades in Southeast Europe has changed the perceptions of so-called hunting-gathering societies in Europe and pointed to the earliest evidence of food production in that part of Europe in the 7th millennium BC. Lepenski Vir and Vinča are just two of the many sites discovered in the last few decades. Some of the discovered settlements are very old and have been created in the Palaeolithic and the final part of the Pleistocene [12], such as Cuina Turcului I Climente I and II, all discovered in the Iron Gate.

The growth of the population has fuelled cultural development and social stratification. There is some evidence of the existence of two different ways of business, two different economies, in the old-fashioned complex during the same time of 7500-6500 BC. Iron Gate was the place of exchange between the hunter-gathering population and the more advanced food producers known as Starčevo culture. There is evidence of socio-cultural practice, construction of houses, warehouses of food and preparation of food. The Mesolithic society in South East Europe had three components: a sedentary lifestyle, food storage and exchange [13]. Researchers and interpreters of this culture have responded to many questions about old European history in a non-traditional way. By finding new evidence, the scientists opened a new discussion of the period they know relatively little about.



The settlement and architecture of Lepenski Vir cover a limited area of about 2000 m<sup>2</sup> and about 85 dwellings, i.e., houses. The inhabitants raised their villages on the river terraces. All houses are built of stone and it can be noticed that they have been renovated, rebuilt, or increased from time to time. Villagers built floors on solid ground so that every house was inhabited for a long time and was used by many subsequent generations. The prehistoric settlement was built on the sunny side of the Danube River, between the steep fallen mountains of Koršo and the line of the spring's highest water level of the great river on low porphyry walls that descend all the way to the Danube. The dwellings discovered are known for trapezoidal houses, which had one of the first types of concrete, as their foundations (Figures 12 and 13).

Since the trapezoidal shape was most probably taken for construction to provide more sunlight and fresh air inside the dwellings open to the river Danube and the East, the contours of the foundations were marked at once, by setting the boundary of broken stone. Thus, the openings are set up for the roof beams again on the edges of the foundation, but the stone slabs that are edged and reinforced always set horizontally, not vertically. The position and shape of the hearth remain the same, and the stone vessel is in its usual place. The structure of the hearth, however, is in the scale of 1:3, or in the scale of 1:2, and the stone vessels have become broad and heavy. Some walls carry traces of secondary, hydrothermal pigments that are different from burning traces. The mounds were processed by striking the surface around pre-designed ornamental and figurative motifs. Additionally, the red pigment booms appear.

The form of architecture and methods of building these dwellings was genuine and shows something completely new. These stone houses are of a trapezoidal shape, or as "a form of a circular chisel with opposing sides at an angle of 60 degrees [14]. This form is clearly defensive and completely closed, but not geometrically rigid. It seemed to be changing, and the houses were twisted or tapered within a large circle design, like a fan" [15]. The culture, art and religion of Lepenski Vir belong to the ancient culture of the central Balkans and the lower Danube basin [16, 17]. The artists of Lepenski Vir made decorated sculptures and figural sculptures of a fishing shape. The material for that was the special stone available in that area [18].

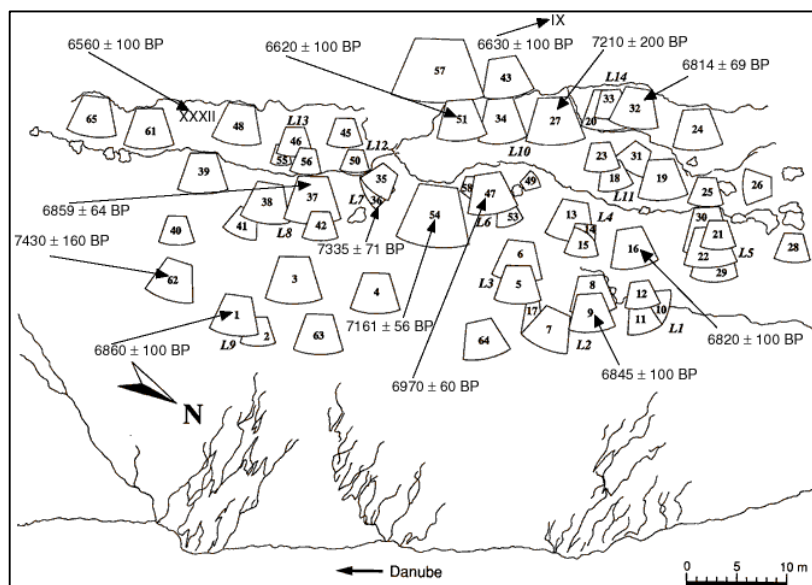


Figure 12. Arrangement of dwellings in Lepenski Vir I [19]



Figure 13. Lepenski Vir Ib with the presentation of the layout of the dwellings and their bases and purposes. Significant dwelling No. 54 was painted red, dwelling No. 28, "the sanctuary under the walls", was painted yellow, dwelling No. 26 which is oriented north south is coloured blue, dwelling No. 45, for which an altar carved in the shape of a fish, between the centre and the stone table, is painted green, and dwelling No. 61, which had its grave in its frame, it was painted brown. Two pink coloured areas may have been intended for trade, or public ceremonies. They are both on the main passages and they are easily connected in one.

It seems that the fish played an important role in the religious life of the people of Lepenski Vir. Almost all sculptures are either sculptures of fish, or they are sculptures of people with facial characteristics like fish. This also speaks about the importance of fish in the economic life of people. Lepenski Vir is ideal for catching fish. The legendary sturgeon and catfish provided an enormous amount of food for those who could catch it in the Danube whirlpool nearby just below the settlement and take it to the coast. Many species of smaller fish were available nearby in the river too, whose catch could provide normal nutrition and a valuable protein, with the minimum experience needed to bring all catch by hook, net, or traps to the coast (Figure 14).

People in Lepenski Vir had their own domestic animals: cattle, sheep, pigs and dogs. There were also many wild animals nearby: buffalo, red deer, deer, wild boar, wild asses, wild cats, martens, badgers, brown bears, wolves, foxes, beavers, brown bunnies, and birds. Skeletons and many fragments were found in this area, and within sanctuaries, bones of large fish, dogs, deer, and another were found [20]. This proves that the people of Lepenski Vir spent their funeral rituals, and some scholars believe that the very location of Lepenski Vir was the sacred place for burial, as there were found 170 skeletons and fragments (Figure 15) [21].



Figure 14. The front of the sanctuary dwelling No. XLIV (Lepenski Vir I) with sculptures of the Danube and a typical, iconic sculpture from Lepenski Vir [22]

The economy of Lepenski Vir was based on fishing and gathering, but the inhabitants exchanged their goods with neighbouring cultures [23]. They traded with cultures in Bosnia, on the Dalmatian coast, in the area around the Tisa River in what is now Hungary, and even in Sardinia over the Adriatic, Ionian and Tyrrhenian Seas. The main object of the exchange was the Aegean shells used to produce necklaces, beads and rings [24].

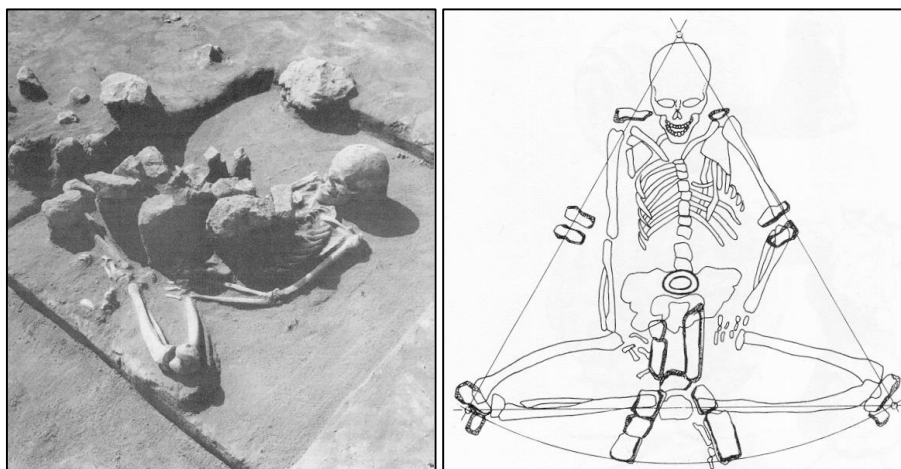


Figure 15. Skeleton located in the triangular shape on Lepenski Vir I. [19]

When Starčevo culture expanded other cultures, like Vinča, were developed. Before the Lepenski Vir and settlements in the Iron Gate were found, the scientists believed that Vinča was one of the oldest inhabited places in Southeast Europe but finding a settlement in the Iron Gate drastically changed this attitude. The function of the

sanctuary on Lepenski Vir is a question for many scientists. Its inhabitants use to simply bury their dead under their own place of residence. But many scientists believe that it was a sanctuary that served other purposes, and believe that the egalitarian community has already been in the process of disappearance among individual households [25]. Some authors believe that the sculptures were of religious significance to the population [14]. The graves and sanctuaries were triangles and skeletons were found on a triangular red lime mortar [26].

