

An updated GIS approach to studying Bronze and Iron Age hillforts on the islands of Brač, Hvar and the Makarska Littoral, Croatia

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Aerial photo of Likova Glava Gradina. Joško Barbarić.

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Declaration of Candidate

I certify that this thesis does not incorporate without acknowledgment any material previously submitted for a degree or diploma in any university; and that to the best of my knowledge and belief it does not contain any material previously published or written by another person except where due reference is made in the text.

Joseph Sarunic
July 2023

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Abstract

The factors which motivated the construction and placement of hillforts, prominent during the Bronze and Iron Ages on the islands of the Central Dalmatian coastline are only vaguely understood. What is also unclear is how these sites were politically organised and whether they formed groups or not. Upon carefully considering the location, viewsheds and elevation of structures upon the islands of Hvar, Brač and the Makarska littoral as well as supporting landscape data and the locations of exotic trade good artefacts, it is clear that the the main priorities when selecting a location to place a hillfort or settlement was the control of fertile soil for the growing of crops and grazing of cattle, and of secondary priority was control over trade lanes present prior to the founding of Greek trading colonies in the region. Also clear is that extensive networks of cooperation existed between settlements as evidenced by intervisiblity links and that small political bodies of multiple structures existed across the study area.

Chapter 1: Introduction

1.1 Background

Between the late Bronze Age and the beginning of the Classical period the islands of the Central Dalmatian coast were inhabited by people who left extensive examples of stonework structures which still dot the landscape today (Čučković 2017:530, Wilkes 1996:226-227). These vary from small half circles large enough to house only a few inhabitants to large concentric ring structures that may have served as fortresses on the spurs of mountains overlooking plains (Wilkes 1996:190). Such structures likely served as the nucleus of power for tribal hegemony and the centre of trade networks which during the later Iron Age included traders from the Aegean and Italy (Wilkes 1996:224). The way in which these structures interacted with each other and were interlinked is unknown due to the limited physical evidence currently available to archaeologists, however extensive work has been done cataloguing the various sites present among the central Dalmatian islands, notably Brač and Hvar.

From 385 BC Hvar was settled by Greeks from Paros who brought both commerce and conflict with them, thereby changing the social landscape of the island and the ways in which the previously built settlements interacted with each other. Brač currently has no known foreign settlement yet has evidence of foreign interaction dating back to before the Iron Age at large sites such as Škrip. Due to the great advances in geographic information systems or GIS technology which have occurred over the past few decades, the positions of the Bronze and Iron Age structures present on Hvar, Brač and the area of mainland between them; the Makarska littoral, can be visually represented and compared to other forms of data such as the positions of ancient harbors which have also been catalogued and agriculturally suitable land.

Through this method of investigation called landscape analysis it is possible to place these sites back into their historical landscape context and thereby gain a greater appreciation of the factors dictating their placement and construction. The purpose of examining settlement layout on the islands over the course of both the Bronze and Iron Ages is to examine the evolution of settlement patterns and especially the possible changes brought about by the influx of traders from outside the Adriatic Sea.

1.2 Aims and research questions

This thesis will attempt to answer the following question:

How did the landscape features of the islands of Hvar, Brač and the Makarska littoral dictate the placement of fortifications between the Bronze and Iron Ages and how did this relationship change during the period of Greek commercial and colonial activity?

The process of answering this question will consist of completing the outlined objectives.

Objectives include;

1. finding out which prehistoric fortified structures within the study area formed networks with each other;
2. determining what does this infer about the connections between structures on the Makarska littoral and islands of Brač and Hvar;
3. examining what role Greek colonial and commercial activity played in the formation of these networks and;
4. delineating what other factors influenced the placement and construction of fortifications within the study area; and
5. applying this data to further assess the political and societal organization of the study area prior to and during the period of Greek involvement.

1.3 Layout of research

The first full chapter of this report of research shall be a review of the literature related to the history of the Central Dalmatian region as well as of the archaeological projects which have taken place on Hvar and Brač. A description of fortifications built by both the inhabitants of the Dalmatian coast and islands as well as the Greeks shall be given, alongside a discussion on maritime practices in the region such as the importance of harbors and the presence of piracy. Finally, archaeological techniques employed throughout this study such as landscape analysis shall be listed and explained as well as how they relate to the study of fortifications.

The second full chapter consists of a methodology, building upon the previous chapter's explanation of the analysis techniques used in fortification studies and description of the historical landscape of the Central Dalmatian Coastal Region. Further additions to the techniques previously listed shall include GIS analysis, viewshed analysis and network analysis based on exotic trade goods.

The third chapter shall consist of a description of the results gained throughout the process of research using the methods described within the methodology chapter. The main categories of results will include; the characteristics of the fortifications analyzed such as their elevation

and size, an analysis of the viewsheds of the structures including how they interact with each other and what other structures can be viewed, an examination of the landscape surrounding the structures and how they are placed within it and a survey of the locations of foreign trade goods across the landscape. Finally, to provide a total picture the study location will be fully described in a coherent way and including all the above mentioned elements; harbors, agricultural land, intervisibility links and trade goods in both the Bronze and Iron Ages. Following this will be a in depth discussion concerning the collected results, concerning in order; Broad fortification trends across the study area, particular trends in the different locations, the role of Greek structures in determining fortification layout, militaristic explanations for fortification placement and

Next will follow a discussion of the results gained over the course of investigation which shall in turn address each of the five objectives of research as discussed in section 1.3 in order and relating to each of the three locations tackled within this study.

Finally, a conclusion shall be given summarizing the major pieces of information which have been gained throughout the process of research and presenting in a short manner the pieces of evidence most relevant to the overarching study question. This section shall be divided into five sub chapters each relating to one of the aims as explained above (section 1.2).

1.4 Description of location

The islands of Hvar and Brač lie within the Split-Dalmatia County, historical region of Dalmatia, Croatia on the eastern side of the Adriatic Sea. The Makarska littoral is the name of the stretch of coastline which runs alongside the two islands for 60 km between the Omiš coastline in the north and the Neretva Delta in the south.

1.5 Significance of research

The social organization and settlement patterns of pre-Roman occupants of the Dalmatian coast are poorly understood, and this issue primarily stems from a lack of intensive study of the sites and the relationships between them. Also, GIS technology has had very little time to flourish within the context of Mediterranean archaeology, the first usage was only three decades ago in fact (Gaffney et al 1991). Some of the sites within the chosen study area have been examined using GIS technology previously, but on a much smaller scale and more sites have been discovered since then, meaning a reassessment of the data with more up to date

GIS technology such as viewshed analysis will lead to new results and understanding of an area only briefly examined in the past.

1.6 Limitations

The lack of excavations within the vast majority of the sites included within this study means that very little information can be gained about their dating and what sort of artefacts may be present within them. This has the potential to make the network analysis portion of this study biased, as sites which have been excavated will inevitably have a greater quality and quantity of artefacts found, meaning they will be considered to have a greater degree of trade contacts than sites with little or no trade goods found at them, whether they are present or not. Also, the fact that many sites have no time period associated with them means that the archaeological and historical record of the study area can only be illustrated halfway.

Chapter 2: Literature review

2.1 The East Adriatic Region

2.1.1 Landscape

The East Adriatic region aligns closely with Braudel's description of the Mediterranean being made up of "mountainous peninsulas interrupted by vital plains" which divide "vast, complicated and fragmented stretches of sea" (Braudel 2000:26). In particular the east Adriatic coast consists of the Dinaric Alps, situated between the Julian Alps to the west, Carpathian Mountains to the north and Adriatic Sea to the south and the Pannonian plain, separated from the coastline by the mountains. This great mountain range, impassable and almost uninhabitable in places due to ridges created by uneven erosion and possessing little greenery was formed primarily during the Palaeozoic period (Wilkes 1996:21). It runs parallel to the coast on a NW-SE axis and sometimes falls directly into the sea, submerged alongside a series of valleys and plains once exposed and inhabited during the last glacial maximum as attested to by submerged archaeological finds including mammoth bones (Rossi et al. 2020:1065–1068).

All that remains of this submerged landscape are the anticlinal peaks of the mountains forming the Dalmatian islands, a series of entities ranging from large islands housing thousands of inhabitants to islets with barely enough room to stand upon (Stančić et al. 1999:24). The Dalmatian coast is divided up into roughly three zones, the north, central and south coast. The central coast is prominent for containing large islands with long occupation

histories such as Vis, Palagruža, Korčula and of particular importance to this thesis; Hvar and Brač. Much of the terrain making up both the coastal region and the islands themselves consists of large tracks of Cretaceous limestone known as karst, limited in vegetation coverage and even sources of water, with some of the only permanent rivers along the Dalmatian coastal region being the Neretva and the Drin (Wilkes 1996:14).

The presence of good quality fertile land on the islands is a rarity, with soils typically taking the form of shallow dirt clumps forming in karst basins, in some cases only 35 cm deep which are prone to erosion if not properly maintained (Stančić et al. 1999:8). Despite this, the agricultural potential of the islands and coastal region has been exploited heavily throughout the history of the region. The single largest area of land along the Dalmatian coast suitable for agriculture is the Stari Grad plain on the island of Hvar, settled and used since prehistory and even fought over during the 4th century BCE. Other areas have similar agricultural potential due to the ingenuity of man including relatively lacking islands such as Brač due to the breaking up of the Karst landscape to create new areas of fertile land suitable for agriculture. The products grown include grapes, olives and lavender especially in the case of Hvar, as well as the rearing of sheep and goats (Stančić et al. 1999:7, 10). This practice began in the Bronze Age and is evidenced by the dotting of prehistoric stone tumuli left across the landscape, the leftovers of this clearance work which interestingly are not dissimilar from the heaped stone field divisions used by the later Greek colonists or even modern farmers now inhabiting the region (Gaffney et al. 2001:137).

The climate on both Brač and Hvar is typical of the Mediterranean, bearing short, mild winters and hot summers. On the island of Hvar for example coastal towns are generally hotter with the town of Hvar having an average yearly temperature of 16.7 Celsius and an average annual rainfall of 1028 mm (Climate Data 2023). Towns [farther] inland on both Brač such as Sutivan and Hvar have typically cooler temperatures as they sit at a higher elevation and are more exposed to the *Bura*, a strong northerly wind blowing from inland (Stančić et al 1999:6).

2.1.2 Prehistoric history of the Central Dalmatian Coast

The coastline of Dalmatia has been inhabited and traversed by humans since prehistoric times, with finds on islands such as Dugi Otok dating to the Palaeolithic. Evidence for true sea faring by the region's prehistoric inhabitants comes from islands such as Korčula, which during the Mesolithic would have been a peninsula connected with the mainland. Finds from

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the Vela Spila cave on the island dating to the Mesolithic were found to be made from stone originating far from Korčula, instead coming from the islands Vis, Jabuka and Brusnik, meaning that the materials for these goods travelled some 20 km overseas (Rossi et al. 2020:1073–4). Sea traffic within the region would only intensify in the Neolithic and Bronze Ages as subsequent waves of immigrants arrived among the islands. This is evidenced by the impressed ware pottery of the first farming communities which litters the coastline meaning it is likely that they entered the region via boat, though this would require substantial sea faring capabilities, also early Neolithic finds on Palagruža have been found to be made from chert originating in Apulia, Italy (Rossi et al. 2020:1074). Similarly, pottery from the middle Neolithic Danilo culture found primarily along the coast shows very significant similarities with wares found in both Greece and Italy (Wilkes 1996:32). The Early Bronze Age, beginning 2,300 BC in Dalmatia also was the time of arrival of immigrants of Indo-European origin, who crossed from the coastline to the islands at places such as Sućuraj on Hvar where early Bronze Age pottery has been recovered (Vujnović 2002:78–79).

All these contacts show that the East Adriatic coastal region served as a type of highway between east and west, likely due to the safer journey facilitated by the multitude of protected bays and islands which provided ships with shelter from bad weather. There is some evidence that this trade extended into the Late Bronze Age when Mycenaean expansionism caused ships from the Aegean to traverse large tracts of the Mediterranean, with the Albanian portion of the Adriatic bearing extensive evidence of their presence (Bejko 2002). Within the central Dalmatian islands Mycenaean influence has been refuted, as though finds of amber likely originating in the Baltic from Mycenaean trade routes have appeared in Dalmatia, it has been noted that there have only been enough of these found to fill the pockets of a single trader and that all other finds are doubtful (Forenbaher 1995). This was until the 90s when excavations were carried out at the site of Škrip, a hill fort of uncertain origin on the island of Brač which confirmed the presence of Mycenaean pottery; two shreds from a large jar and three other shreds on the site which in fact had been found even earlier (Gaffney et al. 2001:143–148). It is also possible that a miniature Bronze Ingot was found at Sveti Petar in Makarška, it was purchased from there by Sir John Evans while on a trip through the Balkans in the 19th century who recorded the location as Makarška in Dalmatia (Barbaric 2009:320).

The full extent of trade between the Bronze Age inhabitants of Dalmatia and the Mycenaean is unknown, with the possibility being that there was simply not enough mutual interest to support greater endeavours by the Mycenaean in the region (Gaffney et al. 2001:152). This

only brings the grand total of definite Mycenaean finds in Dalmatia to a pocketful of beads and the remains of two or three pots, perhaps one for each hand of the same trader who brought the beads as well as a small ingot and it is likely that any Late Bronze Age trade that did exist in the Adriatic ceased as the Mycenaean state collapsed in the 12th century BC (Cwaliński 2014:194–196). It is interesting to examine the contrast between trade in this period and the explosion of trade during the early Iron Age which left far more traces as discussed further below.

The Iron Age in Dalmatia, starting around 1,100 BC and lasting till the time of Christ has been detailed by Greek historians who travelled through the region and recorded what they saw as well as later Roman geographers. What they left however has served only to confuse archaeologists, as their writings present a plethora of tribal names bounded by geographical features without modern equivalent and without much consistency between sources (Dzino 2008:46). Several consistent tribal names are still recorded however, and an example of these is the Liburnians who inhabited the Istrian peninsula and likely spread their influence over the north and central Dalmatian islands. This influence spread even as far as Corfu before the Corinthian Greeks ejected them, leading to them being referred to as a thalassocracy or sea empire as they were known for raiding Greek and Roman ships frequently (Wilkes 1996:100–101). The locations mentioned by ancient authors such as Pliny and Ptolemy for the homelands of the various tribes may not have remained static as is the case with the Liburnians or even been accurate in the first place, leading to the various inhabitants of Dalmatia being labelled under the blanket term of Illyrians by authors ancient through to modern. Though this term is controversial it is acceptable in archaeological discussion as Iron Age inhabitants of the East Adriatic coast is far too long and no better term currently exists. Whereas other areas of Dalmatia have these tribal names specified by ancient authors, little evidence that could aid in determining tribal affiliations exists for the islands of Hvar and Brač.

A suggestion as to why the written sources remain quiet on Hvar is given by Nikolanci, who states that the silence “most likely expresses a simple inability to distinguish some specific ethnic allegiance of the island inhabitants, as an expression of the fewness of their number” (Kirigin 2006:28). Some archaeologists have suggested that the material evidence present on the island such as a bronze fibula indicate that the island was inhabited by the Liburnians due to some similarities in design, however there is a lack of significant Iron Age metal artefacts within the known archaeological record present to confirm or deny this (Kirigin 2006:28).

This is supported by the fact that both Hvar and Brač are frequently lumped together along with the rest of the Adriatic islands as being Liburnian territory by ancient authors (Stančić et al. 1999:22). On Hvar, a stone inscription dating to the 4th century BC was uncovered stating that the Parians, discussed further below had won a victory over the Iadasinoi, though this name is little help as it could mean inhabitants of Iader; modern day Zadar or the Iadastini tribe from Salona (Barnett 2016:76). This uncertainty is the result of a lack of excavations of Dalmatian prehistoric sites, and therefore a poor perception of the material culture which can only be fixed via systematic research into many sites.

2.1.3 Greek influences in the Adriatic

Emerging from the darkness of the Bronze Age collapse some centuries later Aegean travelers once again stretched out into the Mediterranean in search of land and wealth, reaching the coasts of Syria by the 8th century BC (Katić 2002:423) which was soon followed by the establishment of colonies in Southern Italy and the Black Sea (Schilardi 2002:159). The first Greek ventures into the Adriatic region are likely represented by the colonial attempts of the Corinthians, a major trading power during the Geometric period, who colonised the island of Corfu in 733 BC near the mouth of the Adriatic that served as a base to support their founding of Epidamnos and Apollonia along the coast of modern-day Albania (Wilkes 1996:110). These two cities were well established to trade with communities along the coast of southern and even central Dalmatia as well as further inland, far richer in natural resources than the coast (Gaffney et al. 2001:140; Katić 2002:423) by exploiting natural trade lanes such as the river Neretva, referred to by ancient sources as Naron. This trade typically consisted of wine and pottery, either of Grecian or Italic and Apulian origin being exchanged for hides, metal ore, slaves and other resources (Lindhagen 2010:230, 2014:94). Interestingly this trade also resulted in the creation of completely unique artefacts resulting from the mixing of cultural styles such as the “Greco-Illyrian” helmets (fig 1) found in inland areas as well as on the islands such as Hvar, where an example was found by divers near the shore (Gaffney et al. 1997:207).

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Fig. 1. A typical example of a Greco-Illyrian helmet, this example was traded to the Dardanni tribe (Wilkes 1996:147).

Corinthian examples of weapons and armour had been traded with the Illyrian peoples since the 8th century BC and it is currently unclear if this unique style of armour was made to appeal to a Illyrian market by Greeks or if the armour was made by the Illyrians in imitation of the Greek style with modifications, whatever the case it is representative of the strong trade ties between the two groups (Wilkes 1996:106).

Though these southern Adriatic settlements served as both a gateway into the inland Balkans and as a convenient stopping point along the path to Southern Italy, further attempts were made at colonisation among the Central Dalmatian islands, with the earliest of these likely being Kerkyra Melina on Korčula which was colonised by Corcyrans in the 5th or 6th century BC, though no trace of the original Greek colony has yet been discovered (Radić and Bass

2002). More definite examples come from the colonies of Issa on modern day Vis, theorized to have been founded by the Syracusans some time prior to the reign of Dionysus I (Sanader 2002) and Pharos, founded on Hvar in 385-4 BC by Parians as recorded in the works of the Roman historian Diodorus Siculus.

The account by Diodorus mentions an agreement with the previous inhabitants of the Stari Grad plain where Pharos was founded, where “the Parians, who had settled Pharos, allowed the previous barbarians to remain unharmed in an exceedingly well fortified place, while they themselves founded a city by the sea and built a wall around it. Later, however, the old barbarian inhabitants of the island took offence at the presence of the Greeks and called in the Illyrians on the opposite mainland...” (Diodorus XV, 14). After this, a battle commenced between the Parians and the local Illyrians reinforced by tribesmen from the mainland, likely from the Makarska littoral due to its proximity to Hvar. Ultimately the battle was won when a fleet of Syracusan ships arrived like the cavalry, or in this case the navy to rout the Illyrians and take many of them prisoner. Any mention of relations between the Greeks and Illyrians on Hvar ends here, however debate exists as to whether this can be taken as a sign of peace being reached or not and if this was even their first engagement. Katić (Katić 2002:425) cites the finds of a charcoal layer at both the site of Hvar kaštil (fig 2), previously an Illyrian settlement and Pharos as well as the presence of 5th-century BC Greek Pottery at Pharos which could indicate the presence of a pre-Greek settlement there.

Figure removed due to copyright restriction.

Fig. 2. Hvar kaštil as seen from the south-east, note the elevated position of the current fortifications which would have proved suitable for a hillfort (Vujnovic 2022).

Based on this, it is argued that both of these sites may have been attacked and burned down by the Greeks before the establishment of their colony, a picture quite different from the initially peaceful settlement recorded in Diodorus' account and these may have been but two

of the actions in a larger conflict “according to the archaeological, historical and epigraphic sources” (Katić 2002:425). Though the presence of such events and even a previous Greek colony at Pharos is doubted by Kirigin as no charcoal layer was found during his excavations at the site, it is clear that Greeks had good reason to be “generally reluctant to risk life among the Illyrians” (Wilkes 1996:109). Over at the Hvar Kastil a charcoal layer has been discovered but was dated to the 5th century BC, leading Kirigin and his colleagues to state that this episode had little to do with the events of 384-5 BC (Kirigin et al 2021:21).

This did not stop trade flourishing in Central Dalmatia over the next few centuries, as numismatic evidence shows that the Greeks from Issa did business with everyone from their neighbors Pharos, Epidamnos and Apollonia to places further off such as Athens, Corinth, Macedonia and Ptolemaic Egypt (Mandinić and Visonà 2002:328). Coins from Pharos have even been found as far inland as Ošanići, a settlement at the end of the Neretva River in current Herzegovina which traders likely sailed along to deal with the Daorsi tribe inhabiting that region (Kirigin et al. 2002:250).

2.1.4 Maritime activity in ancient Dalmatia

Due to being cut off from significant areas of agricultural land by the Dinaric Alps, some degree of maritime subsistence among the island populations of the Eastern Adriatic was necessary. As stated before, the East Adriatic coastline serves as the ideal location for such a lifestyle, that of the ancient mariner, due to the multitude of harbors present among the islands and coastlines. Trade between the shores of the Adriatic is proven from at least 9th century BC by finds of bronze artefacts originating from the Apennine region of Northern Italy, most prominently in settlements surrounding the river Neretva (Gavranović 2022:13). The French coastal engineer Arthur de Graauw in 2010 began conducting a wide survey of locations, both attested to by ancient authors and theorised based upon nautical knowledge, of potential ancient harbors. Upon examining the Adriatic region he found that it had 49 potential locations out of the approximately 200 he recorded, with only the Red Sea beating it out with 77 potential harbor locations (Graauw 2020:3).

The form taken by vessels used on the Dalmatian coast is currently unknown, however from the writings of ancient authors come the names of two types of vessel: the *Lemb* or *Lembos* and the *Liburnian* or *Liburnica*. Whether these vessel types existed concurrently, were used in different geographical locations or even different names for the same vessel is also unclear,

though some archaeological finds, such as coins minted by the Illyrians bear depictions of them (fig 2) (Wilkes 1996:177).

