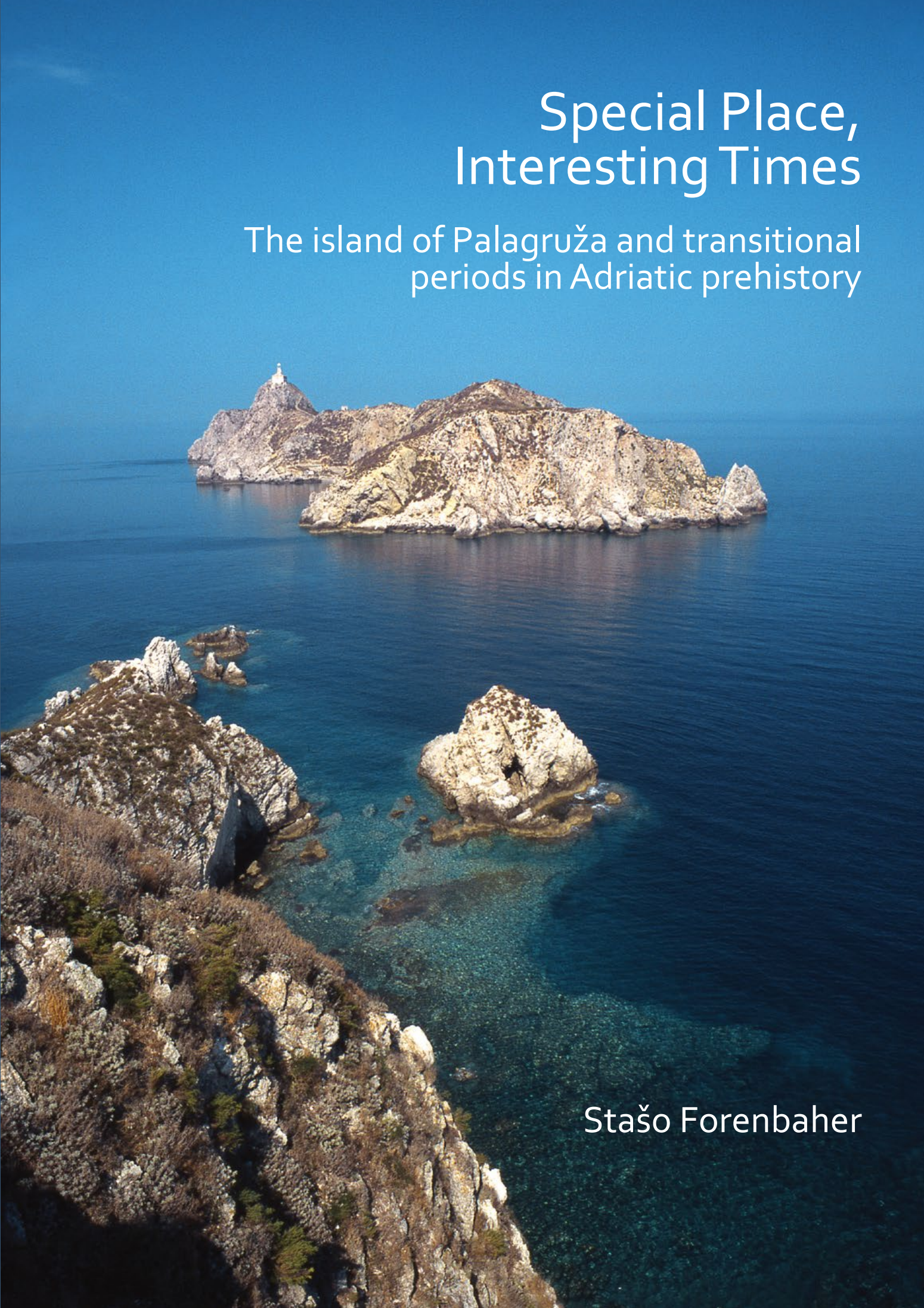
Special Place, Interesting Times

The island of Palagruža and transitional periods in Adriatic prehistory



Stašo Forenbaher

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Stašo Forenbaher

With contributions by

Zlatko Perhoč and Robert H. Tykot

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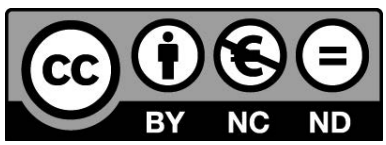

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Preface

May you live in interesting times! While nobody knows the origin of this alleged old Chinese curse, its meaning is clear: in times of upheaval and radical change, most people's lives are neither safe nor easy. Archaeologists are drawn particularly to such turbulent periods, marked by rupture and innovation which they can detect in the archaeological record, try to grasp their origin, and explain their consequences.