### 3. Sustainable Energy Efficient Settlement and Dwellings in Prehistory

Lepenski Vir is very well known for its unique architectural design and preserved settlements and dwellings [26]. If analysed in the light of several natural (meteorological, geographic, astronomical and vegetation) characteristics of the environment, and if we have in mind the consumption of energy for heating and ventilating these dwellings, or if we take into account their thermal comfort, we can easily conclude that their builders paid special attention to the energy efficiency of their buildings even while they were designed (Figures 16 and 17) [27-32].



**Figure 16. A view just across the Danube to the top Treskavac from Lepenski Vir settlement**

Builders' procedures for improving energy efficiency are still clearly visible and noticeable in the dwellings of the prehistoric settlement Lepenski Vir. They are the clear remains of very proper energy efficient architecture. Considering their time, the technology they had at their disposal, and contributing to the longevity of the settlement itself, these builders' dwellings were sustainable and energy efficient [33]. Their designers had, it is quite clear, a complete awareness of what we today call sustainability, energy efficiency, bioclimatic architecture, heating, cooling, ventilation, solar energy, and compactness.



**Figure 17. Đerdap Gorge on the Danube River**

Bioclimatic architecture is a new discipline in architecture, yet it still has a Millennia long tradition that connects it to this subject [34, 35]. It should provide answers to questions about the site of urban planning and design of the construction in relation to climatic factors, as follows: what is the optimal location and orientation for the building, what are the favourable and unfavourable climatic factors, how can they be adapted to the design and construction in the optimal way, and vice versa, and last but not least how to improve the microclimate around and inside the building. These questions are strongly posed before the present builder too. The architect should be sure that his project will provide the correct answer to these questions by adjusting the house to climate factors (such as outside temperature, solar radiation, wind speed and direction, humidity, etc.) and vegetation in the environment (vegetation has a very significant impact on every microclimate). Such a project ensures a comfortable intrusion and save energy from fossil fuels needed to meet such conditions. It should include renewable energy sources. And the sun's energy was certainly the first and foremost renewable energy source used in prehistoric times too. A recent flourishing of solar architecture design occurred only after the excavation of Lepenski Vir in the mid-1970s, following the energy crisis and the so-called "petrol stroke" [36]. This is why the aspect of passive solar heating was not considered at a time when Lepenski Vir was excavated. It was still simply out of anyone's sight at the time. Only bases of dwellings, made of hardened material that resembles concrete, are preserved. Fireplaces were connected to the bases at the entrance, as an active heating system. The third dimension was most probably constructed of less durable materials that disappeared in time (such as wood, leather, mud) and was not preserved. We can only assume how exactly these dwellings looked like (Figures 18 and 19).



Figure 18. Lepenski Vir terrace above the Danube, originally, before immersion, during excavation on the spot [22]



Figure 19. An overview of how life in Lepenski Vir was once looking like, apparently different than in a tourist resort as shown here at the end of this paper, with new technologies and materials, along with building machines. Perhaps, if they could, the inhabitants of Lepenski Vir also made bigger houses for themselves, but the technologies, materials and structures available at the time did not have the capacity to enable so. The project of the tourist village for 21st Century is an improvement, but not a change in the true essence. What could be improved, it was improved, but every time needs its art, and its own architecture.

The architecture is characterized by the dwelling with the basics shaped in the form of a cut of the circle cut off from the top, with a convex side facing the river, i.e., rising sun. The back side of the dwelling is much smaller, while the front side is shaped like a circular arch. The sides are shrivelled [25]. The fireplace made of stone blocks, in the direction of the coast-hinterland, is located at the entrance of the dwelling. We can see that the fireplace at the entrance

is located for the same reason from which today we are positioning the radiators under the windows (Figures 20 to 22).

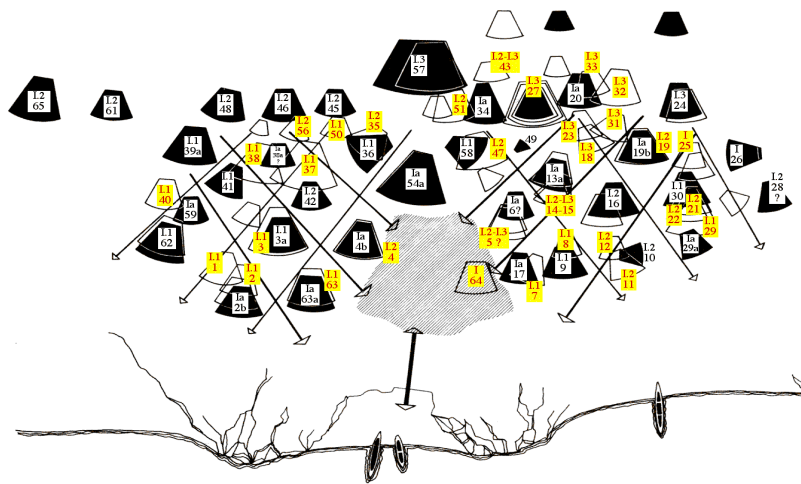


Figure 20. The basic flows of communication in Lepenski Vir, as an excellent proof that urban planning is a science that is much older than it is usually considered. From the time of its creation, man constantly tries to ease everyday life. The best way to provide yourself and the offspring with everything you need is to settle down in a favourable place. And that means near food, for hunting and gathering, far from possible attackers, other hostile tribes, and dangerous animals. At the same time, care should be taken of weather conditions, that they are not too harsh, neither the passionate winter nor the overly dry summer. If there is no room and no disposal is just a natural cave or similar, then we are satisfied with what we have. If we find a suitable place that has all the present capacities and at the same time enough space for our construction, then we begin to apply the knowledge which we can shortly call - urbanism. The planned construction starts. First, the most suitable spaces are taken and those that can be easily reached. It is possible to provide facilities near the coast, or on an elevated surface and the like. Here we can see that our ancestors greatly watched everyone have some good conditions. Everyone was connected by footed streets. Everyone had their privacy as much as possible. It was planned for the benefit of all, those who first built their houses and those that will come later.

Many, including Srejović himself, wondered how this dwelling looked like in the area. Some wondered what the purpose of such a construction was, and why these dwellings were built exactly in that way. The answer to the second question can be found even without the correct answer to the first. The purpose is obvious: to achieve comfortable living conditions within the natural environment. Reconstruction of the house was tried by Predrag Ristić, Hristivoje Pavlović, Dušan Borić and others. During wintertime, in the architecture of Lepenski Vir, very clear principles for reducing heat transfer by direct contact and ventilation were applied. The first of these principles is compactness. Significant is the interrelation between the dimensions of the structure itself, that is, the surface of its shell and the extent of its base. If the shell of the building is compact, the heat transfer is less. The best in this sense would of course be a ball-shaped form.

In Lepenski Vir we only know the basics of the dwelling, so we need to have a relationship between the wrap and the volume, to make an analogy to the third dimension of it. The best energy efficient geometric body in two dimensions is of course a circle. For dwellings in Lepenski Vir, a roller with an adjusted base may be somewhere in the middle of its compactness, since the ball would be clearly the most favourable three-dimensional solution, and the semi-circle and the cube are less favourable. The shape of many buildings today is much less favourable in this sense than the cube, let alone the ball.