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Fig. 3. Illyrian coins depicting ships from Scodra (top) and Lacus Labeatis (bottom) (Wilkes 1996:177)

Later historical authors also make reference to the war ships used by the Illyrians such as Polybius, who mentions that while fighting with the Aetolians over the city of Medion in 229 BC “100 boats with 5000 Illyrians onboard arrived at the point on the coast which lay nearest to the city” (Polybius II, 3). This quote would indicate that Illyrian vessels were small, having the capacity for 50 or so troops a piece though it is unclear whether this includes all hands or just the marines on board. This quote also indicates that the Illyrians were in the practice of beaching their ships rather than mooring them at sea, again indicating that they were small vessels capable of being dragged ashore or beached through momentum, though Polybius does note that “The Aetolians...were at first amazed at the unexpectedness and audacity of their landing” (Polybius II, 3). This mirrors other accounts of beaching during the classical period such as those included in the work of Thucydides who mentions that the Athenians were willing to “break up their ships so long as they forced a landing” (Thucydides IV, 11), indicating that such an action had potential to damage the ships of the time. Whether or not Illyrian ships could be beached, larger ship types such as Hellenistic and classical triremes

definitely preferred to remain anchored offshore within protected harbors, either natural such as those found along the East Adriatic coast or constructed such as the Liburnian pier at Pakostane. Harbors therefore were of use to the Illyrians as though their small ships had potential to land upon beaches; “neither warships nor merchant ships (of the Grecian sort) were habitually beached” (Vortuba 2017:25).

A prickly issue within Eastern Adriatic archaeological and historical discourse is the existence of piratical activity conducted by the ancient inhabitants of the Adriatic. Several ancient authors, notably Livy, Polybius and Diodorus Siculus, record instances of piracy against Greek and Roman shipping leading to the angering of larger fish in the Mediterranean pond, most notably the newly arisen Roman Republic. The issue with taking these texts at face value is that they may be based upon a narrative; Illyrians are a barbarous and thieving people who live off piracy for example, which was used as a pretext for the invasion of the Eastern Adriatic region and its eventual conquest by Rome. According to Boršić et al there is little reason to doubt that piracy did occur, in fact that there is “no doubt that the indigenous population of the Adriatic engaged in naval warfare before the last two or three centuries BC. Raiding enemy coastal settlements and intercepting and engaging with enemy on the sea must have been a part of life for all communities living off the Adriatic sea in prehistory and protohistory” (Boršić et al. 2021:21). Where issue is taken however is with the assumption by Roman and Greek scholars that piracy was a cultural habit or common economic practice of the East Adriatic communities all throughout their history. Instead, a hypothesis is put forward that within the Adriatic the presence of traders from the wider Mediterranean sparked a craze among the elites of the Late Iron Age for status goods only obtainable through interaction, whether hostile or peaceful, with trade networks frequented by foreigners and that they were ready to defend their personal right to these networks with force (Boršić et al. 2021:23–24). Whatever the case, it is clear that maritime activity among the East Adriatic coast also included violent aspects and this is very likely reflected in the building practices of the peoples living on the coast and islands.

2.1.5 Previous research in Central Dalmatian prehistory

Antiquarianism within the region of central Dalmatia begins at the same time that the Croatian literary language does, as the first document written in Croatian refers to the toponyms of several sites and even prehistoric tumuli on the island of Brač. This document was the Povelja manuscript, a record of the estates owned by the Sveti Ivan monastery in

Povlja and was originally written in AD 1184, though only a 1205 copy remains (Stančić et al. 1999:13). Other medieval sources serve as valuable sources of information on sites within the area, such as the Hvar statute from AD 1331, which although vague does mention “old walls”, “old roads” and an “old town”, the first mention of any sites on the island of Hvar. This is completely overshadowed by the famous speech by Vinko Pribojevič *On the Origins and Fortunes of the Slavs* given in the 16th century within which an excellent knowledge of classical sources is displayed, as he accurately stated that the town of Stari Grad was founded by the Greeks and called Pharos and even mentions that mosaics and other artefacts were found all throughout the town in his time (Gaffney et al. 1997:12). This is more a credit to Pribojevič’s personal scholarship rather than general knowledge at the time however as other scholars such as the contemporary Venetian official Gian Battista Gustinian noted that Pharos was located not at Stari Grad but at the town of Hvar. An interesting account on the founding of Brač appears out of the work of the 15th century priest father Dunham Hranković, who records that the island was founded by Greeks from a town called Ambratia, later corrupted to Brač, who fled the fall of Troy and that this was recorded in ancient sources widely known in his time (Stančić et al. 1999:13).

Great developments in knowledge of antiquities in the region were limited to the work of renaissance and enlightenment era travel writers, priests and historians until the early 19th century, when interest in the past in central Dalmatia flourished as the region was exposed to new archaeological theories from Austria which resulted in the founding of the Archaeological museums of Split, Zadar and Zagreb (Wilkes 1996:5). This imperial patronage which helped spark the careers of several highly influential local archaeologists made the Dalmatian coast and the land north of it some of the “best observed regions of Europe” in an archaeological sense (Wilkes 1996:8). These local researchers of renown include Don Frane Bulič, dubbed “father of Croatian archaeology” who can be credited with some of the earliest excavations in Dalmatia, certainly on the island of Brač and who contributed heavily to knowledge of the unrecorded past of the region through his excavations, such as when he recovered three Greco-Illyrian helmets from Vičja Luka (Stančić et al. 1999:16). His work for the archaeological journal of the museum of Split was wide ranging, from details of Roman inscriptions to descriptions of the walls of Pharos and finds of artefacts uncovered during building projects on Hvar (Gaffney et al. 1997:20–21). Another important 19th-century contributor to archaeological knowledge was Šime Ljubić, also a priest and a native of Hvar who was the author of the great work *Numografia Dalmata*, a record of vast coin collections recovered from around Stari Grad, though this was only

some of his early work. Josip Brunšmid should also be noted for contributing heavily to studies on Greek involvement in the Adriatic with his work *Inschriften und Münzen der griechischen Städte Dalmatiens*, which helped inspire later archaeologists such as Beaumont and Bračcesi to continue research into Greeks in the Adriatic into the 20th century (Cambi et al. 2002:7).

After the end of Hapsburg rule in the region the pursuit of archaeology continued in Dalmatia. The result of decades of research along the coast as well as the rest of the territory making up former Yugoslavia can be seen in the form of the monolithic work *Praeistorija Jugoslavenski Zemalija*, a five-volume compilation of all archaeological knowledge from the Mesolithic to the Iron Age which was published by the Centre for Balkanological Research. Several other major works have appeared on the ancient history of Dalmatia and the surrounding lands including the works of Stipčević (1977) and Wilkes (1996), both titled *The Illyrians*.

The most significant contributions to archaeological knowledge on the central Dalmatian islands to come out of recent times must be acknowledged to result from the work of the intrepid team of researchers behind the Adriatic Island Project, or AIP. This large-scale project, decades in the making is an attempt to provide a highly detailed while also wide-ranging survey of the central Dalmatian islands, as all examples of archaeological heritage from prehistoric to medieval times are recorded as well as much needed excavation data for many of the more significant or interesting sites in the region. Also, the work of key members of the project such as Branko Kirigin, Vince Gaffney and Nikša Vujnović has broken ground in the integration of technologies such as geographic information survey, or GIS within Dalmatian and even Mediterranean archaeology, such as their study on the hillforts of Hvar. This project revolutionised the way the territory of settlements, or their “catchment” was analysed. The area surrounding a settlement which could be considered its territory, i.e. what land the inhabitants of a settlement could realistically exploit and maintain exclusive control over, was measured previously using the traditional method of drawing a 5km radius around each settlement, giving very simplistic and abstract results. Gaffney et al used GIS technology and DEMs to analyse how long it would take someone to walk 90 minutes modified based upon elevation and slope leading to a much more realistic model for the control of surrounding land which takes into account different terrain types (Gaffney and Stančić 1991:52). The land within the catchment is then considered the territory of this larger structure, with all smaller structures within this radius being subsidiary constructions which

complement the fortified population centres. Although the zone of control created by this method is abstract, it is assumed that the settlement's inhabitants would have difficulties interacting with structures or exploiting resources much farther than the distances presented here. The territorial catchments which resulted from this study were then used by Gaffney and Stančić to divide the island between the major hillforts present there, giving an idea of the political organisation of the communities on the island (fig 3).

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Fig. 4. Territorial catchments on the island of Hvar with soil quality indicators within the catchments (Gaffney 1991:).

This study in fact represents the first major usage of GIS technology within Mediterranean archaeology, though it has since become obsolete (Gaffney et al. 2017:604). Not only has GIS tech significantly improved since then but also later research has proven that some of the hillforts included within this study such as Umič where in fact gomilas and new hillforts have been discovered on the island, therefore it is a worthwhile endeavour to update this study with new methods and current information.

The fourth volume of the AIP which will contain this excavation data from sites such as Škrip and around the Stari Grad plain is soon to be published and will be very welcome in an area which in recent times has been in desperate need of extensive excavations (Gaffney et al. 2001:139). This represents one of the major issues in the study of East Adriatic prehistory, the lack of excavations larger than small trial trenches which tend to only reveal limited amounts of data. This is attributed by Forenbaher to the costs associated with large scale site excavations as well as the difficulty in preserving structural remains after the completion of excavation (Forenbaher and Šikanjić 2006:467). Another factor is site preservation, as though the lack of destructive development until modern times along much of the Dalmatian coast has led to numerous structures being preserved (Gaffney et al. 2017:605) these structures

very frequently suffer from erosion due to resting upon karst stone which also makes excavation of the sites difficult.

2.2 The Archaeology of Fortifications

2.2.1 Previous studies on fortifications

The study of fortifications has been a constant throughout the history of archaeology, as large imposing structures such as the defences of Ilium or Jericho have always excited the imagination of explorers. However, this reflects issues inherent in previous practices within archaeology, as “scholars have long neglected the rural landscape of ancient cities, famously focusing instead on urban monuments and contexts”, therefore ignoring the multitude of regional fortifications scattered across the landscape (Fachard 2016b:208). Also called extra-urban fortifications, these structures were typically designed to defend areas outside of urban population centres and typically took the form of isolated forts, watchtowers, fortresses and even personal fortified villas or castles. Typically, these structures enjoy better preservation conditions than urban examples due to sitting in rural, non-built up areas, such as large portions of the Dalmatian Coast, therefore these structures provide great cumulative value for archaeologists (Gaffney et al. 2017:605). All too often regional fortifications have been considered, however, from a purely militaristic approach, with any walls and fortified towns being assigned a purpose of blocking roads or passes as part of a grand strategic plan, inspired by such examples such as the Roman *limes*. This does not however represent every example of fortification, in fact few of them as has been proven by the attempts to demilitarize regional fortification studies. One example of this can be found in the work of Creighton who analysed the positions of castles throughout the landscape of Medieval England, noting how instead of being purely military structures “the defining feature of the medieval castle was, rather, that it served a number of diverse needs. All castles were built, at least to some degree to serve as high-status private residences and estate centres as well as military strongpoints” (Creighton 2005:1). Other researchers such as Fachard encourage the integration of landscape archaeology to the study of regional fortifications to aid in determining “the factors that commanded the placement of fortifications in the landscape” in a further attempt to explain fortification placement from a non-militaristic approach (Fachard 2016a:414). This, in Fachard’s view, is done through detailed study of the physical landscape, either by field walking or using GIS analysis which can then be combined with information such as agricultural land use and soil data (Fachard 2016b:213). This filling of the empty space between archaeological sites is the speciality of landscape archaeology,

which is commonly focused on the “political and economic dimensions of landscape, aiming at establishing site hierarchies and territoriality catchments” which can also “provide insight into the different social groups” of a region (Attema 2002:18–19).

2.2.2 Prehistoric fortifications within the East Adriatic Region

Hillforts begin to appear in the Dalmatian region during the Later Bronze Age at a later date than on the mainland (Gaffney et al 2002:30). Large studies on hillforts in southern Bosnia, some 50-70 km from the coastline managed to detect two distinct phases of hillfort construction within the 100 or so examples they studied, one during the early bronze age and another around the end (Benac 1985; Govedarica 1982). Though the hillforts along the coastal region and islands may follow a different development cycle the Bronze Age in the region is associated with the construction of many stone structures. There are thousands of examples of structures along the length of the Dalmatian coast, usually with only 2-3 km distance between them (Čučković 2017:530). These structures typically consist of ramparts made from stacked stones with no mortar, called drystone walls, with larger examples bearing multiple concentric ramparts and smaller ones sometimes only having semi-circular walls facing areas not protected by difficult terrain. As with similar structures in other parts of the world, many hillforts in Dalmatia are constructed high up on hills and mountain ridges, with a preference for areas with difficult approaches and which provide good lines of sight.

There is also no clear indication of the purposes of these hillforts other than defensive enclosures for settlements, and some examples are much too small or isolated to fit this role as well as lacking nearby fresh water sources or cultivatable land necessary to support large populations. Other possibilities for their usage are watch towers or forts garrisoned by only a small handful of warriors who could signal to larger settlements, enclosures to shelter or house livestock and beacons or markers for ships. The role of these hillforts may have even changed in the transition from the Bronze to Iron Age, for example on Brač many Bronze Age hillforts are typically built close to fields further inland, while later Iron Age examples are more frequently situated towards the coast (Gaffney et al 2002: 34). This could possibly represent a shift in priorities from dominance and protection of agricultural land to exploiting trade lanes, either through peaceful interaction or raiding which became even more profitable than agriculture. The chronology of hillforts is not particularly well understood due to the previously mentioned issues of “virtually no stratigraphic excavations of major enclosure sites over large parts of the region” and “no established ceramic sequence” (Gaffney et al. 2001:137). One can only wait till the highly anticipated research from the AIP project is

released and more subsequent excavations, perhaps then a true understanding of the region's prehistoric inhabitants can be gained.

2.2.3 Greek fortifications

The Greek colonies in the Adriatic, although bases for trade and commerce rather than aggressive expansion, were still fortified in a manner similar to their Aegean counterparts. Evidence for the regular fortification of Greek cities during the archaic period (800 to 500 BC) is debated (Frederiksen 2011 and Hüllden 2018) as only limited examples have been discovered so far and these are doubtful. It became a regular practice, however, during the Classical and Hellenistic periods, with Aristotle mentioning in *Politics* that by his time there were almost no unfortified settlements and that these were considered antiquated (Aristotle 1330b: 32–35). In the *History of the Peloponnesian War*, Thucydides describes the conflict between a group of exiled Corcyraeans against their Athenian backed country men, stating that the former; “occupied various fortified posts on the mainland, gained control of the Corcyran territory across the straits, and used this as a base for making plundering expeditions against their fellow citizens on the island. Thus, they did a lot of damage and caused a serious famine” (Warner 1972:245).

This system of interconnected extra-urban forts, garrisoned only during times of war due to the dual nature of Greek citizen soldiers (Anderson 1970:5), is common among Classical and Hellenistic era *Polises* and can also be recognized in Greek colonies such as Pharos on Hvar, one of the best researched Greek sites in Croatia. Though bearing its own walls and system of towers, Pharos is also associated with three other stone structures; the towers of Tor, Purkin Kuk and Maslinovik, which were used for the protection of the nearby *chora* or fields as well as a refuge for citizens (Kirgin 2006:86–88). These are located upon hills around the edges of the *chora* and provide a direct line of sight to both the surrounding area and to each other. In terms of construction, the walls of Pharos show similar building methods to contemporary Illyrian sites, namely drystone wall compartments packed with rubble, with the addition of connected towers which are hypothesized to be the remains of the settlement gates (Kirgin 2006:58–60). The towers of Tor, Purkin Kuk and Malisnovik all remain distinctive elements of the surrounding landscape, not only because of their imposing size, even in their ruined state, but also because of their typically Greek craftsmanship, most notably the worked edges on the stone blocks (Kirgin 2006:89).

Conclusion

The Central Dalmatian Coastal Region is home to; Bronze and Iron Age stone fortifications large in both number and variety of purpose and form. Though little has been determined about the circumstances of their construction due to a lack of excavations, the integration of archaeological techniques, such as landscape analysis alongside a consideration of the positions of these structures has great potential to aid in discerning the factors which led to their construction and placement. In particular, close proximity to harbors would have been of great importance to the inhabitants of the coast and islands, even more so after the arrival of Greek traders during the Iron Age.

Chapter 3: Methodology

3.1 Techniques Used

3.1.1 GIS' potential for archaeology

GIS technology has several benefits for the study of historical landscapes and fortifications, with the main advantage being the ability to manage and display amounts of data which under normal circumstances would be time consuming to process with analogue methods. This has led Garcia and Detes to label the view provided by GIS as a “God’s eye view” (Tejerizo-García and Canosa-Betés 2014: 297), as this potential for multi-criterial analysis gives those who use it the ability to view different data sets layered upon each other in a “all seeing” fashion. The second benefit of this ability to speedily process data is the increase in the size of archaeological surveys now possible. Silke Müth et al state that “One of our first recommendations for the new study of fortifications is to choose as broad an approach as possible, to analyse as many components as is feasible. The broader our aims for research on fortifications are, the wider the range of the applied methods must necessarily be. In addition, the variety of methods will open up a welcome multitude of perspectives” (Müth et al. 2016: 23).

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It is these other methods which come bundled with GIS’ data analyst tools which transform the technology from simply a method of map making to a powerful asset for archaeologists. Out of the variety of tools available to GIS users, two of the most commonly exploited ones within archaeology are viewshed analysis in its multiple forms, designed to examine the projection of control over a landscape through sight lines and settlement catchment analysis, designed to observe the economic situation of a site by analysing its zone of control.

3.1.2 Viewshed, cumulative viewshed and intervisibility analysis

One of the many applications of GIS software and DEMs in the study of geographic data is the analysis of sight lines in relation to geography. Two forms of sight line analysis in particular are used within archaeology, namely; “Predicting whether one point is visible from another (intervisibility analysis) and predicting the total area which is visible from a single point (viewshed analysis)” (Young-Hoon et al. 2004: 1019). Furthermore, the viewsheds of several sites can be analysed on top of each other so areas that can be seen from multiple points are revealed, a technique referred to as cumulative viewshed analysis. These techniques have wide applications in various fields such as construction and urban environment planning but all at their core focus on the visual interactions of an environment's inhabitants with the surrounding landscape. These techniques are performed by calculating; “the elevation difference of intermediate pixels between the viewpoint and target pixels”. For example, if two points are selected the elevation of all points in between them is analysed to determine if any point blocks line of site. If any does, the points are considered invisible to each other, if not then they are visible, forming the basis of intervisibility analysis. This is expanded upon for viewshed analysis, where; “the line-of-sight computation is repeated for all target pixels from a set of viewpoints, and the set of targets which are visible from the viewpoints form the viewshed” (Young-Hoon et al. 2004: 1019).

3.2 Preliminary Research

3.2.1 Data collection

Landscape archaeology methods which will be employed over the course of this thesis require geographic data relating to not only the fortifications being studied but also various elements of the surrounding landscape as well as detailed DEMs. The region in question has luckily been thoroughly surveyed over the course of the past few decades during projects such as the AIP and the various surveys of the Makarska region, meaning the vast amount of the required archaeological data has been collected already. Both regional surveys and excavation reports will be relied upon for the main settlement data while other sources will include satellite images from government websites, topographic maps and photos taken in person while at the site of various hillforts as well as the excellent study; *The Catalogue of Ancient Coastal Settlements, Ports and Harbours* (<https://www.ancientportsantiques.com/the-catalogue/adriatique/>) which records the locations of ancient harbours from across the Mediterranean.

3.2.2 Soil data

Land usage and soil data will prove instrumental in determining the positions of valuable land with agricultural potential. Large scale studies have been performed on the totality of Croatia, resulting in a 1:300,000 covering the various soil types present within the country, however maps on a smaller scale on the Dalmatian islands are currently limited to only Brač and Hvar, both at 1:250,000 (Gaffney et al. 1996: 337). Though these maps are astoundingly detailed, the multitude of soil types present within them is too complicated for the study proposed here, so it is necessary to mimic the soil classifications used within the AIP project;

- Very good soil
- Good soil
- Poor soil
- Very poor soil

The potential for error inherent in this method is noted by Gaffney and colleagues, who state that “Many areas which now have limited agricultural potential must have been more attractive to human use in the past, and some areas which may not have been so useful, e.g. seasonally flooded valley bottoms, may now have been modified to form attractive agricultural zones” (Gaffney and Stančić 1992:114). The reconstruction of past, especially prehistoric agricultural land usage is a difficult task, therefore the only option is to consider this data and the consequent survey results carefully.