One might say that prehistory of the Adriatic was always in transition. Step-by-step changes continued in all ages, but their rhythm was not always the same. On several occasions, a series of changes over a relatively short time period resulted in dramatic transformations. Three crucial episodes of change marked the later Adriatic prehistory. The first one, which took place around year 6000 BC, was a transformation of subsistence strategy, transition from hunting and gathering to farming. The second one, which in the absence of a better term I prefer to call the raise of elites, was a social transformation that played out in the third millennium BC, when for the first time we can see the power of individuals clearly expressed by material culture. The third and last episode, inclusion into the Mediterranean world system and the classic Mediterranean civilization, coincided with the end of prehistory in the Adriatic region.

During all of those episodes, travel and connectivity with distant lands played an exceptionally important role. Under the circumstances, some places gained particular importance due to their unique geographic location. Palagruža is among the most prominent such places, its importance being out of all proportion to its physical size. Adriatic prehistory cannot be told without mentioning Palagruža, and prehistory of Palagruža cannot be understood without knowing Adriatic prehistory. Due to its strategic position in the very center of the Adriatic Sea, due to the mystery born of distance and isolation, due to its wild and spectacular landscape, Palagruža indeed is a special place. A reflection of its specialty is an unexpected abundance of high-grade archaeological evidence, dating precisely from the three aforementioned periods marked by radical change.

This book consists of four parts. The first, introductory part discusses geographic location, natural environment and resources of Palagruža, offers an attempted reconstruction of its appearance during Holocene, and describes archaeological investigations that preceded our own work, including the archaeological evidence recovered by those investigations. The second part of the book provides detailed descriptions of prehistoric sites and finds accumulated during our investigations that lasted from year 1992 until 2009. Most of it is dedicated to Salamandrija, the central and most important site on the island, which is dominated by prehistoric pottery, flaked stone and ground stone assemblages from the third millennium BC. Among other sites that follow, Jankotova njiva stands out due to its few, but very characteristic, finds from the first half of the sixth millennium BC.

The contributions written by Zlatko Perhoč and Robert H. Tykot on sources of the raw materials for the lithic artifacts from Palagruža are of key importance for our understanding of long-distance connections. Zlatko's petrographic analyses of chert demonstrated the existence of intensive and persistent trans-Adriatic interaction, while Rob's analyses of obsidian confirmed occasional contacts with much more distant Mediterranean islands: Lipari in the Tyrrhenian, and Melos in the Aegean Sea.

The third part of the book begins with an analysis of natural characteristics of all small, remote Adriatic islands, and of peculiar circumstances that predetermined Palagruža's special role. Discussions follow of its role in the crucial episodes of Adriatic prehistory, eight thousand years ago during the spread of farming into the Adriatic, and five thousand years ago during the rise of the first Adriatic elites. These are accompanied by an additional chapter on Adriatic pottery styles of the third millennium BC, without which it would not have been possible to write coherently about Palagruža, or about the Adriatic, during that period. The fourth part of the book, an appendix containing summary information about more than 150 sites that yielded characteristic pottery, supplements the discussion of those styles.

A careful reader wills soon notice that in this book, like in many of my earlier writings, I have consistently avoided the concept of 'archaeological culture'. I also tried to minimize the use of common terms for archaeological periods (Mesolithic, Neolithic, Eneolithic, Bronze Age and Iron Age). I discuss the reasons for that in some detail in the introductory part of Chapter 3.3, devoted to pottery styles. Current prehistoric archaeology is mature enough to organize its discourse by centuries, styles and interaction networks, rather than ages and cultures.

Approximately two and a half millennia ago, during the last of the three episodes of change mentioned above, the Adriatic region was absorbed into the classic Mediterranean civilization, but since those events lie beyond the scope of the present book, Palagruža's role in that crucial transformation will be addressed in a separate monograph.