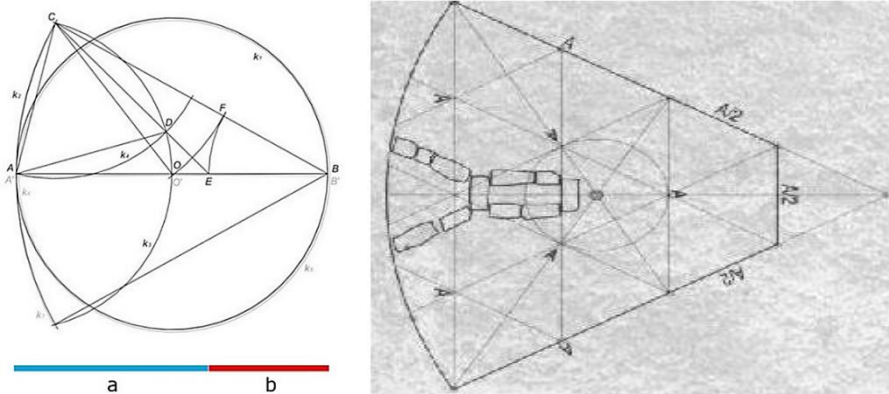


Figure 21. The Euclidean method, the golden-cross section, and the geometric analysis of the foundation of the Lepenski Vir dwelling, as a matter of fact, by no means an interesting coincidence [19]

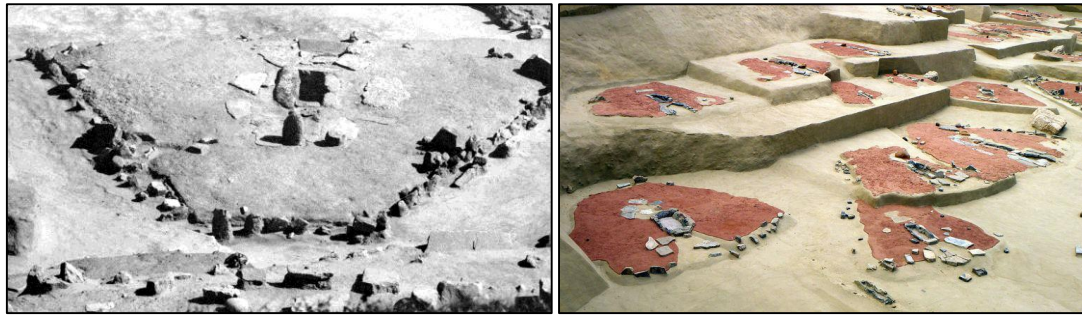


Figure 22. Plan of the constructive base of a typical dwelling in Lepenski Vir. The modularity of the building is very easy to see. It significantly simplifies construction for builders and greatly shortens the time needed for this. The most characteristic thing in this drawing is the incitement of two opposing walls. Namely, to be as simple as possible, one should have as few walls as possible, and here are only two walls in question. They cut at an angle of 60 degrees. The cross-section of these two walls at a sharp angle is difficult and impractical to perform, especially because this side of the building is buried. The entrance is the only open part on the building and accordingly, it is difficult to completely isolate the house. As light and heat enter the house with the sun, it is best to leave the entrance open to the river and to the light. And in order to increase the space as much as possible, both physically and psychologically, a semi-circular wall was introduced beside fireplaces, an incredibly simple and fantastic practical solution.

The basics of dwellings in Lepenski Vir are very compact. They are a combination of trapezoidal and circular chisels. The extent of this or similar figure is smaller than the extent of the square. Heat transfer and losses are substantially less with this type. If the roller with optimized bases of dwellings in Lepenski Vir is compared to the cube, it saves 5-7% of the energy in the transfer of heat energy if we calculate the orientation of the dwellings. So, this type of habitation in Lepenski Vir is very favourable in the light of passive solar architecture. Another principle for reducing the heat transfer in Lepenski Vir is the orientation of the dwellings. The advantages of these asymmetric or eccentric shapes are clearly demonstrated if a suitable orientation is applied. The orientation of the dwellings in Lepenski Vir is mainly towards the east and towards the river, which is east of the settlement. Orientation of the construction to the south at a given location steep to the east was not favourable. Due to the soil configuration and the hills in the background, the location was mostly exposed to the sun in the morning, facing the river. The third principle of reducing heat transfer is the use of solar energy for better thermal insulation. The materials used to build the shells were all from the natural environment. And the materials applied to the "walls" were mostly wood, leather, mud, and the like. All these materials lose their thermo-insulating properties under the influence of moisture. Atmospheric humidity in the Đerdap Gorge is 20% higher than in the surrounding areas. The drying of sagging walls in the sun improves the thermal characteristics and increases the degree of isolation. Thus, losses in the transfer of heat energy reduce and even disappear (Figures 23 and 24).

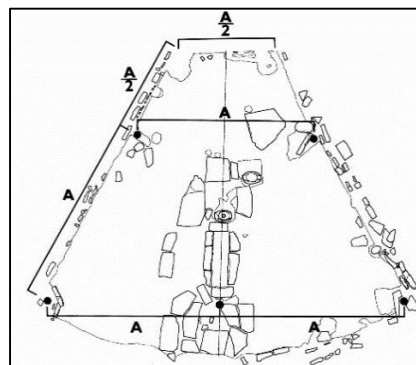


Figure 23. The foundation of the building, with clearly visible walls: two walls at an angle of 60 degrees are cut in advance and one semi-circular. It is simple in every sense [37]

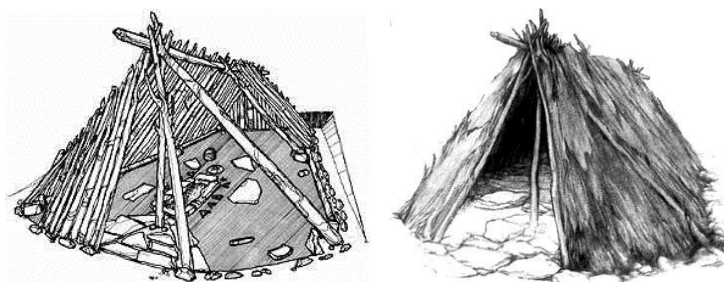
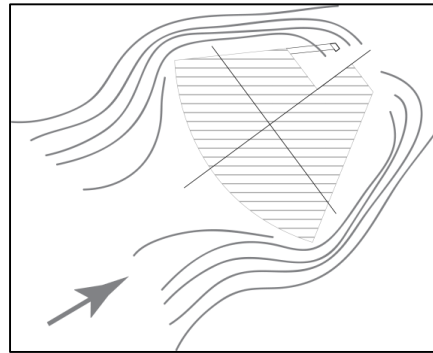


Figure 24. Two similar reconstructions of the house in Lepenski Vir [37]

To reduce heat loss through ventilation, two principles in Lepenski Vir act together: aerodynamic shape and suitable orientation. It can be assumed that the settlement was exposed to winds that were blowing from the river, as vegetation and steep background reduce the possibility of wind blowing from other directions. The shape of the base is also very favourable from the perspective of ventilation losses, as it allows natural circulation with small falls and pressure differences and allows the maintenance of a favourable internal temperature. Clearly remarkable here is the aerodynamic shape of the base, otherwise much better than, for example, a square or a cube.

Aerodynamic shapes reduce the penetration of outer air into the interior of the building. This reduces the air circulation to the interior, and the heat exchange with the environment is reduced. Disposition of airborne vents (windows) is not known, which is why the calculation of heat losses is not possible. Massive losses in ventilation are reduced by using the base in a favourable aerodynamic shape with suitable orientation. Wind gusts are diminished by curving the front side (Figure 25).



**Figure 25. Circulation - aerodynamic form of the optimized base of the dwelling in Lepenski Vir**

The losses in the transfer of heat energy are reduced by the compactness of the shell, by drying up the walls and by improving the thermal insulation properties of materials used for walls using solar radiation, which is the reason why the most favourable orientation to the east and river is used.