3.2.3 Fortification data

The fact that many varied elements of each example of fortification will be recorded and used over the course of research necessitates the creation of multiple tables for the recording of data so as to organize it categorically. These tables, numbering four, will be laid out as follows. Firstly, a general table will be used to record the most basic but also most essential information for each structure:

- Name
- Location
- Coordinates
- Preservation
- Size
- Associated time periods
- References

The aim of this table is self-explanatory, to record the basic context for each fortification as well as other important data. The location category refers to which region or town the fortification lies within, preservation will provide a comment on the current condition of each

structure and associated time periods will describe which periods the site was occupied in, though in instances where no accurate date exists generic terms such as “prehistoric” will be used. Next a table detailing the various strategic and defensive qualities, both in terms the location chosen and the aspects of construction for each structure will be used:

- Elevation
- Distance to nearest fresh water source
- Distance to nearest food source
- Distance to coastline
- Structure type
- Fortification style

By analyzing these qualities more information can be gained on the decision-making process and particular practices of the prehistoric local inhabitants when defending a region such as where or what they chose to fortify and how they did so. The information contained within the first category of this table after name; Elevation is aimed at placing each fortification within the geographic landscape. The following three relate primarily to the analysis of what features within this landscape may have influenced the choice of location and method of construction for fortified structures, such as proximity to various locations that may have proved of importance to the original builders. The last two are designed to differentiate each fortification based purely on their physical qualities (structure type is explained in section 3.2) fortification style provides a brief comment on the construction of the fortification, such as if the walls are considered megalithic or not and how many ramparts the structure possesses. The third table relates to the various aspects of each structure’s viewshed:

- View of ocean
- Number of Greek structures within viewshed
- Number of Illyrian structures within viewshed
- Total area within viewshed

This will be one of the most important tables as tracking lines of sight is currently the best way of tracking lines of communication, and therefore the networks formed by prehistoric structures. As such the recreation of the “cognitive landscape”; what the original inhabitants of these structures saw and experienced is of paramount importance to the understanding of the reasons behind their construction. The majority of information within this table will be filled out during succeeding phases of research. Considering that this thesis deals primarily with the securing of maritime trade, structures with a view of the ocean will be of the most importance. The purpose of the rest of the categories within this table is to establish each structure’s potential for serving as an effective observation post by determining how many

other structures, some of which may have needed to be communicated with or perhaps watched closely such as the Greek structures. The final table is designated as “other” yet relates primarily to what factors may have influenced each structure’s place within the surrounding trade routes:

- Quality of trade goods discovered
- Evidence of local goods production
- Currency discovered

The quality of trade goods within each structure will aid in determining which examples may have been preferentially selected for trade, therefore a brief comment will be provided within the relevant category as to what goods of note have been found, where they originated and a general rating based on the following formula: Low for only local goods, Medium for foreign common goods such as pottery or tools and High for exotic goods such as jewelry or noble armaments like blades or armor. The presence of currency within a settlement is also a telling factor as to whether it was visited by traders or not, as is the presence of facilities for the production of goods for trade, therefore each structure will be given a note based on these factors as well.

3.3 Analysis

3.3.1 Viewshed and intervisibility analysis

After the inputting of the various types of data collected above into GIS software, specifically ArcGIS Pro, the analysis of the data can begin. Firstly, an intervisibility analysis will be performed to establish, through sight lines, which structures may have formed networks with each other. This will be followed by a cumulative viewshed analysis done on each network as well as a careful observation of any connections that may appear between structures on separate land masses. By analysing the sight lines of hillforts more about their specific functionality can be gleaned, with those placed upon large hilltops with wide sight lines for example likely being watch towers or those in view of agricultural land being fortified settlements. A potential issue may occur during this step resulting from inexactitudes in the point that viewsheds are measured from, as a difference of a few metres vertically or horizontally can drastically change the results of this analysis. A remedy for this is to default to the highest point within or directly next to hillforts that could have realistically been climbed to, therefore ensuring that each hillfort is consistently given the best possible representation of its viewshed.

This is an attempt to embody the principles outlined in Fachard’s description of the landscape method, namely endeavoring to determine “the factors that commanded the placement of

fortifications in the landscape” (Fachard 2016a:414). In fact, a “GIS-based study of a region’s archaeological dataset...based on the collection of published and known archaeological features, which are subsequently linked with geographical information in a dynamic and accessible digital environment” is exactly the recommended technique (Fachard 2016b:213).

3.3.3 Trade networks analysis

All the above data should be considered alongside a survey of trade goods discovered within each settlement with the aim of tracking the flow of trade between the structures. It is hoped that through the addition of this data resources of particular importance to the study of trade routes; currency, exotic trade goods and the facilities for making them can be tracked. Settlements with high amounts of these trade related goods can then be theorized as centres with frequent foreign traffic, likely due to them being set up in favourable conditions. However, it must be noted that this step requires that sites be properly investigated through excavations, therefore a bias may exist where settlements which have been extensively excavated are considered more connected with maritime trade routes above those that have not been. Nevertheless, this method can be used to find correlations between the presence of trade goods and factors such as location and structure type.

3.3.4 Settlement typology

Once all the data has been added and the surveying methods performed, structures should be categorized into groups based upon their theorized function, based upon each structure’s results in categories from the other tables. The two categories are:

- Subsidiary structure
- Settlement

Potential as a tower is based upon the size of a structure’s viewshed and how many valuable locations are encompassed within it, such as harbors, other structures, agricultural and the ocean. Also, to be considered as a tower a structure must be situated upon a high point at least 100 m above sea level or if situated lower than this it must be within 1 km of the coastline. This is to include structures which may have been placed specifically for the observation of sea traffic for example which would necessitate close proximity to the coast but not require high elevation. Potential as a population center is based upon size; above 2500 m² at least and proximity to fertile land, in this case within 2 km which would be needed to support a large number of inhabitants. The reason for the selection of 2500 m² is that during the AIP several sites were labelled as settlements, the smallest of which was Rat on Brač which was listed as

being 2500 m² in size. This report shall therefore follow suit and use this size as a base minimum for settlement sizes.

Conclusion

The fortifications spread out among the islands of Hvar, Brač and the Makarska littoral are best studied through a combination of several different analysis techniques which detail the physical landscape, the interconnection of sight lines and the frequency of exotic trade goods within the study area. Through this process, the blank space between sites will be detailed with historical data, leading to the establishment of a settlement hierarchy, the discovery of the factors which detailed settlement placement and how these changed with the increase of foreign presence in the Adriatic.

Chapter 4: Results

4.1 Fortification Characteristics

4.1.1 Elevation

The highest recorded elevation across the study area in meters above sea level was 778 at Vidova Gora on Brač and 5 at the lowest at Pharos on Hvar, though this is based on the location of the current Greek ruins as an approximation of a potential prehistoric settlement's location and elevation. Brač has the overall highest elevation for its fortifications with a 389 m average while Hvar has 199 m and the Makarska littoral has 192 m. On the Makarska littoral, the structures do not lie on the highest possible peaks, but rather on moderately level portions of the spurs of the mountains, typically on a lower elevation than would be offered by the higher peaks.

4.1.2 Size

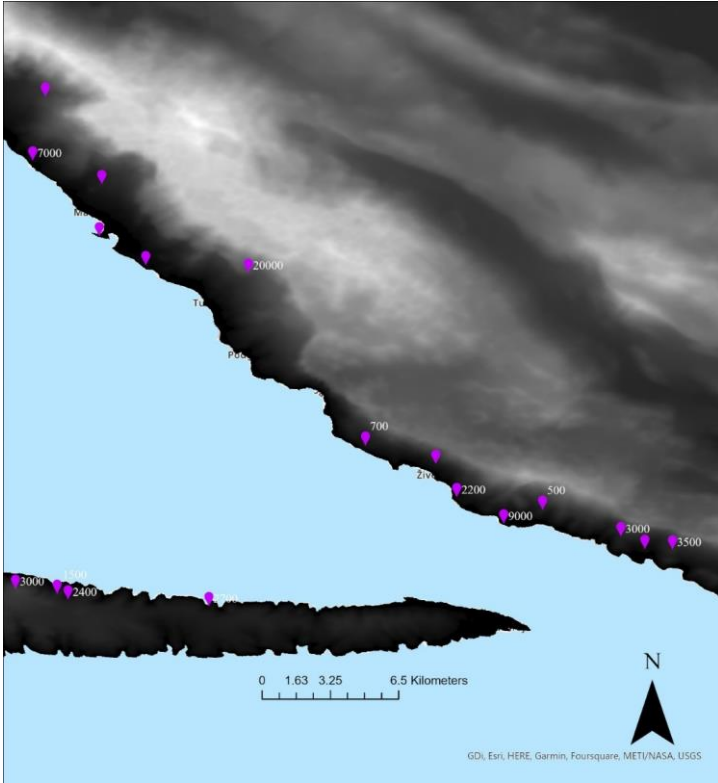


Fig. 5. Size of hillforts on the Makarska littoral and east of Hvar

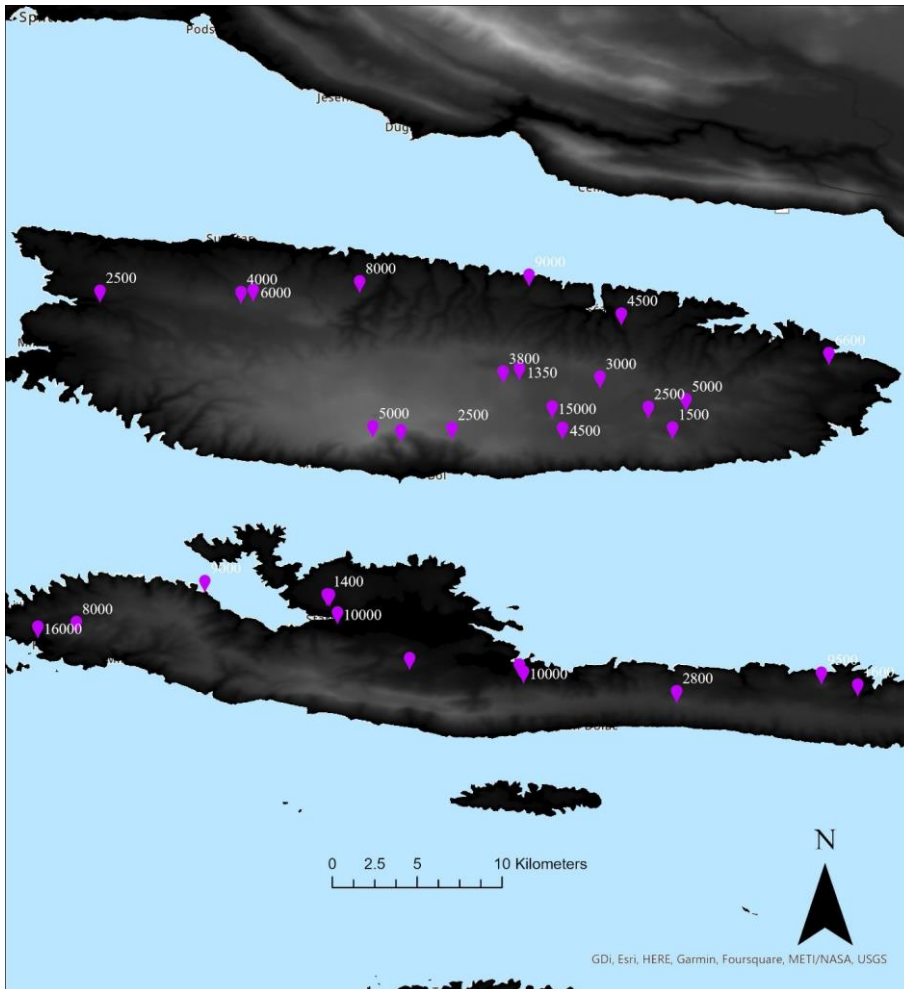


Fig. 6. Size of hillforts on Brač and the west of Hvar

The average size in meters squared of the structures built upon Hvar is 5723, 5015 on Brač and 5737 on the Makarska littoral. Typically, one larger structure is surrounded by several smaller ones, though in some locations such as the north of Brač and the west of Hvar structure sizes are on average larger.

4.2 Intervisibility and Viewshed Analysis

4.2.1 Connections with other structures

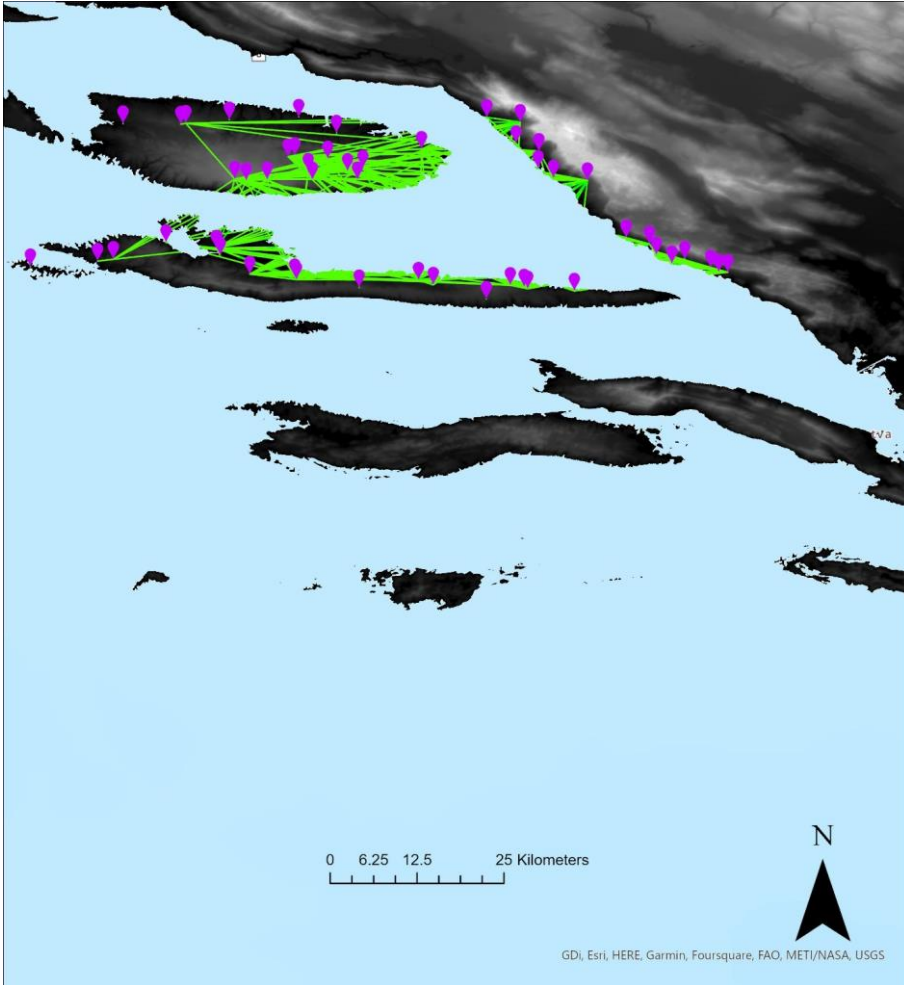


Fig. 7. Intervisibility connections across the study area

Viewshed networks can be traced across the three different locations, with all the structures on the Makarska littoral, the north-central parts of Hvar and the south-eastern parts of Brač having a large number of other structures in view. On the south and south-western portions of Hvar however there lie structures which are not connected via intervisibility with any of the surrounding sites, this is also the case on the north-western parts of Brač. These fortifications, isolated from other existing intervisibility networks are typically close by to other structures meaning some connection may have been maintained through a method other than sight, however this is not the case with the sites on the north of Brač which are in more isolated

locations. If one untangles the mess of intervisibility networks, it is possible to distinguish small networks forming between closely aligned structures which are almost all mutually visible save for the above-mentioned examples. Along the Makarska Littoral, two main networks can be distinguished.

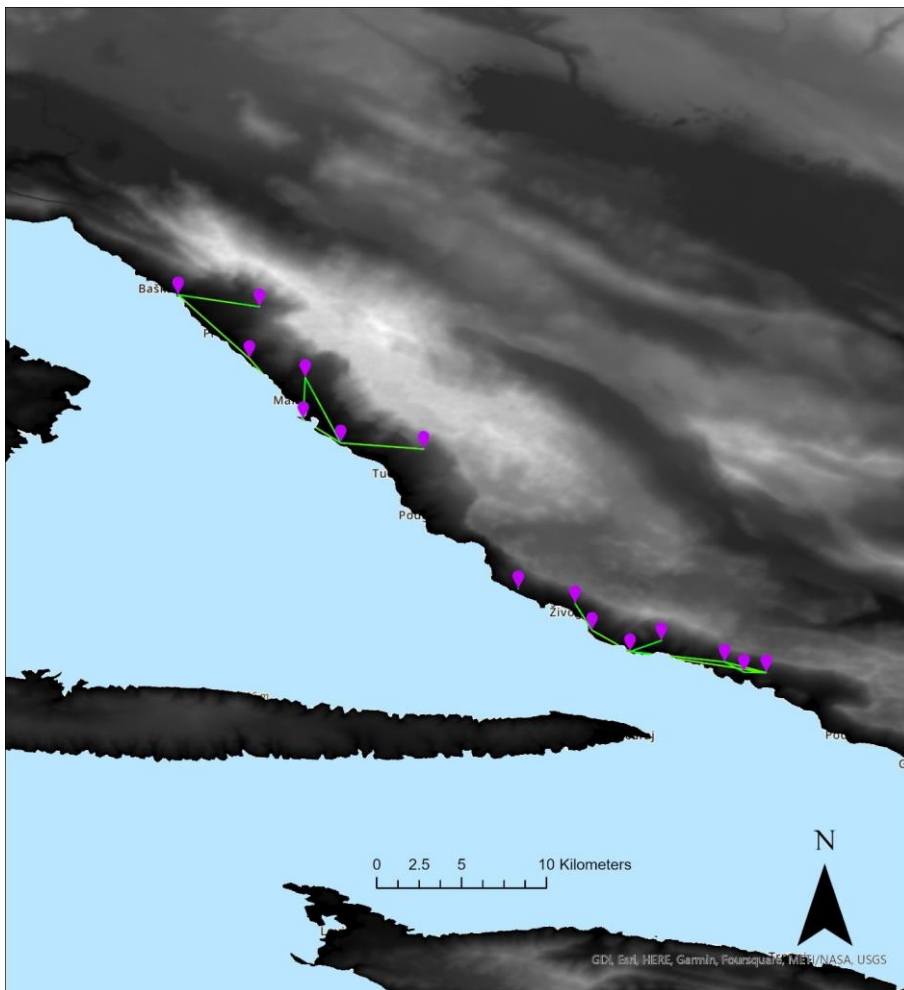


Fig. 8. Intervisibility links across the Makarska Littoral

There is a difference in the way in which these two networks operate, the northwestern example has a string of structures which are interconnected, running from Gradina at Baška in the north to Grad Gradina to the southeast. To the south lies the grouping of structures,

which seems to have multiple branches of intervisibility which meet at Matijaševica and also have a hillfort on their periphery; Velika Gomila to the west.

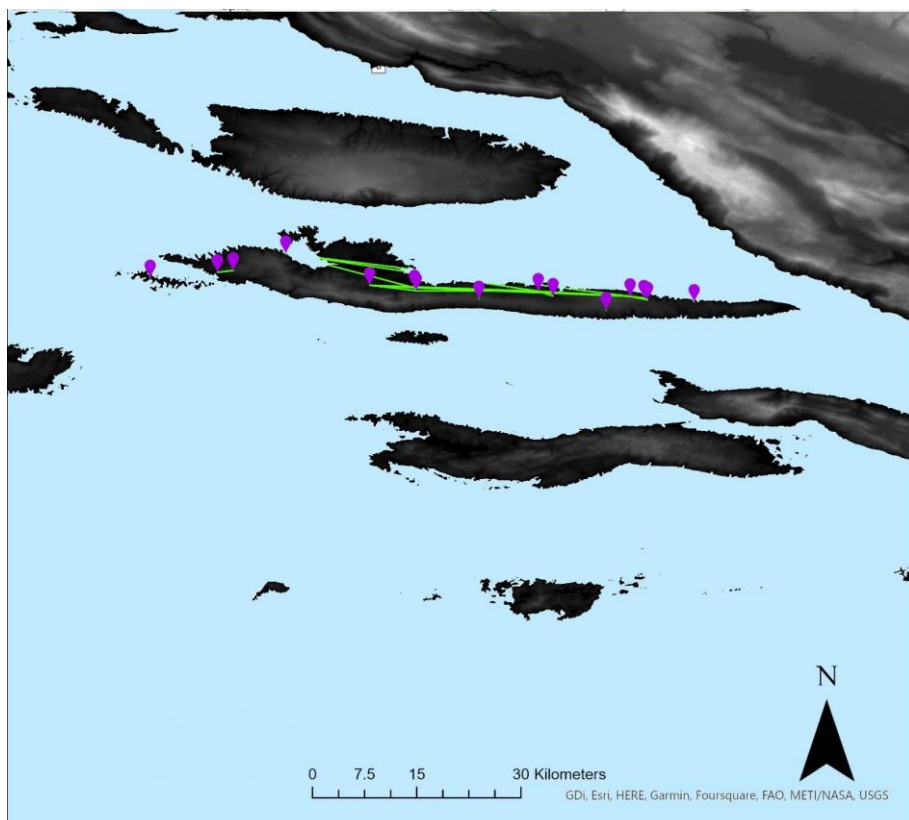


Figure 9 Intervisibility links on Hvar

On Hvar it is harder to distinguish individual networks as a single web of interconnected structures spans the centre of the island with multiple structures lying at the periphery. Some of these structures such as Kastil and its subsidiaries Vela Glava and the hillfort on the Pakleni Otoci towards the west of Hvar may have formed their own miniature networks. The same can be said of Brač, where a single continuous network stretches across the island with structures on the periphery. However, as stated many of these periphery fortifications are more isolated than their Hvar counterparts and therefore may be isolated even from each other.