Many have helped to make this book better, prettier and as complete as possible. Ida Beg Jerončić and Tomislav Jerončić, Dinko Radić and Ivan Šuta sent their unpublished articles and reports, shared new information, and complemented the published data about finds from their own investigations. Emil Podrug provided detailed information about the current state of finds from the third millennium BC in Šibenik area. Jane Sanford provided results of her zooarchaeological analysis of the faunal assemblage from Salamandrija. Roberto Micheli helped with determination of mollusks used for making jewelry. Mladen Juračić cleansed the introductory text on Palagruža's geology of my amateurish errors. Darko Uidl and Šime Ivić explained to me many details about the practical use of archery equipment, while Iva Patarčec painted wonderful watercolor reconstructions of that equipment. Ana Grabundžija drew a myriad of tiny pottery fragments from Salamandrija. Jacqueline Balen and Sanjin Mihelić from the Archaeological Museum in Zagreb, and Damir Kliškić from the Archaeological Museum Split, allowed and helped me to access the old finds from Palagruža curated by their respective institutions. I should add that the entire collection of finds from the new explorations of Palagruža also is curated by the Archaeological Museum Split. Tonči Sreser is the author of the excellent photos of the old finds from the Split Museum. I am most grateful to all of them for their magnanimity and effort.

Over many years, fieldwork on Palagruža was funded from different sources. Among them are (in chronological order): University of Birmingham (UK); Royal Ontario Museum, Toronto (Canada); Split-Dalmatia County; Ministry of Culture of the Republic of Croatia; Ministry of Science and Education of the Republic of Croatia, through projects #0258004, 'Greek and Hellenistic Pottery from the 6th to the 1st century BC in Central Dalmatia' and #244-2440820-0810, 'Adrias Kolpos: Identity and Economy of Illyrians and Greeks on Dalmatian Islands', both led by Branko Kirigin. The Archaeological Museum Split was the main patron institution during all exploration seasons. Analyses of archaeological finds, and writing of this book, were supported by the Ministry of Science and Education of the Republic of Croatia, through projects #0196004, 'Population Structure of Croatia: Anthropo-Archaeological Approach' and #196-1962766-2740, 'Culture Change and Dynamics of Archaeological Populations in the Eastern Adriatic', which I led while working at the Institute for Anthropological research in Zagreb.

I first came to Palagruža in May 1993 as a member of an archaeological team, led by Branko Kirigin and Timothy Kaiser, that carried out the first test excavations on the island. Many excavation seasons followed in the course of the next fifteen years, at first with multiannual breaks, later on a regular annual basis, and sometimes even twice within the same year. I am happy that, during four of those seasons, I had the chance to experience the magic of the place, in the company of a small Robinsonian community of Palagruža archaeologists. Thanks to that, Palagruža is a special place for me at a very personal level. My wife Lara Černicki shared with me all of the enjoyable and disagreeable sides of two excavation seasons, suffered for many years my sometimes excessive obsession with work on this book, and spent countless hours improving photos and drawings of archaeological finds.

Many ideas that I elaborate in this book were conceived during frequent periods spent together with Timothy Kaiser. Our friendship, which grew while we did fieldwork at a series of Dalmatian prehistoric sites, goes back to my beginner's days. The way I do archaeology owes very much to Tim. But my somewhat unusual orientation of an inlander who does Adriatic prehistory I owe mostly to Branko Kirigin, the main 'culprit' for my first fieldwork experiences in Dalmatia. When systematic excavation began at Salamandrija, Branko showed great confidence by entrusting me with the prehistoric finds from Palagruža. I admit that I kept him waiting for a long while: a quarter century has passed since his first, unforgettable and decisive visit to Palagruža (as he once vividly described it to me). I hope that this book justifies his expectations.

Stašo Forenbaher
Zagreb, April 27, 2017.

1

Natural environment and research history

1.1 Geographic location and terrain

Compared to the world oceans, Adriatic is a small sea. Form Venice to Otranto it is barely 800 kilometers long and some 200 kilometers wide at its widest, while its total area is slightly less than 140.000 square kilometers. Nonetheless, crossing is not without its perils, since weather conditions can be unpredictable in any season. A simple sailing craft requires a very long summer day to cross the open water between the outermost Dalmatian islands and the coast of Italy. The crossing cannot be accomplished in a single day by a small paddle-propelled boat. For ancient seafarers it was important to know that there was a place, roughly halfway across, where they could beach their craft and take shelter overnight, or wait out an unexpected storm. With three small beaches facing different directions, Palagruža provides this possibility in most kinds of weather.