The third principle for reducing heat loss by ventilation is the wrapping of walls with earth. It is known that the soil has better thermal characteristics than ambient air. The burial was also used to protect from the wind. The back of the dwelling was dug up due to the soil configuration and to protect it from the wind. The burial height was between 80 and 100 cm. In some places, such a construction served as a support wall. The settlement was terraced. Ventilation losses were reduced by favourable aerodynamic shape, orientation, and burial. During the summer too, such architecture could provide comfortable living conditions, primarily in relation to cooling. Microclimate benefits are primarily used by location selection. The steep background in the west casts a shadow on the village afternoon. This reduces the effect of summer heat. The heat load is highest in the afternoon, due to the common effects of high outdoor temperature and solar radiation. The choice of location, with all its microclimate benefits, was very important. In Đerdap Gorge, the temperature is 2-3 °C cooler in July, while in January it is about 1 °C warmer than in neighbouring areas. The need for cooling in summer is reduced by choosing a favourable location and orienting and utilizing vegetation in the environment. The additional cooling was achieved by a simple solution: splashing the walls and floors with fresh water to evaporate there, thus lowering the temperature, just like we are doing today.

Yet some secondary principles of energy efficiency are clearly visible in Lepenski Vir. Minimalization of heat transfer and ventilation losses in winter and reduction of heat influences in summer were achieved by using primarily appropriate orientation towards the east and towards the river, which resulted from the configuration of the terrain itself.

Excavations were also carried out at the location of Padina - Gospodin Vir (Lady's Vortex), but they remained obscured by discoveries in Lepenski Vir (Figure 26). This archaeological site too, about 6 km upstream from Lepenski Vir, has remained submerged by an artificial lake. The "production" of energy (gains in heat and light energy from solar radiation) and the need for energy (the walls are mostly dried in the morning after dew) is well-established, which reflects in the choice of location. Morning temperatures are less than the outside temperatures during the day, resulting in the need for heating the highest in the morning. The outdoor daily temperatures are the lowest before sunrise. The layout of the habitation and entire settlements is determined primarily by the prevailing orientation of the dwelling to the east and the river. It is also located on the western, Serbian side of Đerdap, with natural conditions very similar to those in Lepenski Vir. The found remains of architecture are like those in Lepenski Vir, but they differ in some detail. Excavations were conducted by academician Borislav Jovanovic, before the site was flooded. Clearly, the architecture of Lepenski Vir did not appear middle of nowhere, because similar remains of dwellings were found in Lepenski Vir and in Padina - Gospodin Vir, a submerged location nearby, with similar microclimate conditions (Figure 27).

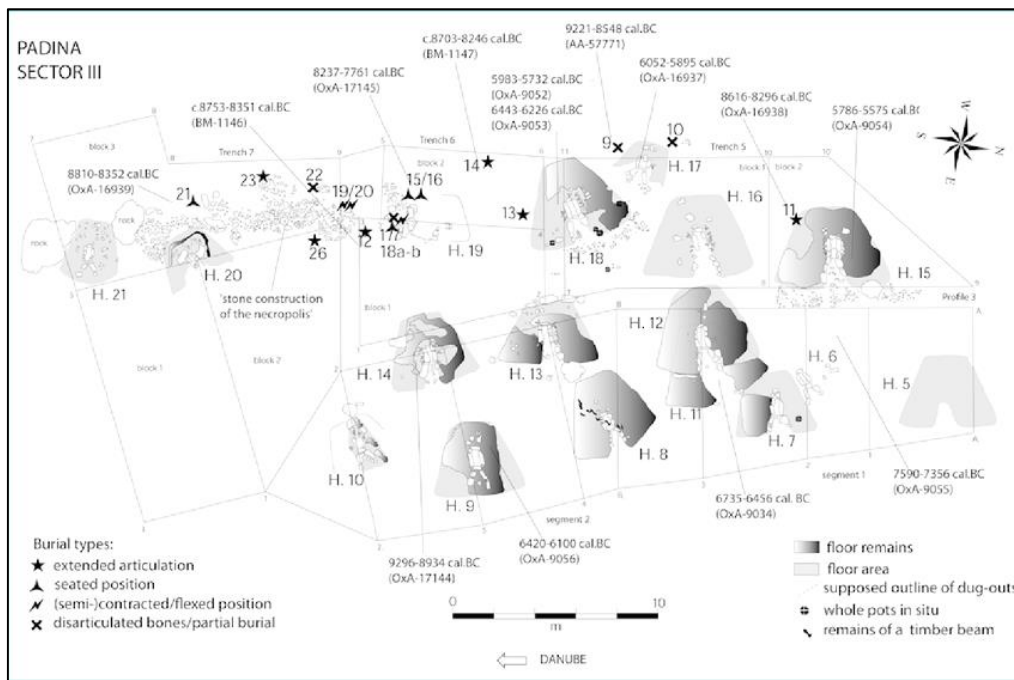


Figure 26. Arrangement of the base of houses in the settlement of Padina - Gospodjin Vir

The remains of Lepenski Vir architecture are silent witnesses of measures applied to improve energy efficiency. It is really possible to talk about the original passive solar and bioclimatic architecture here. The shape of the dwelling, a house is very compact and contributes to the preservation of energy for heating and cooling. Dwellings in Lepenski Vir and Padina-Gospodin Vir are an example of energy-efficient constructions of their time, location and given technological preconditions and applied materials. The architecture of Lepenski Vir did not appear randomly, and from nowhere, and similar houses were also found on the neighbouring locations.



Figure 27. The originally relocated location of Lepenski Vir. The original location was long under water, although some objects and all the sculptures from it were transferred to higher ground [38, 39]

The inhabitants of these two settlements were aware of certain principles of bioclimatic architecture. This is proved by the remains of architecture (the floors of the house) and the natural surroundings of the site, including the movement of the sun along the horizon. This is also supported by the fact that in this settlement and at this location people lived continually about 2000 years altogether, or in about 80 generations, which really speaks a lot, primarily in terms of the sustainability of the settlement and its dwellings.

Obviously, people in prehistory have been very concerned about the energy efficiency of their buildings. The remains of the Lepenski Vir architecture, including the Padina - Gospodin Vir, which was created some 8,000 years ago, point to recognizable measures to improve the energy efficiency of their buildings, which are integrated in the design, structure and construction of their houses and settlements at these locations. Although there is no written



evidence, the basics of these houses speak of the measures applied whose meaning can be understood only if viewed within the natural astronomical, geographical, meteorological, and vegetation environment. The role of sun and sun radiation in these locations is very important for understanding the purpose of the architecture of Lepenski Vir. Although we cannot be quite sure how these houses looked, we can completely conclude, based on the remains of architecture, that the purpose of such constructions was to provide comfortable living conditions, considering the energy efficiency of the buildings [40-42]. Although the third dimension of these houses is not known, it must have followed the shape of a preserved base. The remains of the architecture of Lepenski Vir are the remains of an energy efficient architecture, a kind of ecological house, which is quite certain.

Novadays the Lepenski Vir Museum, which is open only six months a year, has between 10000 and 20000 visitors per year. It is geographically well located on a good road and along the great river, with accommodation capacities, a marina in Donji Milanovac, a small town just 12 km from the locality, and offers excellent opportunities in tourism. Lepenski Vir settlement is moved into the museum. The location is moved due to the raising Danube waters' level and slipping of the terrain. The museum's internal climate keeps archaeological location in its entirety from devastation with climate effects. The choice of new location, steep background, orientation, and surroundings under vegetation also allow favourable living conditions in summer.

The architectural remains of Lepenski Vir were transferred to new locations in two ways. Several characteristic and representative objects were transferred to the whole and intact, or their central parts with fireplace and surrounding equipment were transferred together with their foundations in a thickness of 75-100 cm. Objects that were transferred as a whole were heavy about 20 tons, along with their foundations. They were taken to their new location by a ramp, which facilitated the transport of artefacts, all along steep slopes between the original and the new location. The second method was to dig out fragments, giving the corresponding sizes and all parts of the dwellings' construction, which were then reconstructed at new locations. This method was used for most objects, because it was known that underneath the floors of the dwellings that needed to be moved there were even older remains that were supposed to be archaeologically investigated (Figures 28 and 29).