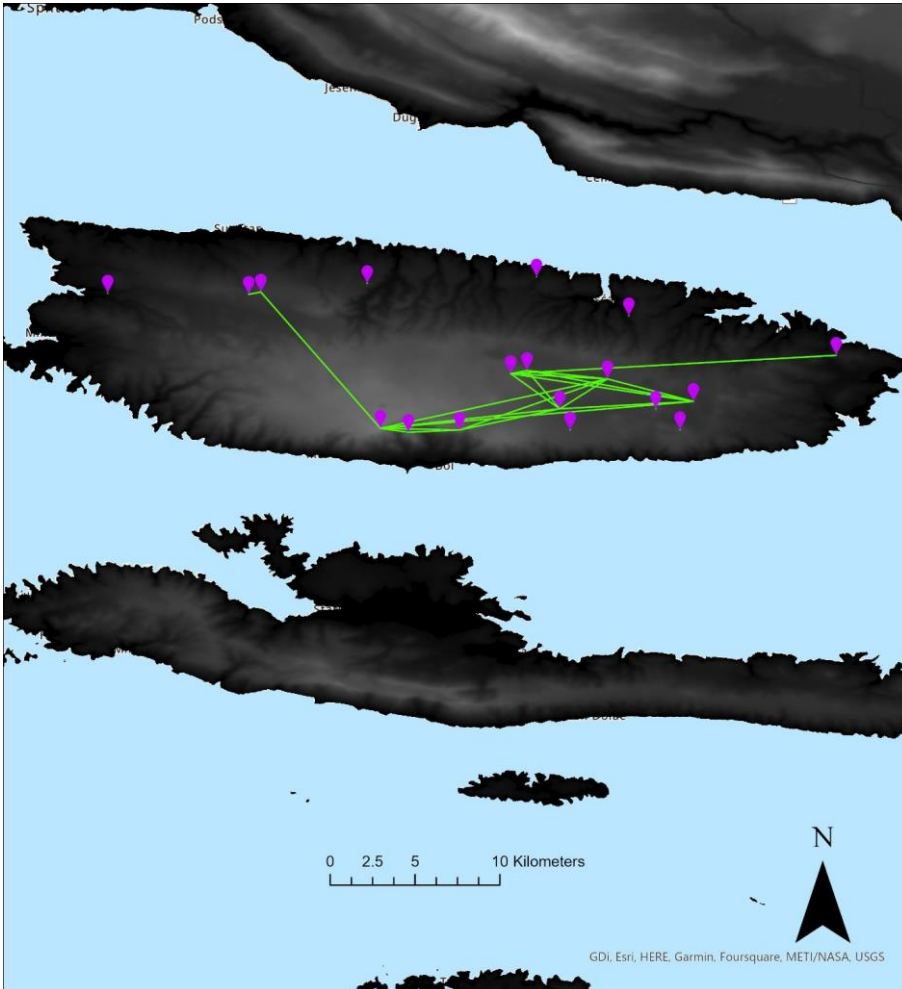


Figure 10 Intervisibility links on Brač

4.2.2 View of ocean

All but one structure has a line of sight towards the ocean, though some structures are quite far away from the coastline meaning they likely would not have a particularly clear view of the sea. Some structures have viewsheds which extend out towards the ocean without much view of the land surrounding them, such as those afore-mentioned sites on the south of Hvar and North of Brač. A wider analysis of the total viewshed of all the combined structures shows that in particular two parts of the coastline was observed by a great many structures, that being along the coastline of the Makarska littoral, particularly its northern segment and

the Peljesac peninsula which guards access to the mouth of the Neretva River, a path running northwest to southeast in between the islands and coastline.

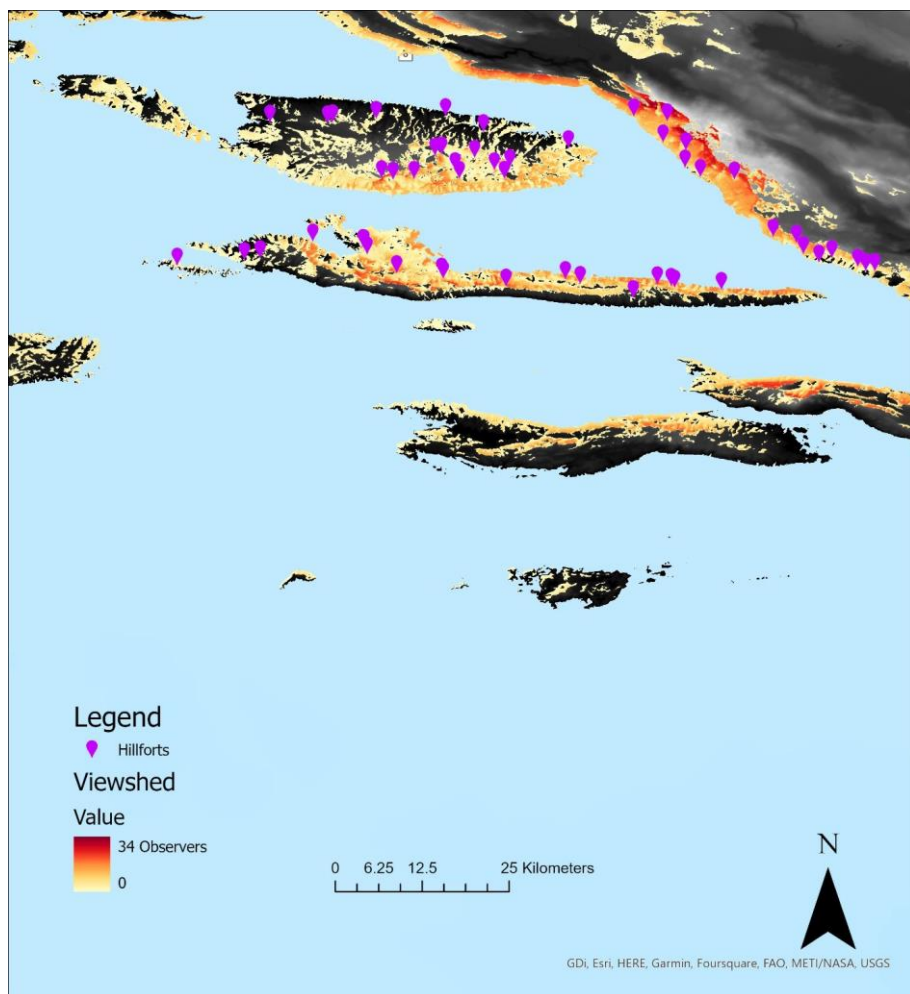


Figure 11 Total viewshed

4.2.3 View of Greek structures

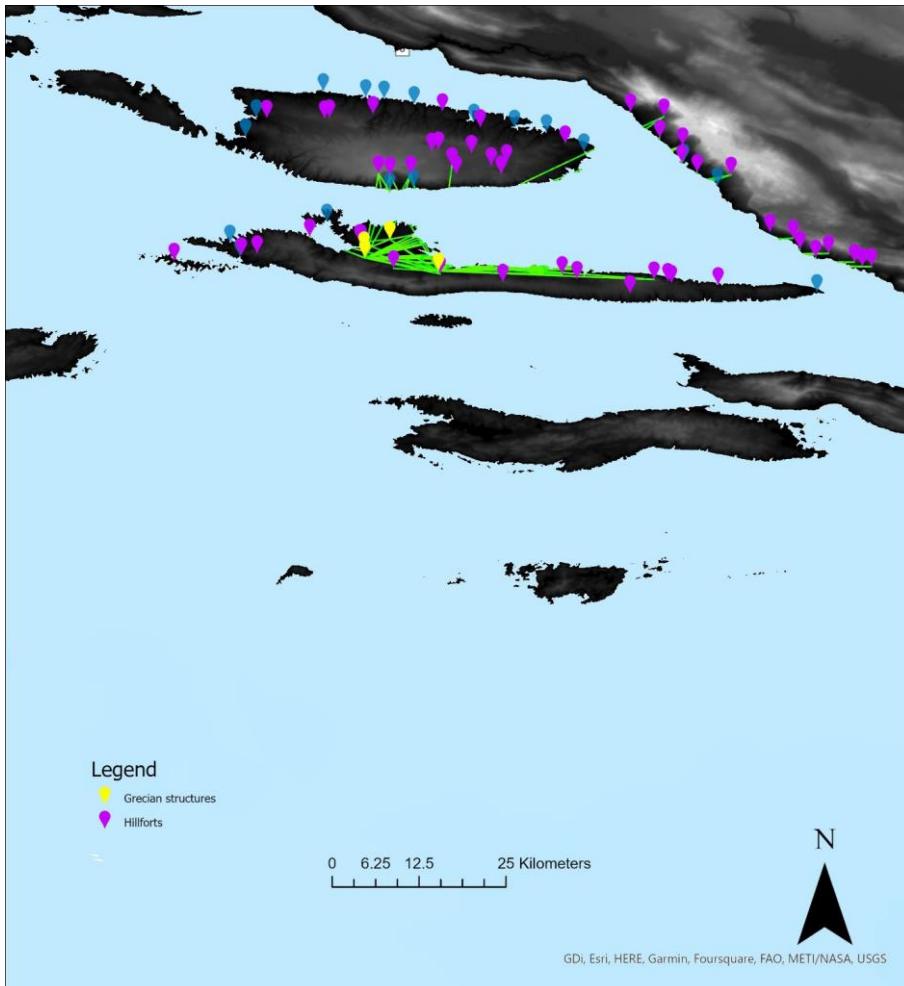


Fig. 12. Locations of Greek structures and harbors

The four Greek sites present on Hvar; Pharos, Tor, Malisnovik and Purkin Kuk can be viewed from some of the sites in all three locations, with only a few on the southern side of Brač and the Makarska littoral having visibility. Less than half of the total structures can trace visibility to the Greek sites.

4.2.4 Inter-locational connections

Most structures can see other sites on the neighboring islands and mainland, in some cases multiple. There are a few which can draw no line of sight to sites on any other locations

presented with this study, however it is likely that they can see structures not contained within this report, such as the aforementioned isolated sites on the west of Hvar and the north of Brač. Interestingly, along the Makarska littoral sites seem to be clustered on the parts of the coastline close to the islands, with the space in between being uninhabited, likely due to distance from either island.

4.2.5 Viewshed changes by time period

Almost every Iron age site except for Gračišće on Brač can draw line of sight to at least one of the Greek structures on Hvar. Also, on Brač the Bronze age sites typically do not make up networks which span the ocean to the other locations whereas the unclassified sites in the south-east of the island seem placed to best observe both sites on the north-central portions of Hvar and along the Makarska littoral.

4.3 Landscape Analysis

4.3.1 Proximity to agricultural land

On Hvar and the Makarska littoral all structures sit directly within or close by to areas of agricultural land, with sites on the Makarska littoral all being under 1 km away. On Hvar it is especially easy to see that the structures are primarily clustered around small patches of land in an equal fashion. On Brač the distribution of structures is more confusing, though no structure is more than 2 km away from a patch of agricultural land on the south-eastern portion of the island where most of the sites are located these patches are small, whereas the north-western portion of the island is covered in fertile land but with only a few fortifications present.

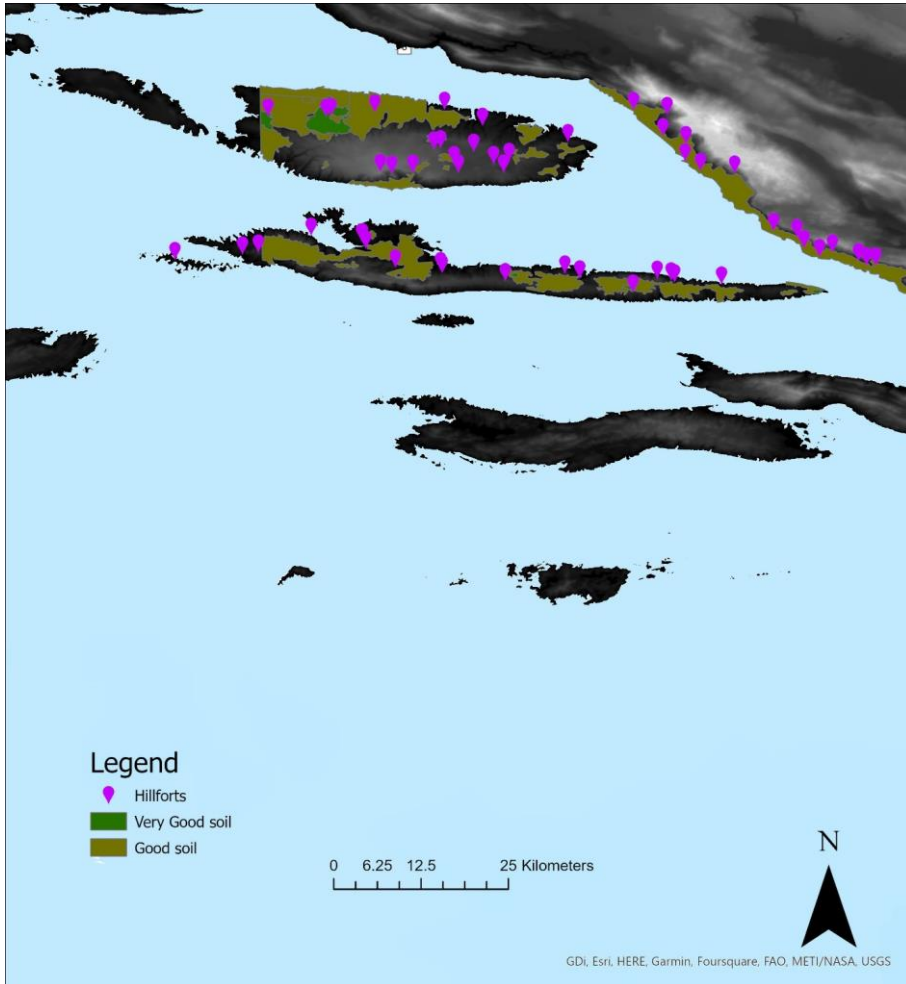


Fig. 13. Site locations in comparison with fertile soils

4.3.2 Proximity to coastline and harbors

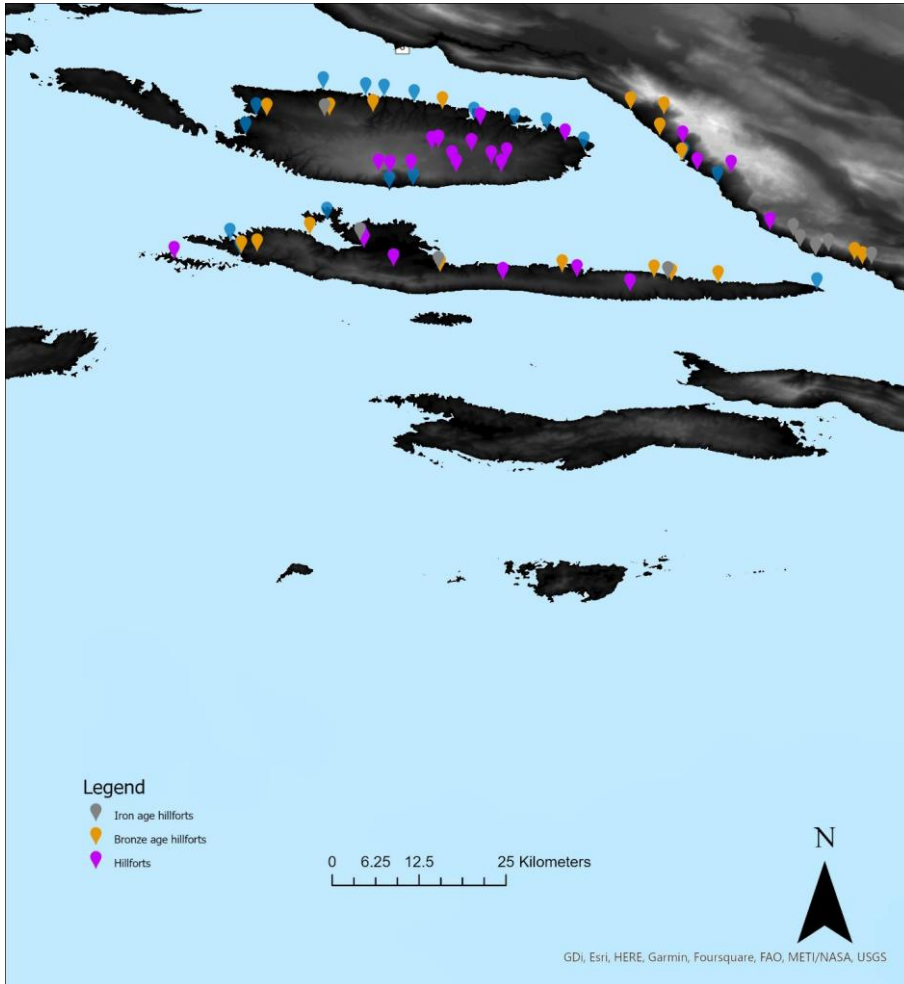


Fig. 14. Hillforts divided by time period

The majority of structures lie less than 2 km from the coastline, with Velika Gomila in the Makarska littoral being the furthest structure away at 7 km. Distance from harbors is increased for most structures, with some examples being up to 19 km away as is the case with Turnić. The distribution of harbors is uneven across the three locations, with many of them lying along the northern coastline of Brač. On Brač in particular harbor proximity seems to have been a dictating factor in the placement of fortifications, and on Hvar the few recorded examples of harbors do have settlements placed close by to exploit them, though this is not the case for the harbor on the far eastern side of the island which would not be exploited till later periods.

4.4 Settlement Typology

4.4.1 Large settlement distribution

On Brač, sites sitting along the northern edge of the island all are above 2500 m² and lie within 2 km of agricultural land and have therefore been labelled as larger settlements capable of supporting themselves. Several also lie within the cluster of hillforts in the south-east portion of the island. On both the Makarska littoral and Hvar larger settlements lay evenly distributed across the landscape. There seems to be no pattern in their placement alongside coastlines or harbors, and while most of them lay within a very short distance from agricultural land, the examples on the south-east of Brač are anomalous. There is also no pattern in their distance from each other, some examples such as the Kastil and Vela Glava at Hvar are less than 2km apart. The structures which have been declared settlements are as follows;

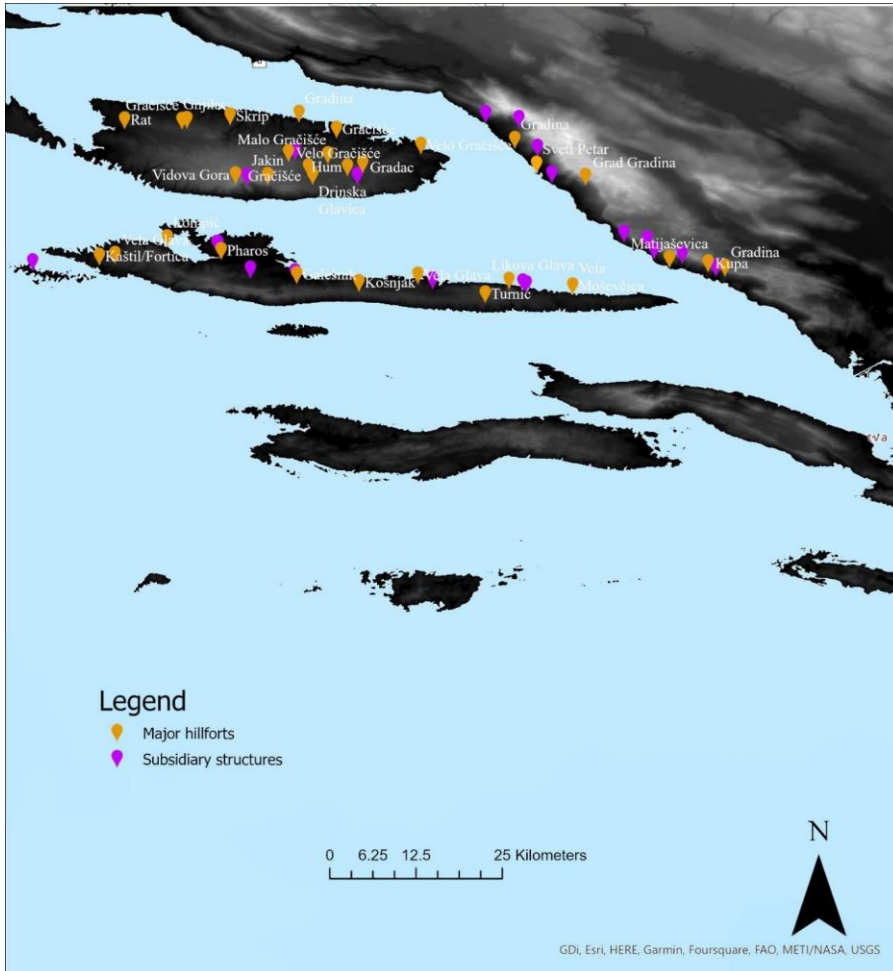


Fig. 15. Major and minor hillforts

4.4.2 Subsidiary structure distribution

Smaller sites which likely were used as look out sites or towers rather than population centres are found close by to larger settlements, though usually no more than two can be linked with any single settlement. On average subsidiary structures lay under 2 km from a major settlement, though some examples have been found further away with the most extreme being Pakleni Otoci which lies 7 km away from Kastil, though they lie upon separate landmasses, so this is understandable. Out of all the structures labelled as settlements; 31 in total, only 13 of them have detected subsidiary structures connected with them.

4.5 Trade Goods Analysis

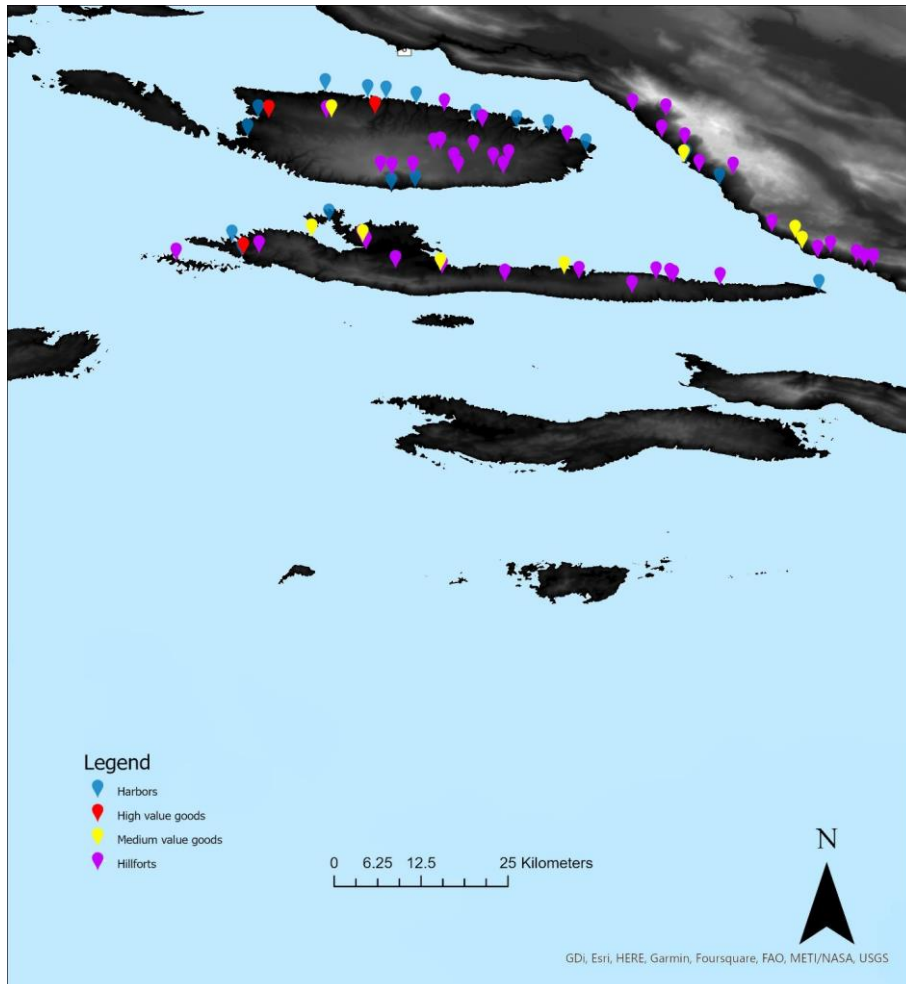


Fig. 16. Locations of trade goods

4.5.1 High and medium trade good locations

The distribution of structures within which trade goods have been recovered; either foreign pottery or more exotic goods are scattered across the study area in an uneven fashion. What is clear is that these goods are more common along the north of Brač and the West of Hvar, areas which both lay close to a number of harbor locations suitable for the mooring of ships.