Palagruža is located near the geographic centre of the Adriatic Sea, at 42° 23' N, 16° 15' E (Figure 1). Whether navigating along or across the Adriatic, one will encounter it somewhere about mid-way. It is also the remotest of all of the Adriatic islands, being almost equidistant from the nearest landfalls in Italy and in Dalmatia: 52 kilometers away from Torre di Calalunga on the Gargano Peninsula and 44 kilometers from cape Kanula on the Island of Sušac. On a reasonably clear day, its rocky spine, rising 100 meters above the surface of the sea, can be spotted from both sides of the Adriatic. This crucial landmark provides guidance to anyone attempting to cross the Adriatic at its narrowest, between Gargano and Dalmatia.

Palagruža archipelago consists of two islets and more than twenty rocks (Figures 2 and 3), 'some of which barely break the water surface, while others tower above it like pointed pyramids' (Marchesetti 1876: 286-287). It includes Galijula, a rock some five kilometers to the east of Palagruža. Total land surface of the archipelago is only 0.32 square kilometers, most of it consisting of steep slopes and vertical cliffs.

Vela Palagruža[1] is an elongated islet, 1450 meters long and 280 meters wide at its widest, with a surface of 0,286 square kilometers (Duplančić Leder *et al.* 2004). The narrow ridge that extends along the island's entire

Figure 1. Location of Palagruža in the Adriatic Sea.

length rises near its western end to 103 meters above the sea level. Its lower part expands to form two small plateaus, Salamandrija near its middle and Jankotova njiva at its eastern end. Two shallow coves, the south-facing Zolo and the west-facing Storo Vloka, do not provide shelter for large vessels, but small craft can be pulled out onto their beaches.

The large lighthouse building was erected in year 1876 on the high ridge, some fifty meters to the east of the island's summit. The trail from Zolo to the lighthouse was built at the same time. The large scar on the slope about fifty meters to the northwest of Salamandrija is a quarry known as Kova, which provided stone for construction of the lighthouse (Kirigin 2012: 122-128). Ruins of several small structures at Salamandrija, a small stone building near Zolo used by fishermen, concrete retaining walls above Zolo, and dry-stone walls enclosing several scattered gardens complete the list of building activities that left their mark on Palagruža.

Mala Palagruža[2] is an irregularly shaped islet, 370 meters long and 170 meters wide, with a surface of 0,027

[1] In local dialect, 'Velo Palagruza' (Božanić 1996a: 100). Except for the generally accepted names of Vela Palagruža and Mala Palagruža, in this book we use consistently the place-names listed by Joško Božanić in his *Onimikon Palagruže*.

[2] In local dialect, 'Molo Palagruza' (Božanić 1996a: 105).