Figure 28. Side view of the steep background of Lepenski Vir and towards the Lepenski Vir Museum on the site above a sunken archaeological site







Figure 30. Perspective presentation of the tourist resort Lepenski Vir, which clearly shows the relationship of communications and facilities. Communication remained the same, and everything is just for pedestrians. There are trees and greenery on all sides. Lepenski Vir, Serbia (2019) by ArhiArhi (Predrag, Vladimir and Grigor Milošević)

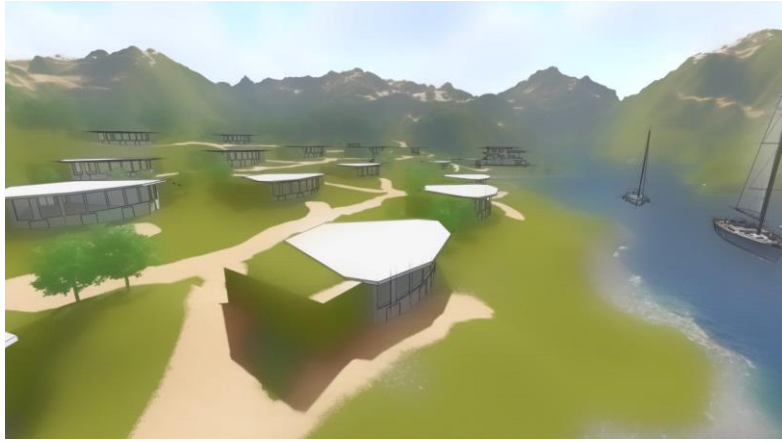


Figure 31. In the right-hand corner of the perspective view, the object can be noticed by a different appearance than others. It is a reception building, where people meet and socialize, where medical help is also located. Our inheritance can be added only to what is necessary, without today it cannot exist. We should not give up on tradition simply because what it offers is not practical at first hand. Lepenski Vir, Serbia (2019) by ArhiArhi (Predrag, Vladimir and Grigor Milošević)

Also, the same system makes the object have a smaller surface. Let us say that one wall is 3 meters high and 5 meters long. This gives us 15 square meters of area on which wind blows. And this is often a strong wind, even in our conditions along the Danube, where the climate changes at every moment and we occasionally have hot summer and harsh winter. If the object were buried in half, we would cut the surface that the wind could strike, by half. We would only have an area of 7.5 m<sup>2</sup>. And that is not only half as much, but essentially much more, given the real consequences, if we calculate the mathematical formula. Let us not forget that these are not reinforced concrete structures, but wood objects, with less technology and construction than today. They were much more susceptible to shooting under strong wind than today's wooden objects. To our ancestors, it was simply natural. They solved it classically, and great, as we have already seen here (Figures 32 and 33).



Figure 32. A perspective view showing the relationship between the level of the land and the roofs of objects. With green rooftops we can restore nature to what has been covered on the ground. Our ancestors could do it as well, and maybe they did it in the prehistoric Lepenski Vir. Lepenski Vir, Serbia (2019) by ArhiArhi (Predrag, Vladimir and Grigor Milošević)



**Figure 33. Perspective presentation with the hierarchy of horizontal levels on the slope of the tourist resort. As the Romans built their amphitheatres millennia after Lepenski Vir, so in this tourist settlement all units were built so that everyone has an unhindered view of the river. So not only units close to the river, but also all the others in the slope above, have a great view of the river. The units are placed on a slope alternately, as benches in amphitheatres; so that no one is disturbed in viewing the river as a scene. Lepenski Vir, Serbia (2019) by ArhiArhi (Predrag, Vladimir and Grigor Milošević)**

At the same time, let us remember that once the original buildings were built mostly with rounded walls. People were trying to create a rectangular wall, and it was not easy to tie the stone. Our ancestors from Lepenski Vir have perfectly solved this. They took two main walls and put those under 60 degrees. At one end, they cut it and put the entrance, which can and should be small. And on the other side, they set up a semi-circular wall that has greatly increased the space. Today we also have semi-circular walls, but mostly in more expensive buildings such as luxury apartments or houses. This is because space is so much better used, which becomes easier to see from within.

The circular basis of human habitation, the house, has proved to be the most stable, most suitable for preserving the interior temperature in it, in case of strong winds or snowstorms, which on the construction with such a base hit only one cylinder lead that occurs above the circle that is in its basis, and not on the whole surface of one side of the dwelling, the house, as it happens with rectangular bases, where the whole surface, the entire facade, is exposed to these strokes, and therefore the loss of internal heat in it is considerably larger. That is why traditional, vernacular homes, houses in various parts of the world, from those in Pueblo in New Mexico in America, through Sahara and Sub-Saharan Africa, all the way to the desert of Gobi in China and Mongolia, have a circular shape in its base rather than a triangle, square or rectangular. The same can be said for the traditionally built dwellings, houses in this part of Europe, “bunje”, built in stone and regularly with a circular base. Practical reasons have always been crucial in building issues.

All these elements can still be used today. The problem arises only in the fact that today's architecture and production and construction technologies rely more on the right lines. But, in the case of a design study that will be shown here, a hotel accommodation in nature, we can see that these elements have remained and are quite practical for us today. It is practical to add a new experience to tourists with half-buried objects, which, in an attractive way, is presented on the world's tourist market. It is logical to put semi-circular walls whenever we can because they are more pleasant. It is desirable to try to get a comprehensive, more open space, not just a box.

The oldest civilization in Southeast Europe, in the Balkans, and throughout Europe, was discovered in the Đerdap Gorge in Serbia, in many ways specific and interesting. When considered in the light of contemporary architectural tendencies, we immediately see its progress in terms of a sustainable community, a comfortable and environmentally friendly area, features that are increasingly demanding on the market today. These trends are nowadays mostly based on the use of modern technologies, increased control of the environment, and the use of a large number of artificial materials. And the real solution lies here, in ancient, proven methods that can be perceived by the research of ancient settlements.

Lepenski Vir is primarily known for its specific form of house, as well as the entire settlement. Let us look at the shape of the base of a single lodging, which was primarily conditioned by climate and terrain, the reaction to the environment and its integration into it. The shape itself is geometrically very regular and represents a circular cut, at the top sealed, which can be divided by a triangular matrix that strives (due to deviations and due to the individual factors of each house) to the modularity of each unit - a single-sided triangle.

This basis primarily influenced the airy comfort of the house and the environment, because in the region where a strong, cold wind like the “košava” is blowing, aerodynamic shapes keep the pleasant air much better than the cube. From the base, the walls are raised, in this case, only one is created. The only wall that the house needed was a shrivelled wall on the side from which the wind blew, to keep the fire and protect the inhabitants. On the other sides

there are pieces of walls, depending on the orientation of a particular house - the basic module does not repeat consistently, but it is shaped in relation to the exact place of individual lodgings. The houses were also partially buried in the ground, to be better isolated and pleasant to stay.

From this construction of the house and the configuration of the terrain, a unique urban arrangement emerged, where the houses were placed so that their broader, curved side is facing east, i.e., the water, and the full side wall to the southwest. The path between the houses leads to the central area which is located along the river - the source of life of the settlement. Since the settlement is on the slope, the houses were terraced to each one to catch the air and look at the river. The trails on the same altitude partially swing to consistently follow the isohels terrain. Such a matrix has provided every unit of the benefits of the river, which, apart from the aesthetic experience, affects the thermal comfort of the reflection of the sun's radiation. For example, in winter, when the surface of the river was frozen and covered with snow, the amount of reflected light, and therefore heat, would increase and the ambient air would certainly be a few degrees warmer than the air in the surrounding hills.

In the review of the benefits that the then "urbanists", working intuitively in accordance with nature, realized in a settlement that was continually settled by at least 80 generations (2000 years, the number that many today's cities still need to reach), we can see what way and how properly preserving the architectural heritage can contribute to better modern planning and construction. What follows now in this paper is a preliminary design solution for a tourist ethnovillage, as an attempt to materialize the above ideas in contemporary culture and technology, and which implies a different spectrum of needs and a higher standard of comfort for today's tourists than it was for a man in ancient Neolithic a settlement in the same Đerdap Gorge [29].

### 5. Designing The Tourist Resort Lepenski Vir

By urban planning, it has been realized that each unit has a look at the river, regardless of the distance from it, as well as a small zone around it where the trees are located - something that was not desirable at the time of the Lepenski Vir, because then the higher density of the population meant higher security, as well as the higher temperature in the settlement, due to the density and population movement (Figure 34).