Along the Makarska littoral however the few locations where these goods have been recovered lie away from detected harbor locations yet close to the coastline regardless. Similarly, every instance of a site with trade goods is in close proximity to agricultural land. The dating of the various trade goods is also an indicator into the evolution of trade routes present within the study area. Of the sites found to have foreign trade goods present, only two have goods which can be dated to the Bronze Age, those being the previously mentioned examples of Skrip on Brač and Sveti Petar on the Makarska littoral.

4.6 Summary of Hillfort Organization

4.6.1 The settlement layout during the Bronze Age

In general, structures present within the study area during the Bronze Age tend to be placed near areas of agricultural land (see section 4.3.1) and the coastline. Also, Bronze Age structures tend to be larger meaning that very few of them fall under the classification of subsidiary structures according to the specifications set during this study. Many of the largest structures where foreign trade goods have been discovered from the Bronze Age, namely Kastil which had reached “pre-eminence” on Hvar in the 4th century BC (Kirigin et al 2021:22), Rat and Skrip lie on the periphery of established fortification networks though examples such as Kastil seem to be a part of their own small networks (section 4.2.1). The hypothetical prehistoric settlement at Pharos also sits near the coastline but is surrounded by several smaller subsidiary structures. The layout of hillforts on the Makarska littoral is sparser, though a substantial grouping around Sveti Petar is present.

In terms of trade goods, On Brač and the Makarska littoral the sites closest to the coastline tend to have trade goods, with almost all Bronze Age sites along the north Brač save for the Gradina at Bratus having some evidence of foreign trade. On Hvar while the spread of trade goods is less structured many of the sites towards the western tip of the island have foreign trade goods, however a few sites along the central northern edge also contain pieces of foreign pottery.

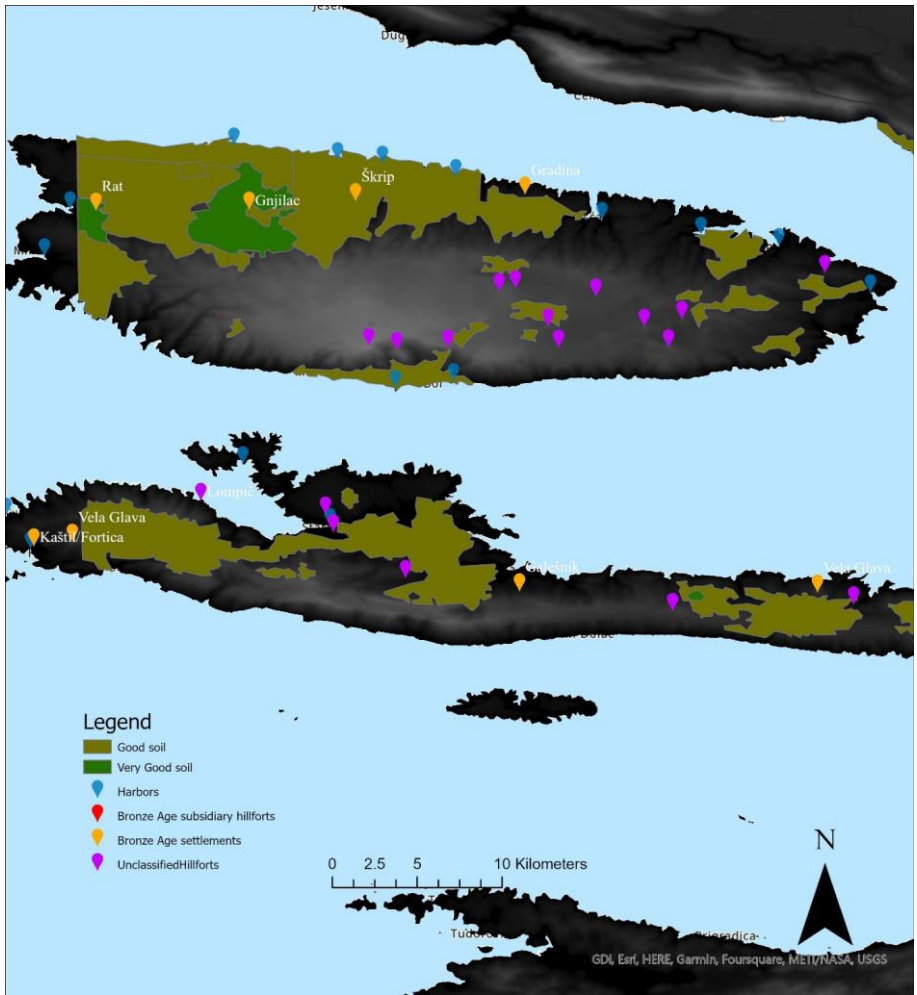


Fig. 17. Summary of information on Brač and the west of Hvar

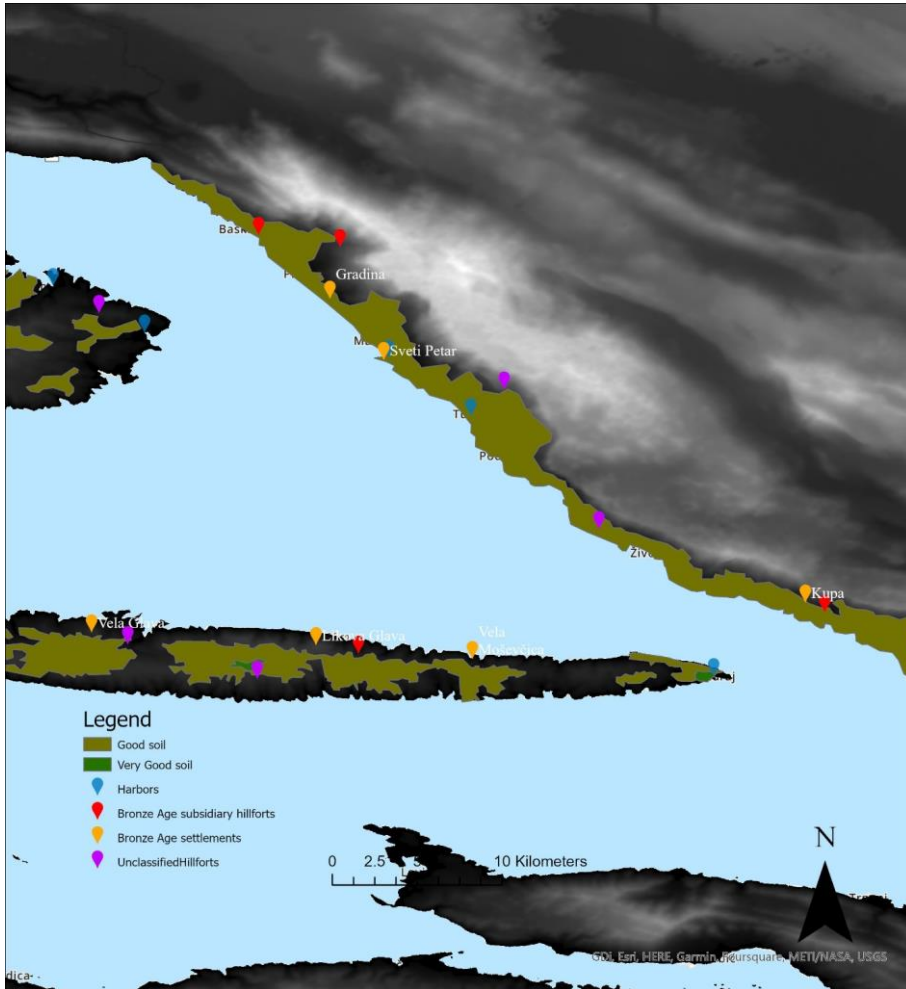


Fig. 18. Summary of information on the Makarska littoral and east of Hvar

4.6.2 The settlement layout during the Iron Age

The settlement layout within the study area maintains a high degree of continuity from the Bronze Age save for two distinct examples. The first and most obvious is the interposing of the Greek field system on the Stari Grad plain consisting of the settlement of Pharos, the tower of Tor which was previously an Illyrian settlement and the new towers of Malisnovik and Purkin Kuk. These structures cannot have appeared earlier in the Iron Age than the founding of Pharos in 384 BC, though it is unclear if they were erected immediately afterward to increase control over the plain or slowly as time passed and the Greeks gained

greater control. Also, noticeable if one looks closely at this system is the hillfort of Glavica to the north of Pharos. It rests close to the Greek sites, closer to Pharos even than some of the other Greek built structures which is unusual.

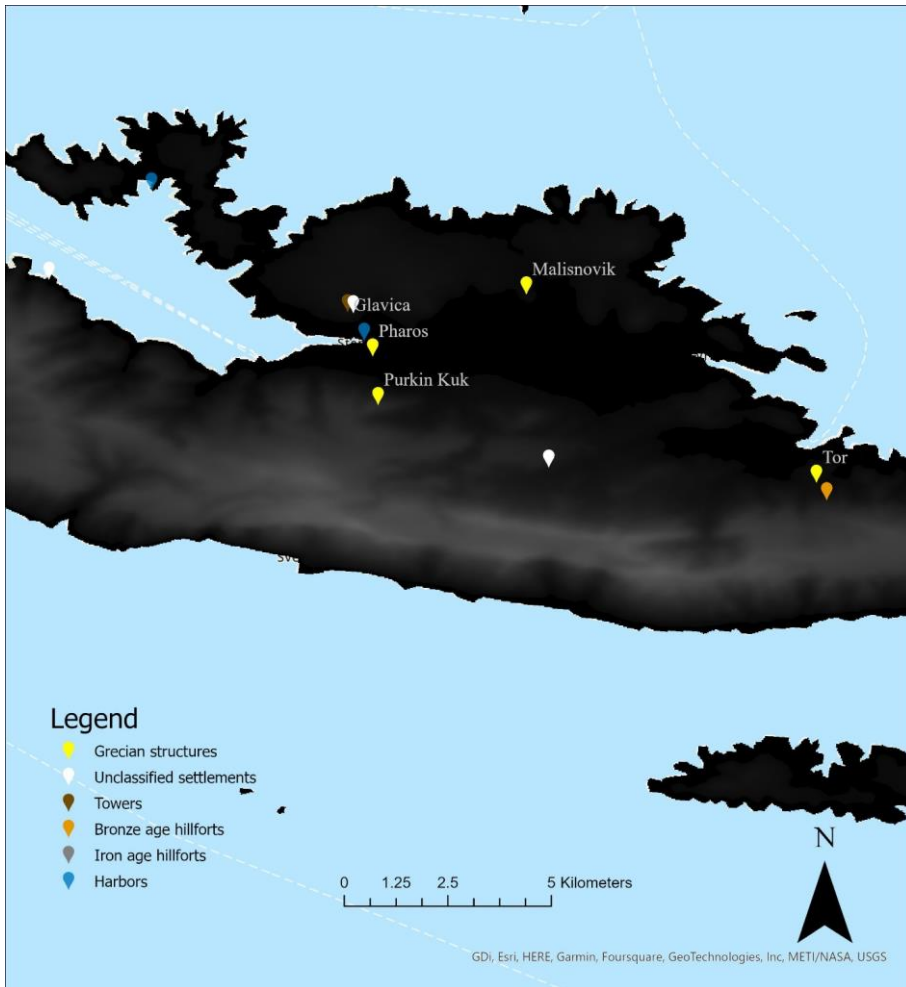


Fig. 19. Closeup of Stari Grad field structures

The other area of great change is on the Makarska littoral where several hillforts appear in the area of ML2.

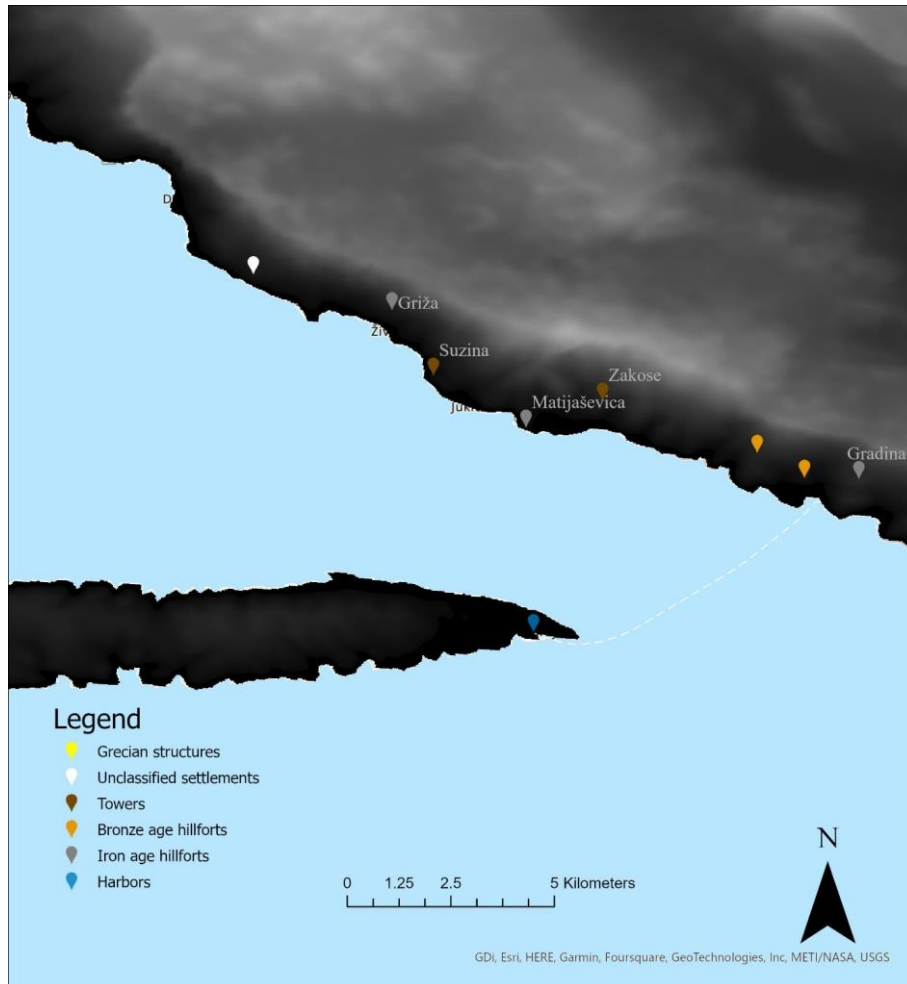


Fig. 20. Close up of southern Makarska littoral network

According to the archaeologist Marinko Tomasovic; these structures appeared in a staggered fashion, the major settlement Matijasevica first during the 8th-6th century BC and the three surrounding structures; Griza, Zakose and Suzina later in response to conflict. In his opinion this is the Roman invasion of Dalmatia, possibly around the 2nd century BC (Tomasovic 2006:51) based upon the presence of early Roman pottery, however it is also noted that generic Iron Age pottery finds are present at all of these sites, meaning that their construction date is difficult to determine.

4.6.3 A note on continuity into the Iron Age

The dating of the structures present within the study area is based heavily upon the presence of artefacts within them from different time periods, the main issues of which will be discussed further below. A brief point is that while it is somewhat simple to tell in the case of the Iron Age which new structures may have come into existence based upon a lack of earlier archaeological material (although this is subject to change as new excavation data is gathered) it is harder to define which Bronze Age structures may have fallen out of use in this transition. A good indicator however is whether sites persisted in usage till Roman, Medieval or even Modern times as it is unlikely that a site, once abandoned, would be resettled unless it was a particularly good location and typically the largest and most populated native sites became Roman settlements after the conquest of the region.

4.7 Issues in Research

Due to the fact that this study is primarily desktop based or relies upon previously performed field work, many of the physical characteristics of fortifications need to be estimated from topographical data in the case of elevation or satellite data for the size of structures. Especially in reference to this latter point, only structures which are highly visible from satellite images are able to have their size and even precise coordinates recorded. For structures which do have visibly remaining ramparts this process is also made difficult by the fact that they tend to blend into the surrounding environment littered with natural stone mounds or farmer's walls quite easily. This has led to some exceptional examples having appeared such as Grad Gradina in Tucepi which judging from the satellite images could be anywhere under 20000 square meters in size! It is listed however as one of the most important forts in the area (Tomasovic: 60). Because these structures have no size associated with them, they do not fit into either the settlement or tower categories and are therefore listed as unclassified. This is not the case on Brač where settlement sizes were recorded on site during the AIP and as such these settlement sizes are much more trustworthy.

The time periods associated with certain sites are unclear from the sources consulted during this study, therefore many have been labelled as unclassified when it comes to time period as well. Unless they have a time period associated with them, they cannot be included in the data set and will leave glaring gaps, therefore educated assumptions will have to be made concerning their placement in the archaeological record. For example, after performing an intervisibility analysis on only the structures which can definitely be said to have originated

during the Bronze Age it was found that practically no structures maintained an intervisibility connection (Fig.).

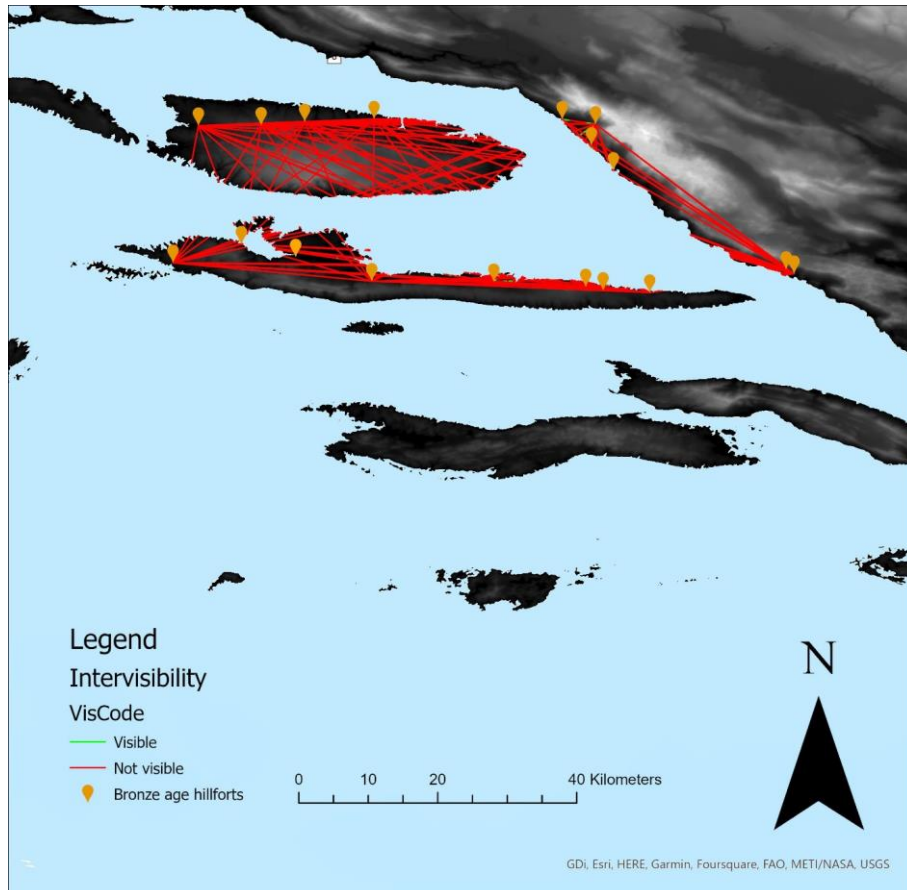


Fig. 21. Links between Bronze Age structures not sharing visibility

The sequence of intervisibility connections which is characteristic of hillforts during this time is broken without the inclusion of the unclassified structures, meaning that they likely did have a place within this network of hillforts during the Bronze Age and should be considered a part of it.

The soil data map used to supply information about the agriculturally fertile land upon the islands is a high-resolution scan collected for the European database of soil maps or EuDASM, however it is incomplete and therefore the soil class data cuts off towards the west end of both islands. This does not drastically change the results, settlements close to the west end of the islands are in close proximity to fertile land rather than being directly placed on

top of it. The distribution of harbors is uneven and cannot represent every location which may have been a viable stopping off point during the Bronze and Iron ages, therefore the harbors represented in this study should be taken as a small selection to illustrate how settlements interact with them.

Conclusion

The above results represent a compilation of published data; settlement, fortification and harbor locations as well as artefact finds combined with collected geographical data to form a comprehensive view of the archaeological landscape studied during this report. This data shall be used in the following chapter to provide a theoretical outline of the factors which influenced the formation of settlement and fortification networks present within the study area.

Chapter 5: Discussion

5.1 Structural Connections

5.1.1 The relationship between the settlements and subsidiary hillforts

A clear pattern of settlement and subsidiary structure placement can be detected on parts of Hvar and Brač where one larger settlement structure surrounded by two or at most three smaller sites. This would be the most effective layout of fortifications if the study area consisted not of a singular political entity spanning all three locations or even a singular location but instead small tribes competing for space and access to the rare patches of fertile land on the islands. However, this pattern does not include all sites within the study area, as there are many examples present which were obviously settlements considering they were large in size, had extensive fortifications and nearby graves and artefacts such as pottery present, yet have no subsidiary structures. Also, the proximity of many of these settlements to each other, in multiple instances only a couple of kilometers away indicates that some form of connection did exist as it is unlikely that warring or even neutral tribes would tolerate each other as competition over resources would have inevitability occurred. Whether this competition was violent or not is uncertain, so the subsidiary hillforts situated around patches of land may be more like white picket fences than barbed wire barricades but in any case, where forts exist, they are most certainly restricting barriers and property markers. Based upon only settlement placement the relationship between sites is unclear.