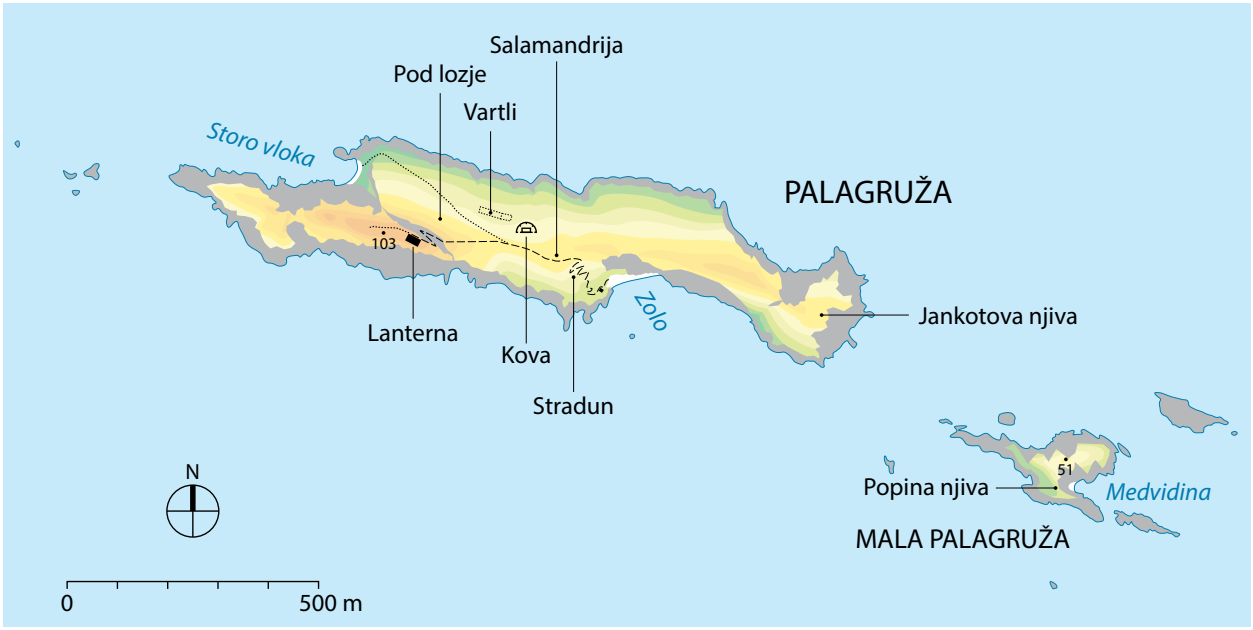


Figure 2. Palagruža archipelago.

Figure 3. View of Vela Palagruža from Mala Palagruža (1993).

km^2 (Duplančić Leder *et al.* 2004). It is even more rugged and inaccessible than Vela Palagruža. It consists of two rocky ridges, one of which juts more than fifty meters above the sea. Between them lies a tiny plateau of Popina njiva. Immediately below it, the well-protected Medvidina cove with a small beach faces east.

After his four-day visit in September 1876, Sir Richard Burton described Palagruža's scenery and atmosphere as follows (Burton 1879: 180-183):

> The form [of Pelagosa] resembles upon the map that of a monstrous fish, with the head to the

west, inclining a few degrees northward, and a welldefined fluke or forked tail to the east, with a little southing. The point of caudal junction, called 'Il Confin', is an ugly knifeboard of crumbling yellow rock, with a precipitous fall on either side. The Scirocco, tyrant of these seas, has converted the whole southern face, except at the 'Žalo' into a stiff and broken cliff-wall, with dentilated head, and face corroded, channeled, and tunneled into a thousand different forms.

...the southern landing place, the Žalo, meaning Spiaggia or beach, [is]a strip of shingle about 100 yards long, which can hardly accommodate more than ten to twelve fishing-boats. They must transfer themselves to the north-west, when the dangerous Scirocco blows...

The northern side, seldom troubled by the Bora, is a dorsum of comparatively gentle slope, becoming more inclined and rocky as it descends seaward, where the bare fawn-colored Calcaire is blackened by the washings of the ever-restless sea. The upper parts are clad with shallow brown humus, scattered stones, and thin vegetation: the chocolate colour of the soil at once attracts notice, after the red earth of Istria and Dalmatia. About the east end of the island, as is also the case in Little Pelagosa, there are caves, hollows, and fissures; and those opening with upper spiracles, when the water expels the compressed air, produce confused and prolongued groans, like moans of pain – lugubrious accompaniments to the rough weather of a storm-lashed wintry night.

A zigzag of 9 ramps, the painful and laborious work of the last three years, leads from Žalo to the summit of the cliff, and here we find the platform of S. Michele... A few yards of strada d'accesso, or level road, lead to the second short zigzag of three ramps, which ascends 'Il Castello', the turret of the 'Last Austrian Ironclad'. This was the fisherman's name for the tall castellated mass which forms the west end of the island; the apex of the comb or ridge, bluff to the south, and of gentler inclination northwards. It was hardly accessible when Pharos was planned...

1.2 Geology, climate and resources

While according to its geographic location Palagruža belongs to the open sea of the Adriatic, its geomorphological and geotectonic characteristics are those of a continental island (Korbar 2013). It is situated on the Adriatic microplate, between the Apennine and the Dinaric mountain systems. Small parts of the Adriatic microplate had moved along fault lines and were uplifted above the current sea level. Palagruža archipelago, a part of a mostly submerged ridge-shaped structure, is one of those uplifted parts.