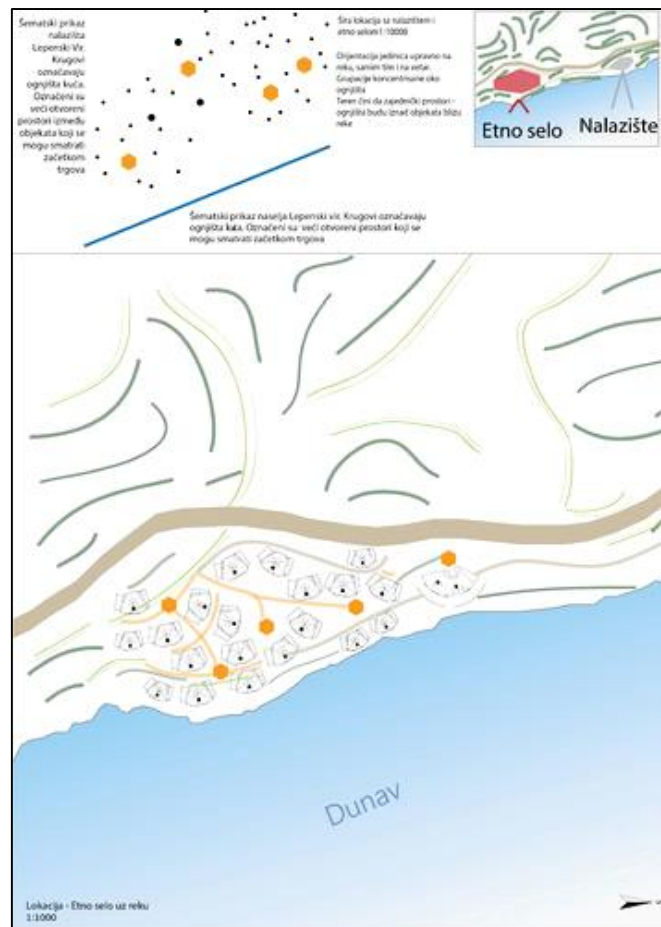


Figure 34. The layout of the Lepenski Vir tourist settlement, according to the pattern and in line with the resolutions of our ancestors. There is one already built communication that connects the settlement with the surrounding territory. The terrain is slightly different from that of the archaeological site. It is slightly more tilted towards the sun, so the microclimate is somewhat better here. But it is still worth taking advantage of what our ancestors left to our heritage. With the help of

new materials and modern machines, we can build thermal, acoustically better insulated spaces. The construction is less expensive; it is fast with all machines available to us today, and safe. The reinforced concrete or masonry construction is strong enough to support strong wind. All new technologies are helpful, but architects still have space to design in a functional way with good connections. It is not easy to learn from history, even when what it tells us is obvious. Earthquakes can be predicted and build by keeping them in mind. But, however, there are no perfect solutions. To assume the future is certainly a difficult task, perhaps impossible. However, our self-confidence is greater when we use the proven methods of our predecessors and the ways in which they built. Of course, with a notion of the time in which we ourselves live now, differently from their own, but in the same place where they lived millennia before us.

The designed tourist settlement on the Danube River is located not far from the Lepenski Vir archaeological site, on whose ideas it relies, in similar surface and on a similarly configured terrain. The terrain is presented as an opening in the surrounding forest by the river, on the coast itself. By its composition it can be divided into three altitude zones, with a difference of 2-3 meters, and the coast itself as the fourth zone. What came first was a typical unit, which follows the shape of the Lepenski Vir house, and has all the necessary contents of today's house. This new, tourist house is, of course, much larger so that it can accept modern standards. It contains a bathroom, a kitchen, a living room, and a sleeping room, opposite its predecessor, which consisted only of fireplace and a small sleeping area (Figures 35 and 36).

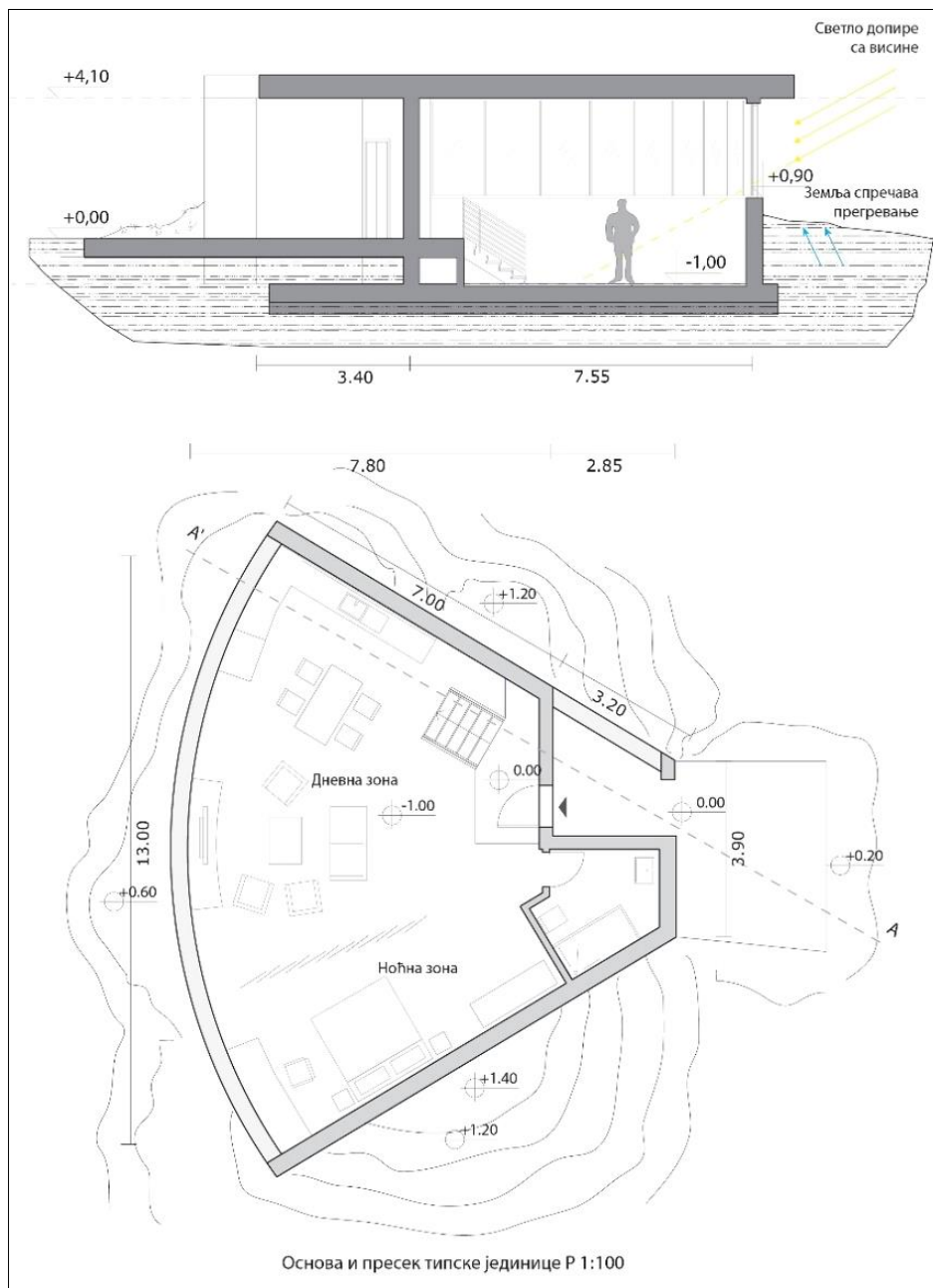


Figure 35. Basis and cross-section of a typical residential unit. Lepenski Vir, Serbia (2019) by ArhiArhi (Predrag, Vladimir and Grigor Milošević)