5.1.2 Intervisibility connections

The mass of intervisibility links present between the included sites brings forth the question; if the study area is made up of a multitude of settlements which may be completely independent and competing for space then why can extensive intervisibility connections be traced between them? The first answer would be to state that they may not be completely independent and multiple settlements could maintain some cooperation in the defense of resources thereby necessitating communication facilitated via intervisibility connections, a topic which shall be discussed further. Another point however is that other reasons for intervisibility links could exist. Assuming that each intervisibility link is purposeful, there very likely was a need for settlements to keep an eye on their neighbors in case of incursions into their designated zones of control, which could include the exploitation of resources such as grazing one's cattle on another tribe's area of field or fishing too close to one of their coastal settlements. It is also entirely possible that the connections were accidental, as a settlement placed upon a high point to observe the surrounding landscape could probably easily see other structures placed upon different high points for the same purpose.

Upon close examination of each structure's viewshed, however, it is clear that multiple settlements were built with the intent of complementing each other by maintaining a view of different areas of the surrounding landscape, such as a grouping of three structures within the

centre of Hvar; Vela Glava, Košnjak and Gradac.

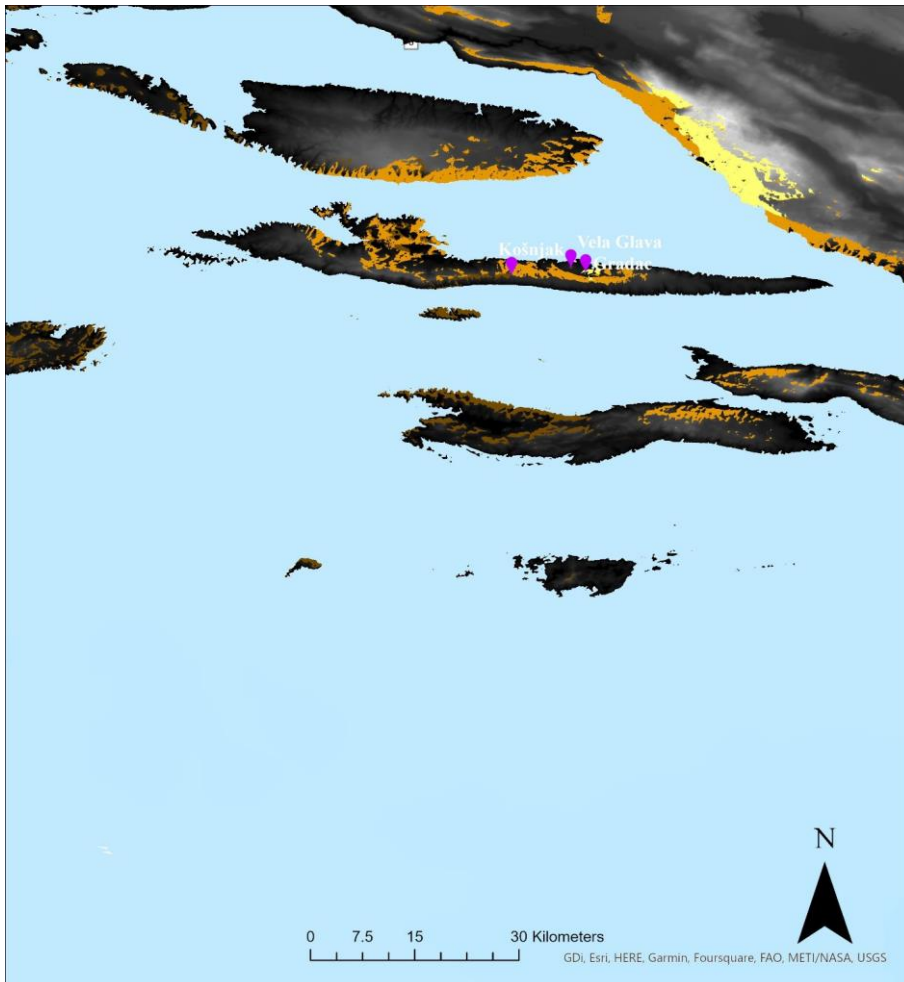


Fig. 22. Viewsheds of Vela Glava (orange), Kosnjak (brown) and Gradac (yellow)

Vela Glava, obviously a central settlement considering its size of 9500 m² is situated on a position 349 m above sea level from which it can observe the area south to it which contains good soils as well as the Makarska littoral and the southern coast of Brač. Košnjak, a smaller structure sized 2800 m² though still a settlement is placed 139 m above sea level and in a position from which it can see most notably the island of Vis to the west of Hvar and the Peljesac peninsula and the island of Korcula to the south, while having very little overlap with the viewshed of Vela Glava. Gradac, situated to the east of Vela Glava seems to be placed very specifically to examine the sites along the northern parts of the Makarska littoral

coast, though the important site at Sveti Petar is just outside of this viewshed perhaps ships travelling there could be viewed from Gradac. Though both Vela Glava and Košnjak are both considered in this study as settlements, the mutually beneficial nature of their viewsheds indicates some kind of cooperation and purposeful placement.

5.1.3 Settlement hierarchy

Perhaps Vela Glava is a larger settlement like a proto civil center or city while Košnjak could have housed a smaller population but still been subservient to its larger neighbour. The question of whether or not settlements had cooperation with each other and if they did, which ones is difficult to answer without the knowledge of tribal alliances, however by taking the size of settlements into account and using this as an indicator of a settlement's potential as a prosperous cultural center it is easier to determine which settlements may have dominated their neighbors. Other than the above-mentioned examples, more evidence examples of cohesive bodies of settlements can be found throughout the study, with the most obvious examples being the grouping of structures in the south of Brač. Upon examination of these settlements, it is clear that they form a radius around the largest settlement on Brač, Gracise at Bol.

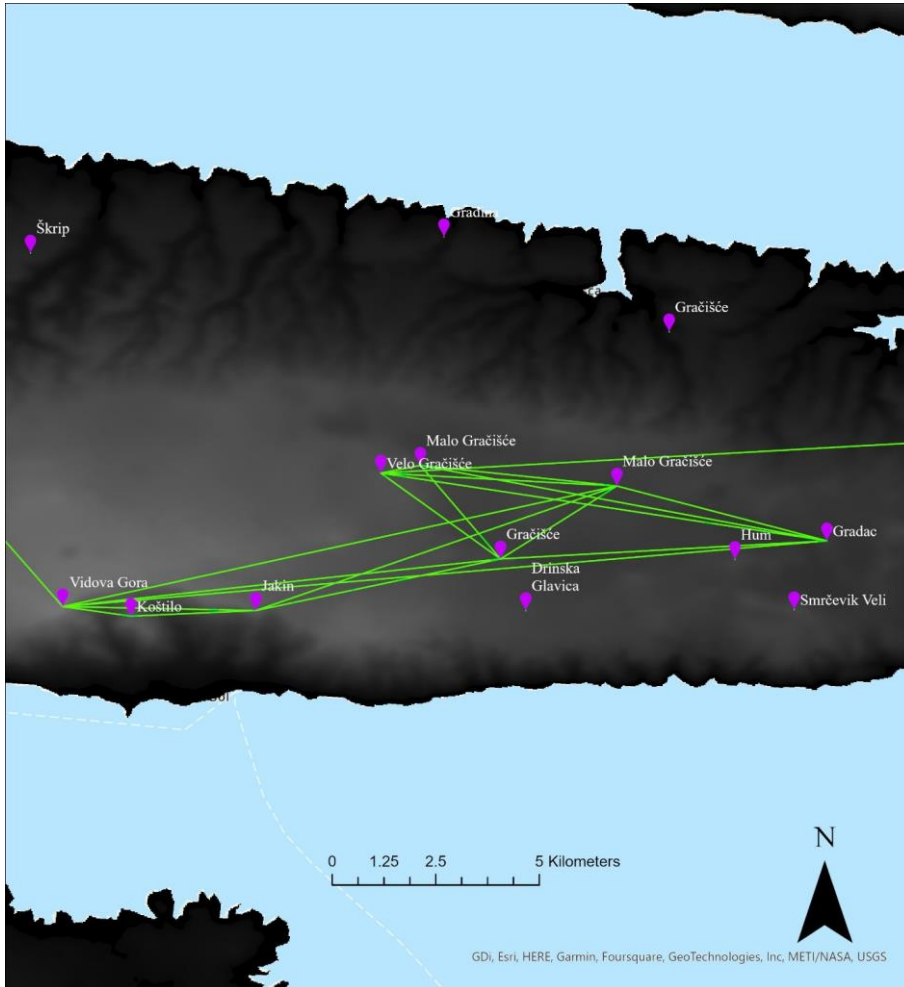


Fig. 23. Close up of southern Brač network

Sized at 15000 m², Gracisce would serve as a perfect central seat of power as it is surrounded by settlements which also maintain visibility connections with it. There is a great distance between some sites, with the furthest from Gracisce; Vidova Gora being nearly 8 km away, however considering the sparse nature of fertile land it makes sense that the settlements and other structures are spread out surrounding small pockets.

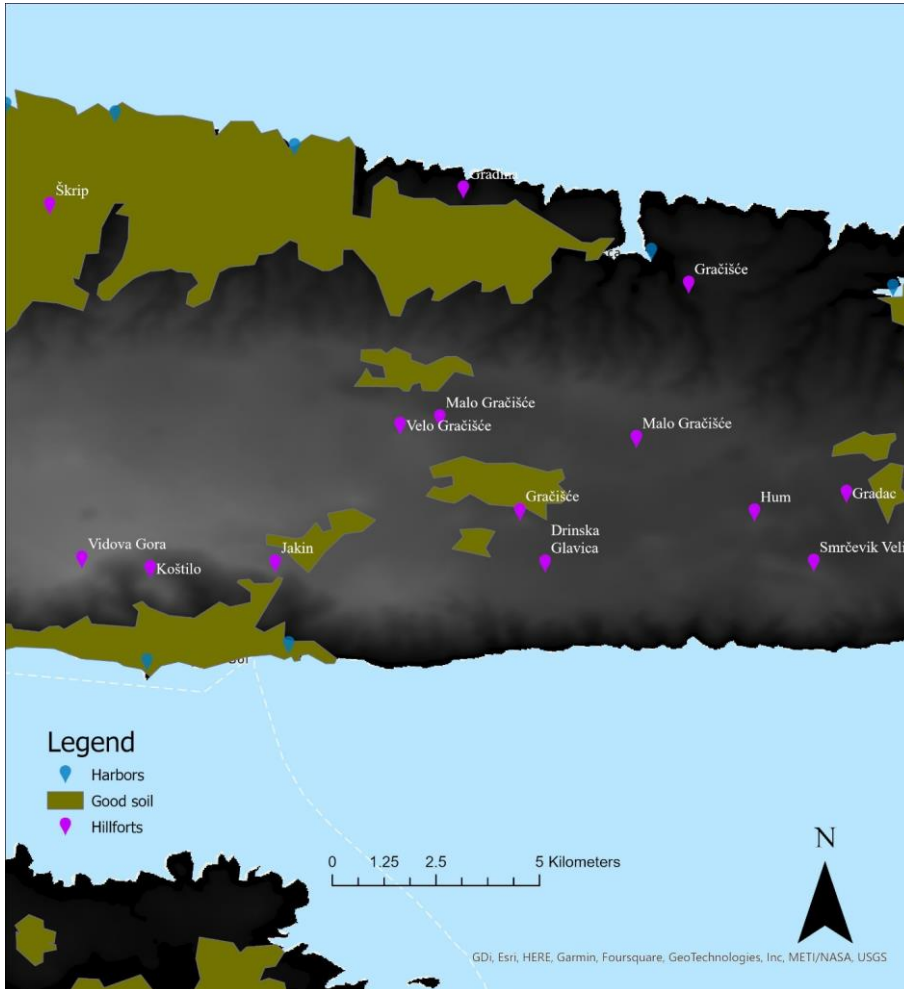


Fig. 24. Southern Brač network with fertile soil data

Viewshed links outside of this central cluster can be made with the hillforts of Gnjlac which can be seen from Vidova Gora and Velo Gracisce at Bol which can be seen from it's namesake within the cluster, also from the region of Bol! All the structures within this cluster which have viewshed links have sightlines with multiple of their neighbors, therefore these singular viewshed connections can be considered non-intentional or at least they do not indicate that Gnjlac and Velo Gracisce are a part of the same network.

5.2 Relations between Hvar, Brač and the Makarska littoral

5.2.1 The validity of inter-locational connections and cooperation

Trade between the various locations within the study area is a definite reality, especially for those structures placed closest to the coastline. However, some form of cooperation more extensive than this is evidenced to have occurred based upon the writings of Diodorus Siculus, who attests that Illyrians from a neighboring location to Hvar came across the water in large numbers, though clearly not as large as the author states, and aided the local Hvar islanders in their battle with the Parian and Syracusan Greeks. These events do indicate that perhaps some form of alliance structure did exist between sites on different islands, though it quite possibly could have been temporary and only within the context of the Greek settlement at Pharos. As shown above (4.2) intervisibility connections existed between the islands, though the question of whether intervisibility links necessarily indicate cooperation is uncertain, there are several settlements along the southern coast of Brač such as Vidova Gora or Jakin which feasibly could have been signaled to via either a messenger or even some form of smoke signaling from sites near Pharos such as Kastil, Lompic and Galesnik. Therefore, communication was definitely possible between the islanders of Hvar and Brač, though it likely only occurred between the inhabitants of the few sites mentioned.

Along the Makarska littoral settlements there seems to be less evidence for communication with other locations as on the east of both Hvar and Brač there are few structures close to the coastline, with Velo Gracise on Brač being the only example. It is possible that longer journeys may have been made to reach sites along the north of Brač or Hvar, though only in the latter island's case can any visibility links be traced with sites on the Makarska littoral. In reference to the sites along the north of Brač, they clearly were placed with the purpose of interconnection with structures not included within this study, and this is evidenced by their proximity to the harbors lining the coastline.

5.3 The Influence of Greek settlement

5.3.1 The changes occurring after the establishment of Pharos

The establishment of Pharos would have significantly affected the organization of settlements in the central portion of Hvar. For example, Galesnik lies right next to what was previously a local settlement that after the settlement of the Greeks was likely razed and turned into a tower, afterward referred to as Tor.

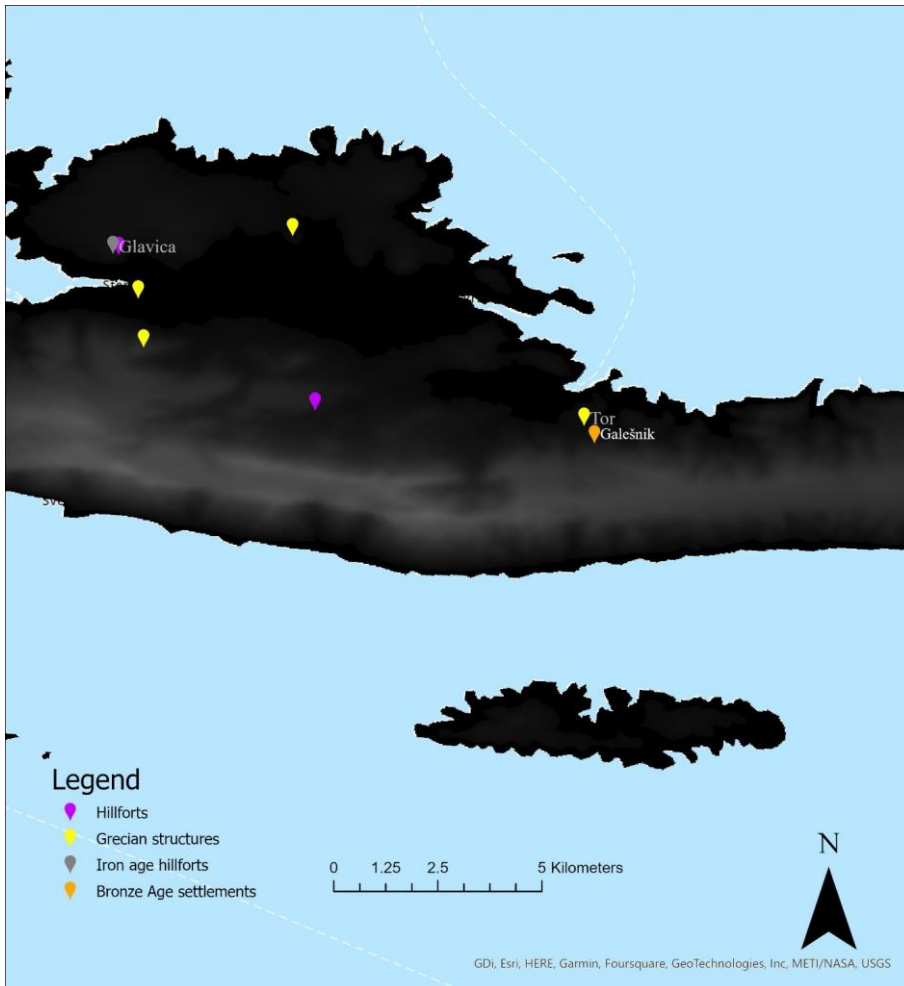


Fig. 25. Stari Grad field network

After hostilities between the locals and the Greeks, Galesnik could have been seen as a significant threat to Pharos, therefore it is a fair assumption that it too was razed and subsequently abandoned, however, material has been found there dating to late antiquity. Perhaps it was repopulated after the Roman conquest of the island, and it is even possible that peaceful coexistence was maintained. What is clear is that some attempts were made by groups of locals to adapt to the Greek colonization of the area, namely the building of Glavica on the hill overlooking Pharos and the harbor entrance. Sized at only 1400 m² it is too small to be a settlement and therefore likely served as an observation post to monitor

shipping going to Pharos. The only settlement it foreseeably could have been linked with is Lompic on the opposite side of the inlet, together both sites are positioned to guard the inlet though likely they simply received incoming trading ships on their path to Pharos, if they tried to violently interfere with the trade lane through piratical activity for example they likely would have also been razed by the Greeks.

The settlements along the southern coast of Brač are anomalous in that there is little agricultural land present to support them and even justify the establishment of settlements there in the first place. What could provide ample justification for the placement of structures along the south of Brač is proximity to Pharos for the purpose of exploiting the influx of trade going there and for trading with the settlement itself. Currently no time period is associated with them therefore it is a possibility that some or all of them could have been established post-Greek settlement on Hvar for the purposes of maintaining close trade links with them. Unfortunately, the lack of excavations at these sites means little archaeological material has been detected which could indicate strong trade ties with Pharos, therefore no conclusions can be drawn.

5.3.2 Emporions and colonies outside the study area

Pharos did not house the only Greek traders present in the central Dalmatian region. The islands of Vis and Korčula had colonies established on them by Greek settlers and several emporions, that is smaller trading posts can be found around the study area. Several of them line the mainland coastline to the north of Brač, namely the three emporions Tragarium, Salona and Epetium. As aforementioned, several sites line the northern coast of Brač which have few intervisibility connections with the other sites on the island, however they lie close to the many harbors along the coast which would have been viable stopping off points for ships coming from those emporions. Considering that many of these sites have trade goods present (section 4.5) it is clear that a major motivating factor for the placement of these structures is trade. The majority of structures placed along the north of Brač however have been dated to the Bronze Age, therefore their placement would have predated the establishment of the emporions and it also is clear that some of the sites such as Skrip enjoyed trade relations prior to the presence of Greek traders as proven by the presence of Mycenaean artefacts at the site as well as its large Bronze Age walls. Therefore, the emporions cannot be used as an explanation for the placement of these sites.

What is clear is that based upon the concentration of the total viewsheds of all the settlements included in this study, a focus of hillfort placement is watching over the mainland coast running from the top of the Makarska littoral down to the Peljesac peninsula (4.2). Though it is possible that these locations may simply be visible from most high points among the central Dalmatian coast, what is notable about the Peljesac peninsula in particular is that it guards the northern entry to another ancient emporion, Naronia in the hinterland of what is now Bosnia-Herzegovina. This emporion lay along the river Neretva and was used as a trading post with large inland settlements such as the Illyrian settlement of Daorson, therefore it served as a “highway into the Balkan hinterland” and would have seen frequent maritime traffic. Ships heading towards Naronia would have had to sail alongside the underside of Brač or Hvar if approaching from the south and along the Makarska littoral from the north.