Palagruža probably sits at the top of a very deep diapiric structure with a salt core (Korbar *et al.* 2009). Built exclusively of sedimentary rocks, it can be described as a vertical topographic feature that has been emerging from the sea in response to active tectonics, and is affected by marine erosion. The oldest sediments are found along an active fault that stretches along the entire length of the island. They consist of soft and strongly deformed siliciclastic rocks (yellowish siltstones and greenish grey claystones of Middle Triassic age) and carbonates associated with gypsum. Grey, hard, cryptocrystalline Late Triassic dolomites that make up most of the island constitute the next sedimentary unit (Figure 4). The aforementioned fault splits this unit in two. Thick bedded dolomites with chert nodules and lenses constitute the southwestern, higher part of Palagruža, while thin bedded dolomites and dolomite breccias devoid of chert make up its lower, northeastern part. In the middle part of the island, dolomites are capped by limestones (calcarenites) of

Figure 4. Dolomite cliffs of the southern slope of Vela Palagruža, with Lanterna (lighthouse) on their summit (2003).

Figure 5. Xerothermal maquis dominated by the tree spurge (Euphorbia dendroides), left: in May (1993), right: in September (2004).

Miocene age, while slopes are covered by cemented talus, rock-fall boulders and humic soil.

Igneous rocks have not been found anywhere on the surface of Palagruža archipelago. Therefore, one should not speak even conditionally of 'the volcanic triangle of Jabuka – Komiža – Palagruža' (Korbar 2013).

Systematic recording of weather began at Palagruža in year 1894, when a meteorological station was established (Pandžić and Sijerković 1996). Thanks to that, characteristics of the island's climate can be clearly defined (Trošić *et al.* 2003). Palagruža has Mediterranean climate, with specific modifications that come as a consequence of its open sea location. Summers are hot and winters are mild, the annual temperature mean is 16,2°C, and temperature variation is the lowest in the Adriatic. Exposure to the wind and sunshine is very high, with 2621,2 hours of sunshine, 104 days with strong winds, and 21 days with gale force winds in an average year. Relative humidity is also high throughout the year, fluctuating through the seasons between 74% and 77%, but rain is rare and light (Milković 1996), since clouds do not encounter an obstacle that would trigger it. The annual precipitation average is only 304 millimeters, which is the lowest in Croatia.

Terrestrial resources that may be of human interest are extremely scarce. Since there are no springs or watercourses, the only water available comes from cisterns that are not easily replenished due to the small amount of rainfall. The oldest preserved remains of such cisterns on Palagruža date from classical antiquity (Kirigin 2012: 90). Not a single tree grows in the entire archipelago, which makes firewood the next crucial missing resource. Degraded Mediterranean vegetation covers the less precipitous slopes of the islands that have not been eroded to the bedrock. Particularly prominent is xerothermal maquis (Pavletić 1996: 188) dominated by the tree spurge (*Euphorbia dendroides*), an allergy-provoking plant that drops its foliage in spring and breaks into leaf in autumn (Figure 5). Among edible and medicinal plants one may note a species of wild onion, capers, rock samphire, wormwood and rue.

Agricultural potential of the island is minute. Cultivable soil covers parts of the island's gentler northern slope. Lease-holders form the island of Hvar used to grow wheat on those fields in 16th and 17th century

(Kovačić 1997: 41). There is mention of seven hectares (0,07 square kilometers) of cultivable land, which would imply that almost the entire northern slope was under cultivation. Rather than hinting at an unusual richness of Palagruža's fields, this testifies of shortage of cultivable land in Dalmatia, and maybe also of an attempt to control the rich fisheries of Palagruža under the pretense of growing wheat on the island (Kovačić 1997: 41-42). Yields varied considerably, but they were always small (less than ten metric tons of wheat), so that leaseholders sometimes could not be found (Kirigin and Katunarić 2002: 300). Parts of the slope were terraced and used for growing 'Palagruzonka' grapes (Božanić 1996a: 104). Some 300 liters of vine could be produced annually from those vineyards (Gaffney and Kirigin 2006: 9). Today, terraces are derelict and fields have been abandoned, aside from a few small gardens tended by the lighthouse keepers' families. A few decades ago, a small herd of goats browsed and a few rabbits pranced about Palagruža. They too were kept by lighthouse keepers, and have been used up by them since. Before the cargo cableway was installed, they also kept a donkey to help them haul equipment and provisions from Zolo to Lanterna.