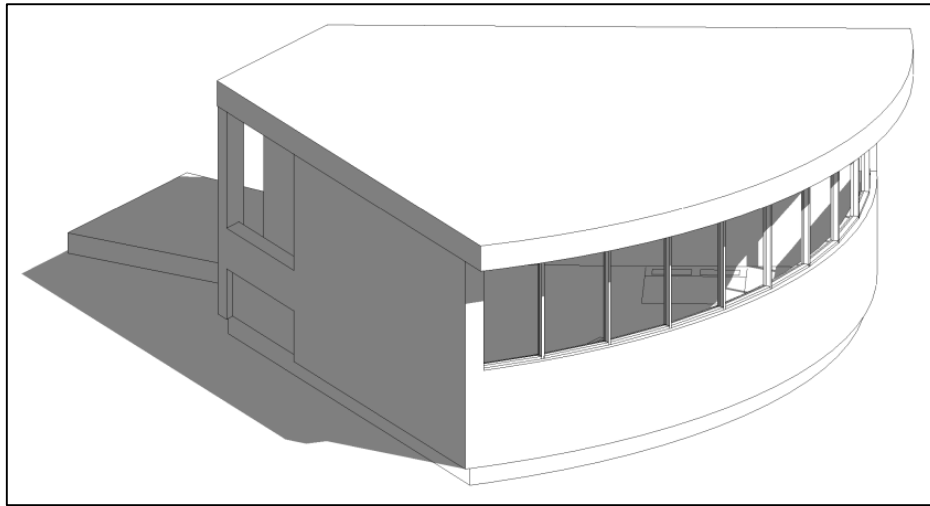


Figure 36. Typical residential unit. Lepenski Vir, Serbia (2019) by ArhiArhi (Predrag, Vladimir and Grigor Milošević)

The residential unit in the tourist resort is to the maximum extent possible by the old design method used during the time of Lepenski Vir. It should not have gone further than 2 meters in height, for ecological and natural reasons (Figure 37). To provide surface ventilation, regulations on objects less than 2 meters should be kept. Since we need an internal height of at least 2.5 meters to live and stay for us to create a space that can be used, we had to bury a little bit of objects. It would not be difficult at this location, as the land is fragile. At the same time, this is how a problem of ventilation was solved, and the objects are not exposed to strong winds. Wind could greatly damage the structure if it was constantly hitting a 3-meter-high surface. Since there are all objects here only 1.5 meters above the ground, it can be said that the problem with the blows of the east wind, “košava”, is solved. Such shaped tourist units are more easily accepted by occasional bumps and wind blows (Figures 38 and 39).

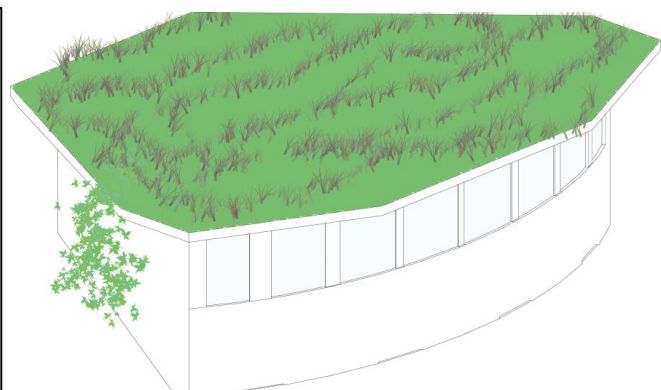
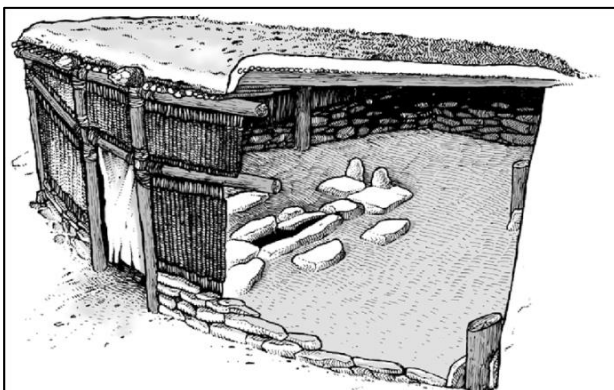


Figure 37. In direct comparison to possible reconstruction of prehistoric dwelling, the simplified axonometric of a tourist unit shows how easy it is to perform. There are only vertical walls. In relation to the Neolithic Lepenski Vir house, noticeable changes are flat roofs and windows on the semi-circular wall. But these are more adjustments to our time and needs than essential changes. Our new technologies, with modern materials and machines, enable us this long row of connected windows. Flatt roof was mentioned by Le Corbusier in his five points on architecture. In this case, it can be covered with soil, grass, and flowers. Let us return nature to the little earth that we have taken, treat and use nature for our basic needs, and not to hurt it. Let us build with nature, not against her, because she is here longer than us and will be here long after us. Therefore, to fight it, it is useless.

The centre of events in the former Lepenski Vir had direct coastline, harbour, and water. For the location in this project to be connected with the Danube River tours, within the settlement there would be a small port with a marina, in a natural bay on the site. The building is of the same shape as the old objects of Lepenski Vir, but for the needs of tourists, compared to the previous one, it is luxurious. There is a narrow entrance part, and opposite to it there is all the remaining area, which is used as a sleeping room, and as a living room, dining room and kitchen. The bathroom is located next to the entrance, for the more rational use of the total area. One of the biggest problems was that the sun is sometimes too strong. During the analysis, people who rented such spaces have made it clear that they do not want to jeopardize their privacy, and therefore the windows have remained at a height where no one can look inside in another object. The windows thus serve only to pass the light.

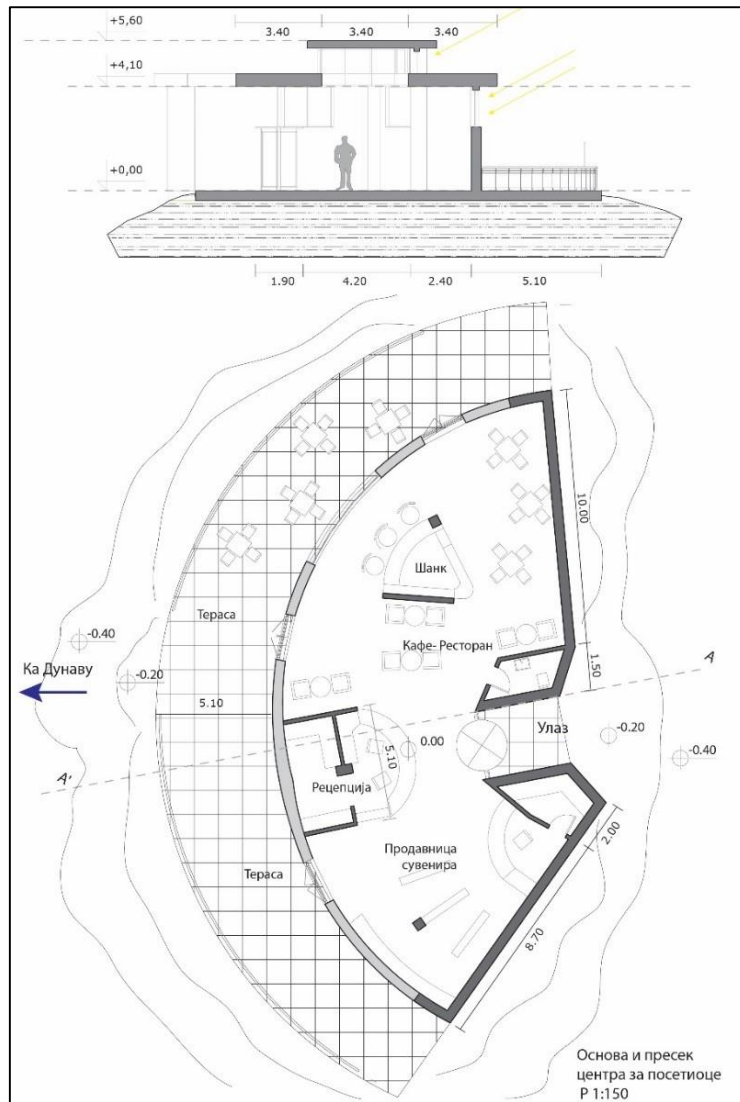


Figure 38. Basis and cross-section of the Visitors Centre, a simple and effective form, reminding a clover leaf. Lepenski Vir, Serbia (2019) by ArhiArhi (Predrag, Vladimir and Grigor Milošević)