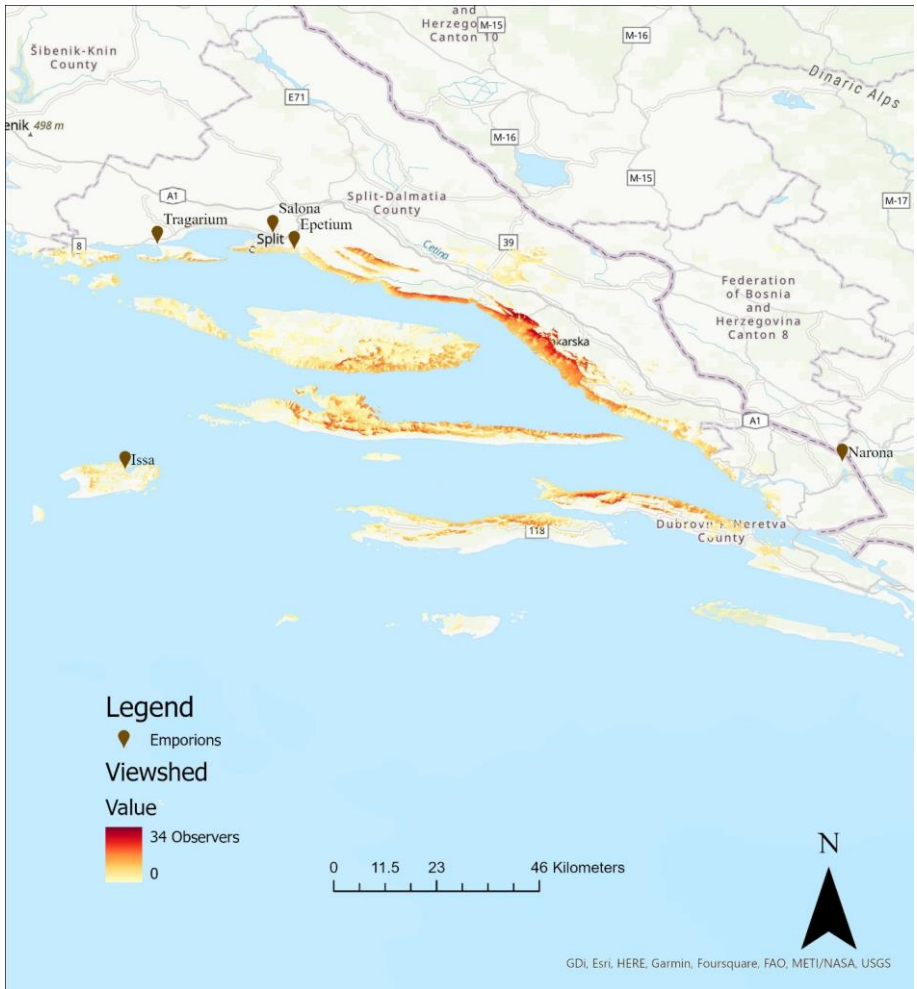


Fig. 26. Locations of Greek structures outside of study area and total viewshed of subject sites

Another location which served as a focus point for trading ships as well as a production center for exotic trade goods was the Greek colony at Issa. While less hillfort viewsheds are focused upon it, some viewsheds towards the west end of Hvar in particular are focused upon

it.

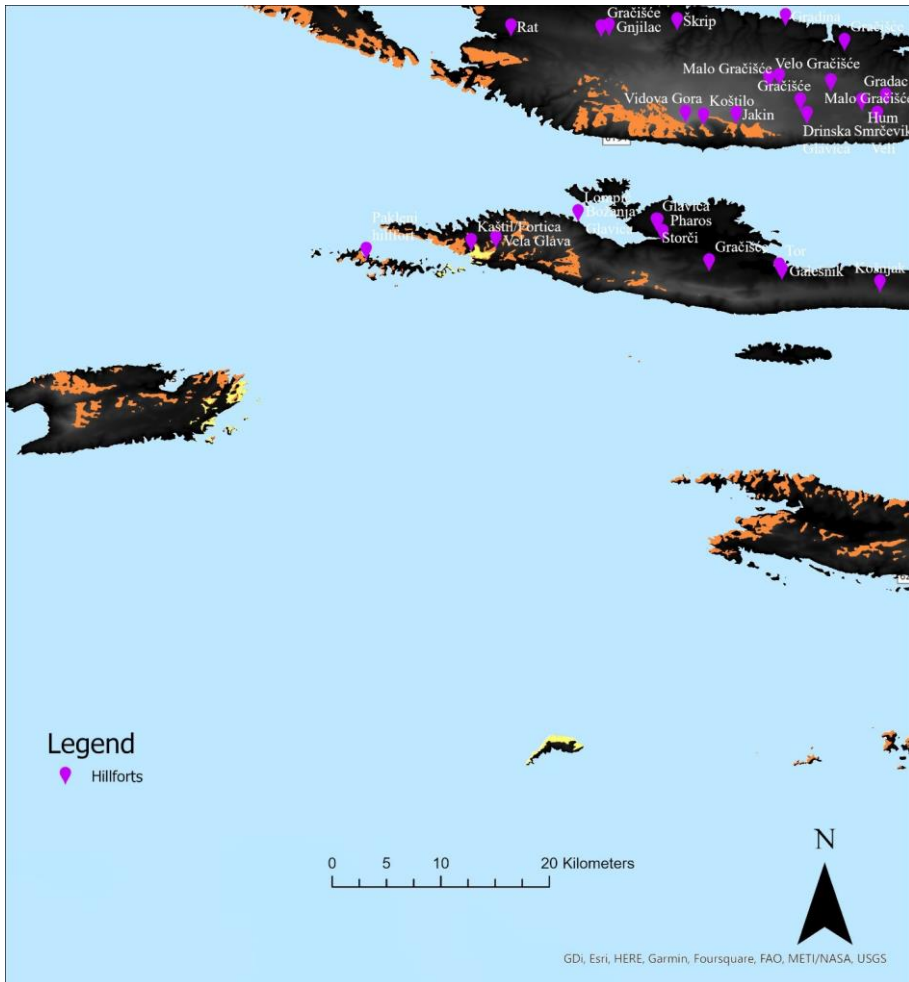


Fig. 27. Viewshed of Kastil (yellow) and Pakleni Otoci (orange)

For example the hillfort on Pakleni otoci has been placed for the very obvious purpose of supporting its nearby neighbor Kastil by providing a wider viewshed (orange) over the study area as Kastil has a viewshed (yellow) which can exclusively see Vis and the small islet directly to the south. Likely the Pakleni hillfort was built after Kastil to further strengthen its position but Kastil was built with a focus upon the island of Vis. This focus upon Vis caused much trade, likely from Vis, to flow through Kastil as fine metal worked objects, amber and pottery from Hellenic and Italic markets have been discovered there. Rat also has been placed

in a position next to a large potential harbor which would have been accessible to ships coming to and from Vis and very obviously benefitted from this position considering the trade goods located there such as bronze axe heads and Italic pottery.

Vis produced great deals of pottery and coinage as well as received trade from areas all across the Mediterranean (2.1.3) and very obviously traded with settlements in proximity to it, so it is strange to see only a few of the settlements positioned with a focus upon the island.

5.3.3 Trade routes predating colonies

Considering that in many parts of the study area settlements were built with a focus upon the locations where Greeks settled or sailed along but built centuries prior to their arrival, it is clear that extensive trade routes existed prior to Greek settlement which proved a greater influence to the placement of settlements. Considering the orientation of the settlements on the north of Brač towards the top of the Adriatic and the focus upon the path along the Makarska littoral down to the mouth of the Neretva River, a likely candidate is traders from the north-western areas of the Adriatic coast around the Apennine region. Bronze artefacts have been found among settlements surrounding the Neretva River which mirrored forms from Northern Italy (2.1.4), providing evidence of increased contact with north Italic tribes who would have sailed downward along the coastline to reach the Neretva River and trade with tribes inland.

Another candidate is Greek traders during the Archaic period, there is significant evidence for this as Archaic Greek pottery has been found at the site of Sveti Petar along the Makarska littoral. Another possibility is even earlier traders from the Aegean during the Mycenaean period, though the supposed lack of Mycenaean artefacts in central Dalmatia has been discussed (2.1.2), Skrip serves as an example of their likely influence, both due to the Mycenaean artefacts found there and even to its unique walls built in a foreign style. Greek settlements and colonies did not influence the placement of settlements within the study area, though they were still focused towards maritime trade clearly, what likely happened is that the Greeks placed themselves along pre-established trade routes, and therefore right in the view of local settlements ready to trade.

5.4 Other Factors Dictating Settlement Placement

5.4.1 Proximity to fertile land and the coastline

An obvious factor which dictated settlement placement within the study area is proximity to agricultural land and proximity to the coastline. No site lays more than 2 km from agricultural land except the hillfort on the islet Pakleni and no more than 8 km away from the coastline, and only two sites; Velo Gracise on Brač and Velika Gomila on the Makarska littoral are more than 5 km away. Clearly this is indicative of the considerations given to both maritime and land-based industry when deciding the placement of fortifications, even isolated subsidiary hillforts. Whether this was for the protection or exploitation of these resources is another matter. Access to both the sea and good soils on land would have ensured the highest amount of economic prosperity as both agricultural and maritime industry could be combined to ensure a constant flow of resources.

Hvar provides a very clear example of what an agriculturally focused model for fortification placement looks like. Fortifications are placed surrounding small pockets of fertile land which mirrors the settlement pattern adopted by the Greeks surrounding the Stari Grad plain. Each pocket has between two and four structures along the edges which are interconnected via line of sight. Whether these pockets form a singular political body encompassing a few fields or separate tribes each occupying their own field is uncertain, however it is clear that there is intent in their placement for the defense of good soils.

On Brač there is a less clear picture drawn as on Hvar due to the fact that large areas of fertile soil that exist on the north-western portion of the island house less than half the island's prehistoric fortifications. The cluster of sites on the south of Brač are actually surrounding small pockets of agricultural land upon closer examination in a similar manner to the sites on Hvar, just on a smaller scale. What is evident about the sites along the north of Brač is that they would have had ample access to the sea and profited well from this as indicated by the frequency of trade goods detected along the northern coastline as discussed above.

The Makarska littoral has an abundance of fertile soils, especially closer to the flat plains under the dinaric alps, therefore it is more difficult to distinguish whether groups of hillforts were placed specifically to protect them. Perhaps the combination of the coastline on one side and the alps upon the other served as natural barriers to raiders and created only a small corridor of land to be protected unlike the areas of land on Hvar and Brač which needed to be surrounded by fortified structures. Since many of the sites present are also constructed near to the coastline, in the case of Sveti Petar and matijasevica right alongside, it is likely that

maritime industry was a large part of their subsistence as evidenced by the trade goods found in Suzina, Griza and Sveti Petar.

5.4.2 Proximity to harbors

Many sites have been constructed more than 10 km away from a location deemed suitable for a harbor, though a lack of detected harbor locations may be the cause of this. As stated above, the ships of the Bronze and Iron Age people of the islands may have been small enough to beach upon the shoreline meaning that harbors would have been of lesser importance when only their ships are concerned. However Greek trading vessels would have required locations to moor their vessels so in this context harbors become of vital.

5.4.3 Viewsheds and elevation

The viewsheds of sites can aid greatly in helping us understand what purpose they were directed to. A common feature throughout the study area is the presence of structures which exist outside of the wider intervisibility networks detected, especially on the north of Brač and the south of Hvar. Upon closer examination of these structures, many of them have viewsheds which can see very little of the surrounding terrain upon the island they are placed on but have wide fields of view out towards the ocean and neighboring islands. Though these structures may be placed to view other native structures in locations not considered within the course of this study, it is also possible that, similar to the previously described examples along the Makarska littoral they are placed in locations away from resources and the line of sight of other structures but within good locations for the observation of the sea.

5.5 Political organization of sites

5.5.1 Makarska Littoral

The settlements in the south of Brač could be theorized to be form of proto-kingdom centered on Gracisce at Bol, spread out to cover a large amount of ground allowing the smaller pockets of fertile land to be secured as has been illustrated (5.1.3), as such it will not be covered in this section. Potentially similar settlement networks may exist within the study area. Considering that structures with viewshed connections to multiple surrounding structures seem to be built purposefully to link multiple sites together, the settlements along the Makarska littoral form likely candidates. Upon examining the intervisibility links of sites within this region, it is clear that two main groups of structures are formed; one in the north and another making up the southern settlements. Considering the artefacts found at Sveti

Petar, the fact that multiple structures in proximity can draw intervisibility links to it and its later role as a church; a central place of gathering for the local people, it is likely that this settlement formed the central seat of power for this proto-kingdom. Alternately the focus may be upon Grad Gradina which lies up in the hinterland and is sized at 20,000 m², though only one intervisibility link can be drawn and it is placed a considerable distance from any other sites other than Gradac.

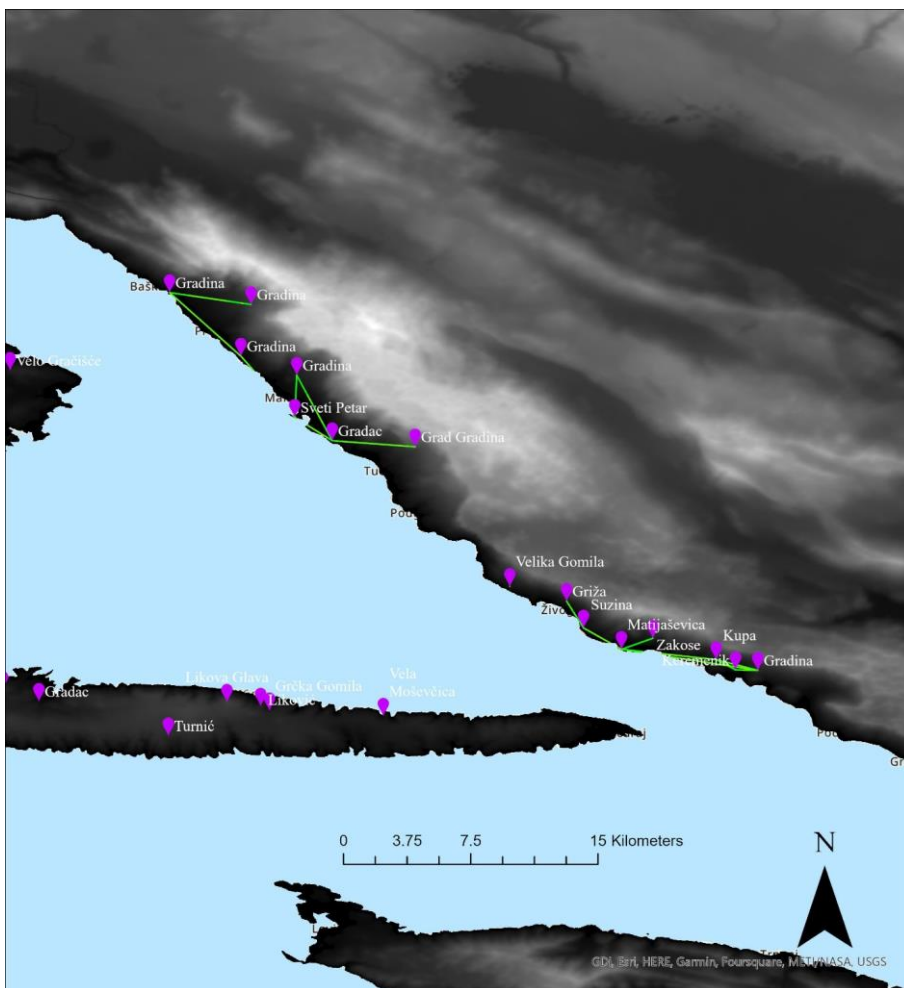


Fig. 28. Makarska littoral networks with intervisibility links

The settlements in the south at first seem to form a singular body, yet upon looking at the founding dates of Griza, Suzina, Matijasevica and Zakose it is clear that they were later

constructions built approximately in the 2nd century BC (Tomasovic) in response to roman invasions. Upon examining the viewsheds, it is clear that Matijasevica is the central element of the four structures as it is also the largest at 9000 m². Velika Gomila has no intervisibility links with any structures and is of a miniscule size, only 100 m² meaning even its status as a hillfort is unclear. This leaves Kupa, Keremenik and the Gradina at Drvenik. The Gradina at Drvenik is the largest of these three structures at 3500 m² but it's origin is also in the Iron Age where as Kupa and Keremenik date to the Bronze Age. Perhaps it could represent a newly formed central settlement which superseded the 3000 m² Kupa. It is also possible that these two groupings mentioned might form a singular group, starting with Kupa and Keremenik in the Bronze Age which was expanded with the other sites into the Iron Age, either all at once in response to later Roman invasions of the Adriatic coast or over time in response to the entry of various foreign groups into the region.

5.5.3 Hvar

Hvar represents a complicated picture due to the imposition of a foreign structure; Pharos and its subsidiary structures, in the middle of the island. What can be detected is that many of the settlements surrounding the central portions of agricultural land have intervisibility links with multiple other structures, and that within the center of the web formed by these links is Vela Glava.

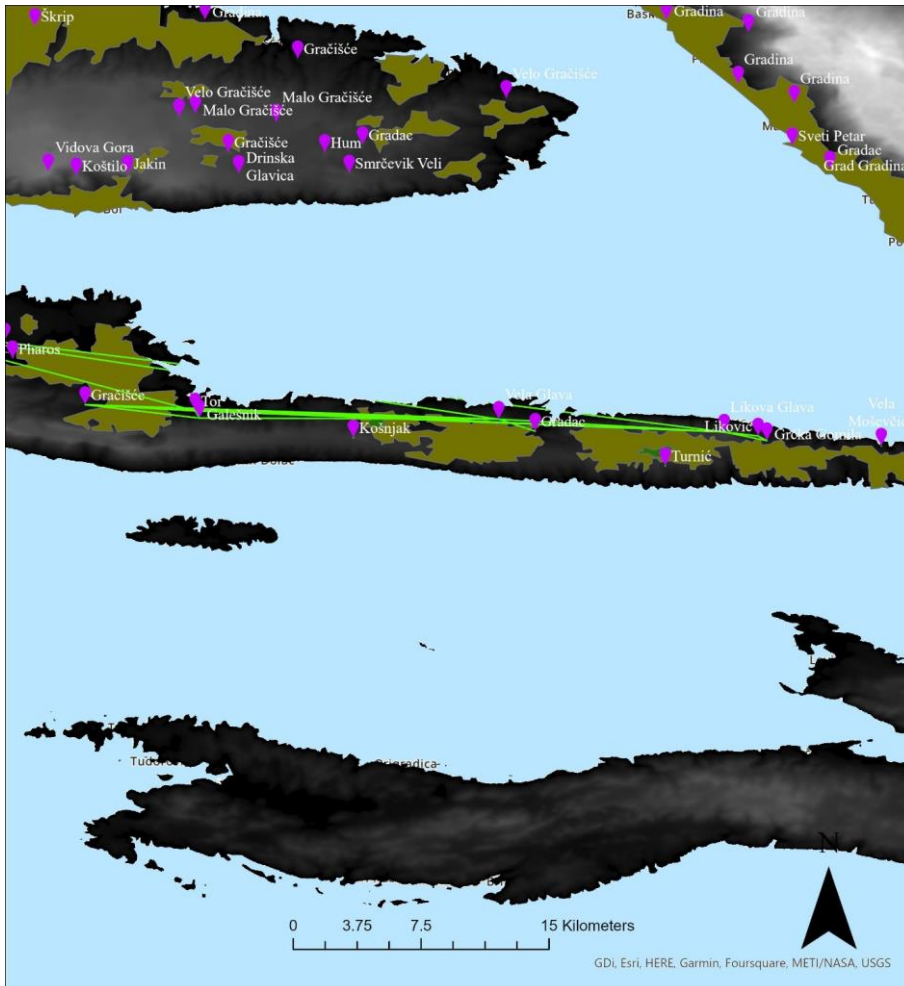


Fig. 29. Central Hvar network with fertile soil

Vela Glava is also the largest structure within this network at 9500 m² and seems to bridge the west sites of Gracisce at Jelsa, Galesnik and Tor with sites in the east including Gradac, Likovic, Likova Glava and Grcka Gomila. Again, there are some sites on the periphery which have only a singular viewshed link such as Vela Moševčica or none in the case of Kosnjak and Turnić. Though this normally would indicate that they lie outside of the network, upon closer examination of the viewsheds of Turnić and Kosnjak in particular it is clear that some form of cooperation occurred between the two.

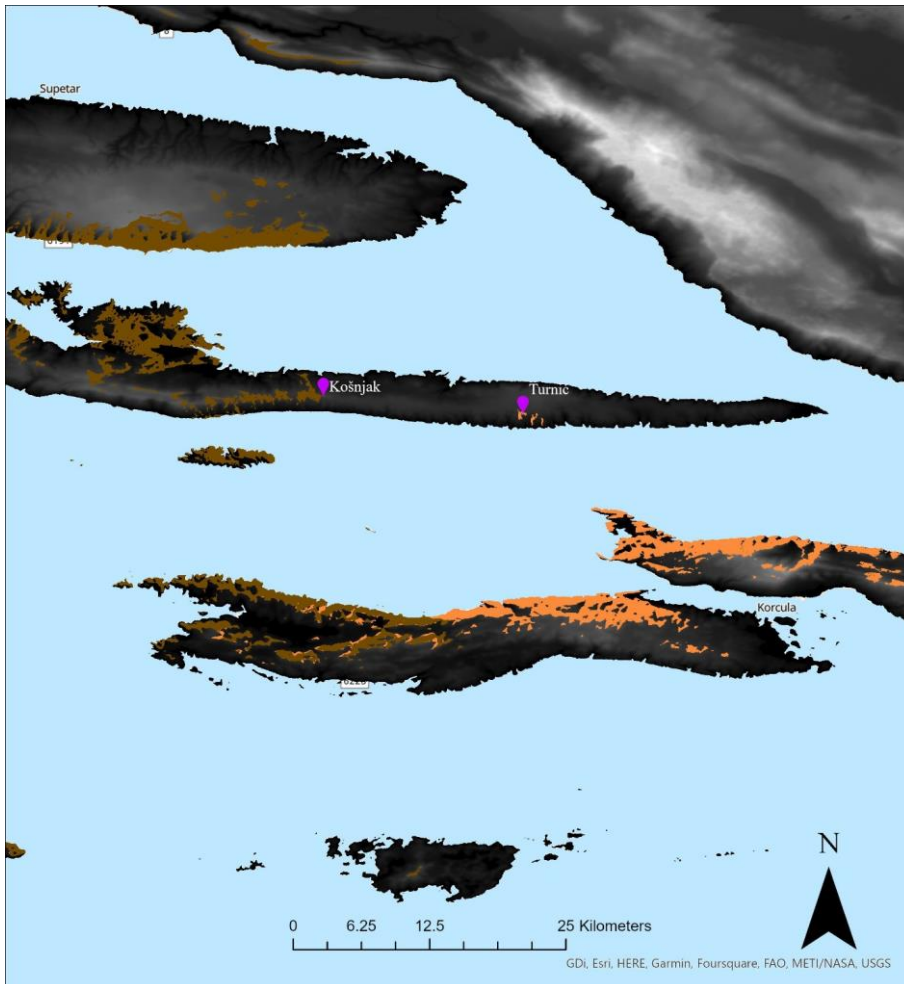


Fig. 30. Kosnjak (brown) and Turnic (orange) viewsheds

The entire passage in between Hvar and Korcula leading towards the Neretva River mouth is well covered by the two structures when their viewsheds are combined with only a small amount of overlap between them, meaning that enemy ships or trading vessels could not escape being spotted by at least one of the two. There is a considerable distance between the two structures however and no intervisibility link, meaning that if there was any cooperation between the two messages would have had to be relayed through other sites. Both Kosnjak and Turnic are closer to structures within the network than to each other, in fact Vela Glava and Gradac lie in between them. It is likely therefore that both these structures are a part of

the network in the centre of Hvar and are linked by close proximity rather than intervisibility links, this compromise likely was made to ensure that proper sight lines over the channel between Hvar and Korcula were maintained. Connections with other structures upon the island do not seem likely, though Glavica on the hill above Pharos has connections with multiple structures within the network it is a considerable distance away and if any structures were placed in between, they are no longer visible due to the imposition of the Stari Grad field system and surrounding Greek structures.