Palagruža archipelago is located at the contact between the deep and the shallow part of the Adriatic, in the path of currents that continuously introduce fresh nutrients (Kirigin 2012: 114-121). Thanks to that, the surrounding sea is particularly rich in fish, and is regarded as the richest fishing ground for sardines in the Adriatic (Jardas *et al.* 1996: 205-206; Sinovčić 1996). Sardine fishing in the open sea is anything but simple. It requires considerable investment in purpose-built vessels, special equipment, and a relatively large and skilled crew. Fisheries around Palagruža gained economical importance only after fishing had evolved to a highly organized and technologically sophisticated activity (Božanić 1996b: 58-63). From 16th century onwards, numerous documents testify of their importance, and of rivalry and conflicts among fishermen from the neighboring islands and both sides of the Adriatic (Kovačić 1997: 40-41; Županović 1993: 225-228).

Mineral resources that may have been of some interest to prehistoric visitors include chert and clay. Clays from the oldest sedimentary unit might have served as raw material for making pottery, but their suitability for that purpose remains to be tested. As already noted, dolomite rocks of Vela Palagruža contain nodules and lenses of grayish chert. Their presence has been noted above Storo vloka cove and at Picokare (Korbar *et al.* 2009: 83-84), as well as eastwards from Pol Forane and at Zolo, where about 5% of the pebbles are made of chert (Perhoč 2009: 33). Chert is particularly common on Mala Palagruža, where series of large nodules and lenses are aligned along layers of bedrock, while smaller eroded pieces can be found on the beach at Medvidina cove (Perhoč 2009: 33, Figure 8). There are many rounded hollows in dolomite bedrock, some of them still containing bits of chert and suggesting chert mining (Forenbaher and Kaiser 1997: 22; Kaiser and Forenbaher 1999: 316). While technical quality of Palagruža chert is not particularly high, it is serviceable for making flaked stone tools. However, the lithic assemblage from Salamandrija belies the use of local raw materials (a topic to be discussed in the next chapter), while Mala Palagruža did not yield a single unquestionable lithic artifact.

1.3 Palagruža and Adriatic navigation

The unique geographic location of Palagruža is probably its most valuable natural resource. The largest lighthouse in the Adriatic, built on the summit of barely accessible cliffs, testifies of the island's extraordinary importance for navigation. Many authors have discussed the crucial role that it must have played for ancient seafarers (Radmilli 1970; Petrić 1975; Forenbaher and Kaiser 1997; Bass 1998; Farr 2006; Kirigin *et al.* 2009; Kirigin 2012; Kaiser and Forenbaher 2016).

Adriatic is the northernmost part of the Mediterranean Sea, a large, elongated bay that reaches deep towards the middle of the European continent. Two recent papers offer overviews of its main topographic, oceanographic and climatological characteristics, especially those that must have been important for ancient navigation (Kirigin *et al.* 2009: 146-148; Kaiser and Forenbaher 2016: 146-151). Its complex currents and winds vary considerably from season to season. Sudden storms are common throughout the year and local currents can reverse themselves, deceiving even a seasoned seaman. More than a thousand islands, islets and rocks, as well as many straits and shoals, are scattered along the highly indented eastern Adriatic coast. Successful navigation therefore depends upon detailed knowledge of topography and 'reading' of currents, winds and other indicators of weather.

When discussing the ancient Mediterranean navigation, most authors make the assumption that the physical environment, currents, and weather conditions have not changed much over the last few millennia (Murray 1987). In classical antiquity, long-distance navigation was limited to the warmer part of the year. According to written sources, the best sailing season lasted from the end of June until the end of September. Risks were considered to be excessive from November until May, especially for merchant ships carrying valuable cargo. Meteorological data suggest that the open waters of the Adriatic were not navigable during the colder part of the year (Kirigin *et al.* 2009: 145-146, 150).

Often it has been asserted that the ancient Mediterranean seafarers avoided navigation out of

Figure 6. View of Palagruža, left: from Vis (1993), right: from Gargano (2008).

site of land (Casson 1995; Kaiser and Forenbaher 2016: 158). In contrast, written sources and recent deep-sea explorations indicate that sailing for days across the open sea was quite common in classical antiquity (Ballard *et al.* 2000; Kirigin *et al.* 2009: 143-144). Earlier prehistoric seafarers attempted such long journeys much less often (Broodbank 2013: 154, 214). In either case, finding and recognizing landmarks such as coastal mountains, capes, or islands must have been of great importance.