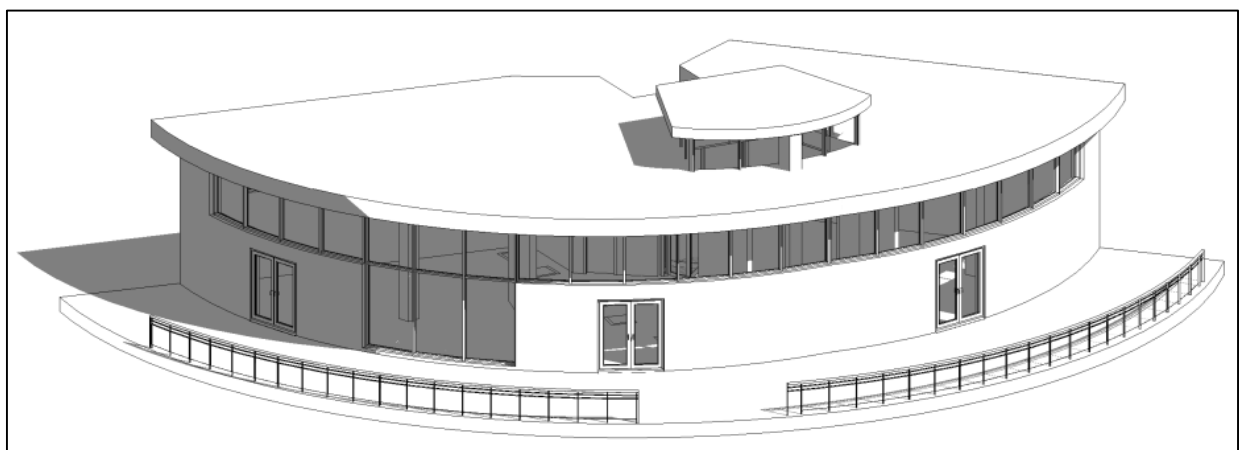


Figure 39. Visitors Centre. It can clearly be seen that the visitors centre is practically made of 2 or more houses merged in one larger building. Lepenski Vir, Serbia (2019) by ArhiArhi (Predrag, Vladimir and Grigor Milošević)

Thus, the ability to place the green roof on the buildings is open, as they are quite simple both in appearance and construction. The green roof would have kept moisture, evaporation, and cooled longer than a regular roof. Also, since the roof is at a height of only 1.5 meters, it can also be used as a green surface. On that surface, one could sit and enjoy the view. It is possible that there was a green roof on old Lepenski Vir houses. It is known that sods of moss or grass were used as a blanket in the construction of houses, and this could be the case in Lepenski Vir (Figures 40 to 43).





Figure 40. Visitor Centre and tourist residential units of the Tourist Resort Lepenski Vir, in the background. Lepenski Vir, Serbia (2019) by ArhiArhi (Predrag, Vladimir and Grigor Milošević)



Figure 41. Visitor Centre and Tourist Settlement Lepenski Vir beneath Koršo Mountain. Centre of the community living in the houses. Lepenski Vir, Serbia (2019) by ArhiArhi (Predrag, Vladimir and Grigor Milošević)



Figure 42. In a walk along the tourist settlement Lepenski Vir. Just like a walk in the park. Lepenski Vir, Serbia (2019) by ArhiArhi (Predrag, Vladimir and Grigor Milošević)



**Figure 43. Entrance to the tourist residential unit. Every house has its own privacy overlooking the Danube. Lepenski Vir, Serbia (2019) by ArhiArhi (Predrag, Vladimir and Grigor Milošević)**

Today, the number of tourists who do not feel the need to enjoy luxury in 5-star hotels with service, and who want to spend their holidays actively in nature, walking in green corridors, often in connection with the traditions and history of the surrounding areas to visit, increases rapidly [29]. In the tourist village there are no streets where cars can be driven. Although the same machine occupies about 12.5 m<sup>2</sup>, and it extinguishes even 90% of the time, it also produces noise and pollution.

Contamination is always a trouble, and there is no reason to allow this kind of tourist resort in the presence of cars to violate the natural beauty and peace of people who have arrived here to rest. Among other things, noise is certainly one of the most severe types of pollution in the environment. That is why in this small tourist village all are walking, being pedestrians [43, 44]. It is healthier for both man and his environment. There are no car crowds, and there are no cars on the sidewalks. If somebody needs a vehicle for medical purposes, for the most basic needs, then it can be assigned to him. It is about a green tourist resort, with special air quality and an open view of a large river - potential that would be pity not to use. Thus, the modern method of placing the green roof would be linked with the ancient technique and the technology of increasing the heat comfort. All the elements of this project are in fact a contemporary response to how our ancestors lived here long ago. They used these objects exclusively as shelters (Figures 44 to 46).



**Figure 44. Interior of tourist unit. In the interior again, as in ancient times, there is a common zone, a place where visitors spend time together, just like our ancestors. There is everything needed in it. Only the bathroom, located next to the entrance to the unit, is separated. The windows bring a lot of light into the unit and invite tourists to spend their time primarily in nature, outdoors, to enjoy it and thus improve their health. Lepenski Vir, Serbia (2019) by ArhiArhi (Predrag, Vladimir and Grigor Milošević).**



**Figure 45. Visitors Centre and part of the tourist resort Lepenski Vir, which clearly show the traditional urbanism used ages ago. Lepenski Vir, Serbia (2019) by ArhiArhi (Predrag, Vladimir and Grigor Milošević)**



**Figure 46. Centre for visitors along the Danube. A very initiative building which fully uses the coastline. Lepenski Vir, Serbia (2019) by ArhiArhi (Predrag, Vladimir and Grigor Milošević)**

They were sheltered from the weather and animals that could attack them at night. During the day, our ancestors were active—they were gathering what they wanted to survive. Only a few would spend much of the day in the building. It was different at night, of course. New materials allow new modes of construction and design. If we cannot completely continue with the old customs, even in 20% of their former appearance, we can always find something useful, something that connects us and our ancestors, in our interest, for our time, and in accordance with tradition.

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## 6. Conclusion

There is obviously a lot to learn from prehistoric settlements and dwellings in Lepenski Vir and the surrounding area. One might be surprised at how those ancient people handled all issues of sustainable and energy-efficient building and the environment, but that is exactly how it was, long ago. Due to its exceptional scientific and cultural significance, as well as the historical remains of the past and its special position in the Danube Gorge, Lepenski Vir is an important destination on tourist and academic roads. It has the potential to become one of the most attractive spots for Danube cruises, and it also has great potential economic significance for the local and broader community. The entire protection interferes with the complexity of Lepenski Vir's location and its place within the national park, as well as the lack of clearly defined financial sources for some necessary work. A feasibility study is needed to create a precisely planned, long-term sustainability project. Today, we live in the same areas where the families of Lepenski

Vir lived. As famous Serbian scientist Milutin Milankovi has stated, the Earth orbits but occasionally leans toward the Sun, warming our Northern hemisphere. But still, the climate has remained similar enough that the old architectural heritage can find a new use. With new materials and even more recent technology, we can get similar results, sometimes maybe even better. But in the meantime, we remain faithful to the ancestors and accept their efforts so that they will not fail and go into oblivion. Our Lepenski Vir ancestors' experience applied to our designs makes them better for us, wherever and whatever is possible.

## 7. Declarations

### 7.1. Author Contributions

Conceptualization, P.M.; methodology, P.M.; software, V.M. and G.M.; validation, P.M., V.M. and G.M.; formal analysis, G.M.; investigation, V.M. and G.M.; resources, V.M. and G.M.; data curation, V.M. and G.M.; writing—original draft preparation, P.M., V.M. and G.M.; writing—review and editing, P.M.; visualization, V.M. and G.M.; supervision, P.M.; project administration, V.M. and G.M.; funding acquisition, P.M. All authors have read and agreed to the published version of the manuscript.

### 7.2. Data Availability Statement

Data sharing is not applicable to this article.

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### 7.4. Institutional Review Board Statement

Not applicable.

### 7.5. Informed Consent Statement

Not applicable.

### 7.6. Declaration of Competing Interest

The authors declare that there is no conflict of interests regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely observed by the authors.

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