Chapter 6: Conclusion

6.1 Results from Objectives

6.1.1 Which prehistoric fortified structures within the study area formed networks with each other?

The structures have been found to have a diverse organization as some form isolated or small networks containing only one major settlement and one or two subsidiary structures, while others clearly form larger political bodies spread out over a large area to control resources. Without a surviving written record, it is difficult to exactly determine the full extent of any network, however the placement of structures in networks would suggest that each location was made up of multiple tribes competing for space, usually with one or two dominating the vast majority of the landscape.

6.1.2 What does this infer about the connections between structures on the Makarska littoral and islands of Brač and Hvar?

Considering that each location within the study area is made up of several competing bodies, it is unlikely that networks formed by interlinked structures extended past the boundaries imposed by the ocean. Trade contacts did clearly exist based upon the placement of structures close to harbors and within sight of each other, but beyond this, there is little evidence to suggest any political or societal connection between sites on different locations.

6.1.3 What role Greek colonial and commercial activity played in the formation of these networks?

Due to the fact that the local settlements predate the Greek colonies, it is clear that the sites chosen by the Greeks, particularly the north and east of the study area were part of pre-existing trade routes which the Greeks themselves occupied meaning that the placement of

local settlements influenced Greek colonization, not the other way around. This is further supported by the trade goods found in settlements along the coastline, as on the north of Brač and the Makarska littoral artefact finds predating the founding of the Greek colonies, namely Mycenaean and Archaic Greek pottery have been discovered.

6.1.4 What other factors influenced the placement and construction of fortifications within the study area?

Based upon the landscape data gathered; a combination of soil data, the locations of recorded and potential ancient harbors and the locations of sites, it is clear that the main factors which influenced settlement placement during the Bronze Age when most structures were constructed was proximity to fertile land, as almost every structure is located no more than 2 km away from patches of it. An examination of the locations of sites in relation to patches of agricultural land shows that in the case of Hvar and areas of Brač they surrounded this land as if to defend it, especially with smaller structures representing minor settlements or forts.

The factor which seems the most important after proximity to good soil is that a location have high elevation and a good viewshed, both for the purposes of maintaining connections with structures to form fortification networks but more importantly to ensure control over resources and areas of the surrounding ocean. The examples of Turnic, Kosnjak and other structures which are in proximity to networks yet possess no intervisibility connections show that connections could be maintained by proximity instead, and that if a good position was found with a strategic viewshed it was preferred to occupy that then to have intervisibility connections with other structures in a network. Upon examining the total viewsheds of all the structures within the study area it was determined that the most important areas to have proximity to were the passages leading towards the mouth of the river Neretva which in turn leads to the Balkan hinterland and later Greek trading colony there.

6.1.5 How can this data be used to further assess the political and societal organization of the study area prior to and during the period of Greek involvement?

What is clear from the data is that little change in settlement layout occurred between the Bronze and Iron ages except in the case of the southern Makarska littoral where a cluster of structures was built after contact with the Romans as well as the sites close to Pharos on Brač and Hvar. The layout of structures and their political organization was likely deeply rooted and well established alongside preexisting trade routes and areas with natural resources,

potentially some sites may have been abandoned in favor of sites which grew larger over the course of time, especially those that benefitted heavily from trade, however this cannot be proven without more data gained from excavations.

6.2 Answering the Research Question

6.2.1 How did the landscape features of the islands of Hvar, Brač and the Makarska littoral dictate the placement of fortifications between the Bronze and Iron Ages and how did this relationship change during the period of Greek commercial and colonial activity?

The main aspects of the landscape in a physical and natural sense which influenced fortification placement were proximity to fertile soil and spots with high elevation which also provided good sight lines. The reason for securing high elevation is that many factors of the landscape in a historic sense also influenced fortification placement such as proximity to other fortifications for the purpose of creating networks across the landscape, thereby better defending fertile soil, view of other networks and view of areas which formed a part of naval trade routes, most significantly the mouth of the River Neretva which leads into the Balkan hinterland. These naval trade routes likely predated the period of Greek colonization, therefore the pre-established settlement patterns influenced Greek commercial and colonial activity, not vice-versa. Other than the building of a few new minor forts surrounding the Stari Grad plain there is no clearly discernible change in the fortifications within the study area, though this remains to be seen with greater levels of investigation performed on the sites.

6.3 Recommendations for Future Research

The first priority for increasing knowledge on the sites covered in this thesis is the continued excavation of at least the largest examples. The potential benefits of collecting a larger variety of artefacts are numerous and include more accurate dating, evidence of connections with other surrounding sites or even foreign cultures such as the Greeks, and even multiple settlement phases to aid in tracking the development of sites. Other than this the addition of other contemporaneous sites such as the very numerous tumuli which dot the landscape would be a valuable area of research as these structures have been theorized to mark the boundaries of networks, therefore one could track their locations to better detect which structures formed networks with each other.

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Appendix

General table

Name	Location	Long	Lat	Preservation	Size m ²	Associated time period(s)	References
Vela Moševčica	Bogomolje	43.138122	17.058977	Collapsed	2700	Bronze Age-Iron Age	Gaffney, Kirigin, Petrić, Vujnović & Čače 1998: 54
Grčka Gomila	Bogomolje	43.124814	16.9987	Collapsed	2400	Bronze Age	Gaffney, Kirigin, Petrić, Vujnović & Čače 1998: 57
Turnić	Bogomolje	43.140557	16.94515	Collapsed	11000	Prehistoric-Medieval	Gaffney, Kirigin, Petrić, Vujnović & Čače 1998: 60

Liković	Bogomolje	43.142649	16.994051	Collapsed	1500	Iron Age-Greek	Gaffney, Kirigin, Petrić, Vujnović & Čaće 1998: 64
Likova Glava	Bogomolje	43.173796	16.976191	Collapsed	3000	Bronze Age-Greek	Gaffney, Kirigin, Petrić, Vujnović & Čaće 1998: 66
Kaštil/Fortica	Hvar	43.157058	16.442728	Built on top of	16000	Bronze Age-Hapsburg	Gaffney, Kirigin, Petrić, Vujnović & Čaće 1998: 87., Gaffney, Hayes, Kirigin, Leach & Vujnović 2002: 39.
Gračišće	Jelsa	43.149403	16.639468	Collapsed		Prehistoric	Gaffney, Kirigin, Petrić, Vujnović & Čaće 1998: 139
Vela Glava	Jelsa	43.139611	16.857436	Collapsed	9500	Bronze Age	Gaffney, Kirigin, Petrić, Vujnović & Čaće 1998: 146
Košnjak	Jelsa	43.153772	16.780789	Collapsed	2800	Prehistoric	Gaffney, Kirigin, Petrić, Vujnović & Čaće 1998: 149
Tor	Jelsa	43.149972	16.697513	Built on top of		Iron Age-Greek	Gaffney, Kirigin, Petrić, Vujnović & Čaće 1998: 151
Unnamed hillfort	Jelsa	43.143066	16.699745	Collapsed	3500	Prehistoric	Gaffney, Kirigin, Petrić, Vujnović & Čaće 1998: 152
Gradac	Jelsa	43.190829	16.876608	Collapsed	1600	Prehistoric-Roman	Gaffney, Kirigin, Petrić, Vujnović & Čaće 1998: 166
Glavica	Stari Grad	43.181219	16.595843	Collapsed	1400	Iron Age	Gaffney, Kirigin, Petrić, Vujnović & Čaće 1998: 177
Pharos	Stari Grad	43.190619	16.601291		10000	Prehistoric-Modern	Gaffney, Kirigin, Petrić, Vujnović & Čaće 1998: 179
Storči	Stari Grad	43.197893	16.597078	Collapsed		Prehistoric	Gaffney, Kirigin, Petrić, Vujnović & Čaće 1998: 179
Lompić	Stari Grad	43.197893	16.531084	Collapsed	9000	Bronze Age-Hapsburg	Gaffney, Kirigin, Petrić, Vujnović & Čaće 1998: 195
Pakleni Otoki	Vis	43.166958	16.358018	Collapsed		Prehistoric	Gaffney, Kirigin, Petrić, Vujnović & Čaće 1998: 209
Koštilo	Bol	43.27979	16.634813	Collapsed		Prehistoric	Stančić, Vujnović, Kirigin, Čaće, Podobnikar & Burmaz 1999: 34
Vidova Gora	Bol	43.308732	16.619982	Collapsed	5000	Prehistoric	Stančić, Vujnović, Kirigin, Čaće,

							Podobnikar & Burmaz 1999: 34
Velo Gračišće	Bol	43.278938	16.688973	Collapsed and eroded	3800	Prehistoric	Stančić, Vujnović, Kirigin, Čače, Podobnikar & Burmaz 1999: 46
Jakin	Bol	43.310405	16.661891	Collapsed	2500	Prehistoric	Stančić, Vujnović, Kirigin, Čače, Podobnikar & Burmaz 1999: 54
Malo Gračišće	Bol	43.318452	16.697566	Collapsed	1350	Prehistoric	Stančić, Vujnović, Kirigin, Čače, Podobnikar & Burmaz 1999: 55
Velo Gračišće	Bol	43.305931	16.861366	Collapsed	6600	Prehistoric-Roman	Stančić, Vujnović, Kirigin, Čače, Podobnikar & Burmaz 1999: 58
Malo Gračišće	Bol	43.290122	16.740187	Collapsed	3000	Prehistoric	Stančić, Vujnović, Kirigin, Čače, Podobnikar & Burmaz 1999: 63
Gračišće	Bol	43.294045	16.714943	Collapsed	15000	Prehistoric	Stančić, Vujnović, Kirigin, Čače, Podobnikar & Burmaz 1999: 75
Gradac	Bol	43.290006	16.785722	Collapsed	5000	Prehistoric-Medieval	Stančić, Vujnović, Kirigin, Čače, Podobnikar & Burmaz 1999: 86
Hum	Bol	43.279117	16.765777	Collapsed	2500	Prehistoric	Stančić, Vujnović, Kirigin, Čače, Podobnikar & Burmaz 1999: 104
Smrčevik Veli	Bol	43.356445	16.778626	Collapsed	1500	Prehistoric	Stančić, Vujnović, Kirigin, Čače, Podobnikar & Burmaz 1999: 106
Škrip	Omiš	43.359972	16.613005	Collapsed	8000	Bronze Age-Medieval	Stančić, Vujnović, Kirigin, Čače, Podobnikar & Burmaz 1999: 125., Gaffney, Čače, Kirigin, Leach & Vujnović 2001.
Gradina	Omiš	43.339361	16.702676	Collapsed	9000	Bronze Age-Roman	Stančić, Vujnović, Kirigin, Čače, Podobnikar & Burmaz 1999: 139
Gračišće	Omiš	43.350717	16.751521	Collapsed	4500	Iron Age-Roman	Stančić, Vujnović, Kirigin, Čače,

							Podobnikar & Burmaz 1999: 143
Gračišće	Omiš	43.351923	16.550226	Collapsed	4000	Iron Age-Late Hellenistic	Stančić, Vujnović, Kirigin, Čače, Podobnikar & Burmaz 1999: 157
Gnjilac	Supetar	43.351386	16.556673	Collapsed	6000	Bronze Age-Roman	Stančić, Vujnović, Kirigin, Čače, Podobnikar & Burmaz 1999: 158
Rat	Sutivan	43.159466	16.475612	Collapsed	2500	Bronze Age-Roman	Stančić, Vujnović, Kirigin, Čače, Podobnikar & Burmaz 1999: 171
Gradina	Drvenik	43.159732	17.257281	Collapsed	3500	Iron Age-Hellenistic	Tomasović 2014: 88
Keremenik	Drvenik	43.16514	17.245464	Collapsed		Bronze Age-Hellenistic	Tomasović 2014: 88
Kupa	Drvenik	43.170626	17.235219	Collapsed	3000	Bronze Age-Hellenistic	Tomasović 2014: 88
Matijaševica	Živogošće	43.181917	17.185082	Collapsed	9000	Iron Age-Hellenistic	Tomasović 2014: 82
Suzina	Živogošće	43.196137	17.164999	Collapsed	2200	Late Iron Age-Roman	Tomasović 2014: 82
Griža	Živogošće	43.176481	17.156023	Collapsed		Late Iron Age-Roman	Tomasović 2014: 82
Zakose	Živogošće	43.203929	17.201707	Collapsed	500	Late Iron Age-Roman	Tomasović 2014: 82
Velika Gomila	Igrane	43.277949	17.125954	Collapsed	700	Prehistoric-Roman	Tomasović 2014: 77
Grad Gradina	Tučepi	43.281176	17.075845	Collapsed	20000	Prehistoric	Tomasović 2014: 60
Gradac	Makarska	43.293541	17.031951	Collapsed			
Sveti Petar	Makarska	43.315843	17.012068	Collapsed		Early Bronze Age-Medieval	
Gradina	Velo brdo	43.353326	17.013152	Collapsed			
Gradina	Bast	43.325975	16.988994	Collapsed		Bronze Age-Hellenistic	Tomasović 2014: 53
Gradina	Bratuš	43.35965	16.983596	Collapsed	7000	Bronze Age-Hellenistic	Tomasović 2014: 57
Gradina	Baška Voda	43.166709	16.945837	Collapsed		Bronze Age-Roman	Tomasović 2014: 49

Defensibility and Strategic table

Name	Elevation	Distance to nearest food source	Distance to nearest harbour	Distance to coastline	Fortification style
Vela Moševčica	114	0.3	10	0.1	Triple drystone rampart
Grška Gomila	190	0.2	15	0.7	Drystone rampart
Turinić	260	0.3	19	1	Drystone rampart
Liković	237	1	15	6	Drystone rampart
Likova Glava	417	5	17	0.8	Drystone rampart
Kaštil	102	2	1	2	Drystone rampart
Gračić	151	0.3	4	3	Drystone rampart
Vela Glava	349	0.3	21	0.9	Drystone rampart
Kočnjak	139	0.7	15	1	Drystone rampart
Tor	235	0.9	8	0.9	Drystone rampart

Unnamed hillfort	175	1	9	1	Drystone rampart
Gradac	141	0.2	0.8	25	Drystone rampart
Glavica	706	1	0.7	0.6	Drystone rampart
Pharos	5	0.2	0.4	0.4	
Storči	64	0.6	0.6	0.6	
Lompić	75	1	5	0.1	Drystone rampart
Pakleni Otoci	36	9	6	0.3	Drystone rampart
Koštilo	599	0.5	2	2	Stone rampart with mortar
Vidova Gora	778	1	2	2	Drystone rampart
Velo Gračšće	546	1	5	5	Drystone rampart
Jakin	596	0.09	2	2	Double thickness drystone rampart
Malo Gračšće	467	0.8	5	5	Drystone rampart
Velo Gračšće	218	0.1	2	0.7	Drystone rampart
Malo Gračšće	405	1	4	4	Drystone rampart
Gračšće	484	0.3	5	3	Drystone rampart
Gradac	372	0.6	5	3	Drystone rampart
Hum	426	2	6	2	Drystone rampart
Smrčevik Veli	440	1	6	1	Drystone rampart
Škrip	232	0	2	2	Megalithic rampart
Gradina	97	0.2	3	0.5	Drystone rampart
Gračšće	140	1	1	1	Drystone rampart
Gračšće	341	0.4	4	4	Drystone rampart
Gnjilac	386	0	3	3	Drystone rampart
Rat	91	0.2	1	1	Drystone rampart
Gradina	297	0	6	0.8	
Keremenik	133	0.6	5	0.5	Drystone rampart
Kupa	247	0	5	1	Double drystone rampart
Matijaševica	80	0	4	0.1	Double drystone rampart
Suzina	108	0	6	0.2	
Griža	180	0	5	0.2	
Zakose	265	0	5	0.6	
Velika Gomila	100	0	0.4	7	
Grad Gradina	560	0.1	2	2	
Gradac	90	0	0.2	1	
Sveti Petar	31	0	0.1	0.1	
Gradina	240	0	2	1	
Gradina	445	0.4	6	2	
Gradina	80	0	4	0.2	
Gradina	25	0	9	0.1	

Viewshed table

Name	View of ocean	# of Greek structures within viewshed	# of illyrian structures within viewshed
Vela Moševčica	Yes	0	9
Grčka Gomila	Yes	0	10
Turnić	Yes	0	0
Liković	Yes	0	21
Likova Glava	yes	0	26
Kaštil/Fortica	yes	0	0

Gračišće	yes	0	11
Vela Glava	Yes	1	25
Košnjak	yes	2	12
Tor	yes	1	12
Unnamed hillfort	yes	1	13
Gradac	yes	0	3
Glavica	yes	1	15
Pharos	yes	2	6
Storči	yes	0	12
Lompič	yes	0	4
Pakleni Otoci	yes	0	4
Koštilo	yes	0	13
Vidova Gora	yes	0	23
Velo Gračišće	yes	0	2
Jakin	yes	3	14
Malo Gračišće	yes	0	15
Velo Gračišće	yes	0	1
Malo Gračišće	yes	0	16
Gračišće	No	0	1
Gradac	yes	0	13
Hum	no	0	6
Smrčevik Veli	yes	4	27
Škrip	yes	0	0
Gradina	yes	0	0
Gračišće	yes	0	1
Gračišće	yes	0	0
Gnjilac	yes	0	2
Rat	yes	0	0
Gradina	yes	1	14
Keremenik	yes	0	6
Kupa	yes	1	10
Matijaševica	yes	1	12
Suzina	yes	1	19
Griža	yes	1	21
Zakose	yes	1	7
Velika Gomila	yes	0	15
Grad Gradina	yes	0	9
Gradac	yes	1	20
Sveti Petar	yes	1	16
Gradina	yes	2	19
Gradina	yes	2	16
Gradina	yes	2	16
Gradina	yes	0	8

Other table

Name	Quality of trade goods discovered	Evidence of local goods production	Currency discovered
Vela Moševčica	Low-local pottery	No	No
Grčka Gomila	Low-Local pottery	No	No
Turinić	Low-Local pottery	No	No

Likovič	Low-Local pottery	No	No
Likova Glava	Low-Local pottery	No	No
Kaštil	High-Apulian pottery, Expert metalwork, Amber, Flint knives, Hellenistic Pottery	No	Yes-Pharos coins
Gračiče	Low-Local pottery	No	No
Vela Glava	Medium-Roman pottery	No	No
Košnjak	Low-Local pottery	No	No
Tor	Medium-Greek pottery	No	No
Unnamed hillfort	Low-Local pottery	No	No
Gradac	Medium-Prehistoric and Roman pottery	No	No
Glavica	Low-Local Pottery	No	No
Pharos			
Storči	Medium-Roman Pottery	No	No
Lompič	Medium-Apulian pottery	No	No
Pakleni Otoci	Low-Local pottery	No	No
Koštilo	Low	No	No
Vidova Gora	Low	No	No
Velo Gračišće	Low-Local Pottery	No	No
Jakin	Low	No	No
Malo Gračišće	Low	No	No
Velo Gračišće	Low	No	No
Malo Gračišće	Low-Local Pottery	No	No
Gračišće	Low	No	No
Gradac	Low	No	Yes-Illyrian coins
Hum	Low	No	No
Smrčevik Veli	Low	No	No
Škrip	High-Mycenaean pottery	No	No
Gradina	Low-Local pottery	No	No
Gračišće	Medium-Roman Pottery	No	No
Gračišće	Medium-Prehistoric and Late Hellenistic pottery	Yes- Quernstones	No
Gnjilac	Medium-Prehistoric, Hellenistic and Roman Pottery	No	No
Rat	High-Bronze axe heads, Prehistoric, Apulian/Italic and Roman Pottery	No	No
Gradina	Low	No	No
Keremenik	Low	No	No
Kupa	Low	No	No
Matijaševica	Low-Iron age local pottery	No	No
Suzina	Medium-Greek and local pottery	No	No
Griža	Medium-Local and early roman	No	No
Zakose	Medium-Local and early roman	No	No
Vela Gomila	Low	No	No
Grad Gradina	Low	No	No
Gradac	Low	No	No

Sveti Petar	Medium-Archaic Greek and Hellenistic pottery, possible Bronze Ingot	No	No
Gradina	Low	No	No
Gradina	Low	No	No
Gradina	High-Bronze Jewellery, Hellenistic pottery	No	No
Gradina	low	No	No

Harbour name	Coordinates
Sucuraj	43.126212, 17.186719
Gradac	43.105054, 17.339739
Tucepi	43.263735, 17.058181
Makarska	43.294630, 17.014630
Stari Grad	43.184617, 16.599442
Luka Tiha	43.217262, 16.553325
Uvala Vira	43.189999, 16.427981
Hvar	43.172576, 16.440911
Bol	43.261248, 16.664829
Zlatni Rat	43.257568, 16.634094
Milna	43.327254, 16.448330
Bobovisca	43.352095, 16.461934
Supetar	43.385891, 16.548632
Splitska	43.378126, 16.603468
Postira	43.376286, 16.627215
Lovrecina	43.369178, 16.666087
Stipanska Luka	43.346467, 16.743427
Uvala Luka	43.338665, 16.795814
Povlja	43.332738, 16.837096
Uvala Rosatica	43.308073, 16.885483

Greek Structure name	Coordinates	Height
Pharos	508234.21, 4782378.98	5
Purkin Kuk	508330.21, 4781205.7	275
Tor	43.153772, 16.697513	235
Malisnovik	43.194679, 16.634609	59