The optimal route of an ancient ship travelling from Otranto to Ravenna or Aquileia leads across open sea, while keeping in sight the mountain ranges that line the eastern Adriatic coast. Thus one can take advantage of the slow current that flows up the Adriatic and is strongest at some distance from the coast. Roughly midway, one should turn westwards toward Gargano, first following the southern Adriatic current vortex to Palagruža, then continuing to the northwest parallel to the Italian coast, but far enough from it to avoid the current that flows in the opposite direction. The optimal route of the return journey follows the full length of the Italian coast and crosses the Adriatic only at Otranto. Its critical point is between Gargano and Palagruža, which thus becomes a particularly important landmark for both directions of travel, marking the riskiest sections of the journey (Kirigin *et al.* 2009: 150).

Palagruža's role in the prehistoric connection between the eastern and the western Adriatic coasts is even more important. The Adriatic basin narrows near its middle, where a chain of small islands (Tremiti, Pianosa, Palagruža and Sušac) stretches between the Gargano Peninsula and the Dalmatian archipelago. Located at its very middle, Palagruža is the crucial link of that 'island bridge' (Radmilli 1970: 440-441; Petrić 1975; Bass 1998: 167). Its high, easily recognizable outline provides an unmistakable landmark that is visible from both sides of the Adriatic (Figure 6).

Information is very limited about prehistoric seagoing vessels in the Mediterranean. Apparently, only small craft propelled by paddles were in use until the third millennium BC, capable of travelling at the maximum rate of four kilometers per hour (Farr 2006: 90, 95; Broodbank 2013: 213-214). Crossing the Adriatic thus would have taken a few days at the least. By using the

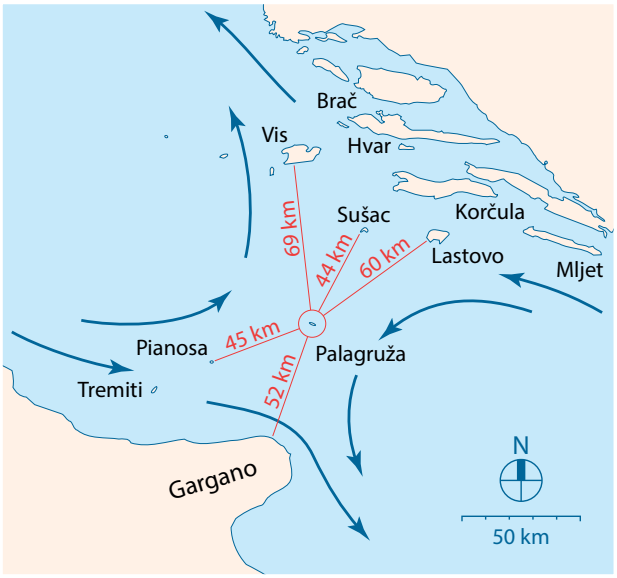


Figure 7. Dominant currents in central Adriatic, and distances from Palagruža to the neighboring islands and mainland.

stations of the island bridge for rest and shelter, the crossing could be divided into several fairly safe stages (Figure 7). The longest stage would have been the one from Palagruža to Pianosa (45 kilometers), but from a seafarer's point of view, Pianosa is a useless islet that is best avoided, since its low profile is hard to spot, it is surrounded by shallows, and completely exposed to spray during storms. In practice, the longest stage would have been the one from Palagruža to Gargano (52 km). This means that crossing the Adriatic during long summer days may have been accomplished without spending the night upon the open sea. If the atmospheric visibility conditions were good, one could always see mainland or one of the islands from a small boat, although Palagruža cannot be seen from the sea level at a distance greater than forty kilometers due to the Earth's curvature. It is not visible when navigating along the coast of Gargano, and it appears on the horizon about one kilometer to the south of Sušac (Kirigin *et al.* 2009: 139).

Prehistoric seafarers crossing the Adriatic would have had a good reason to land at Palagruža, but going ashore is not simple due to numerous rocks and shoals, strong currents and shifting winds. Landing is safest when the sea is calm on the southern side of the island, which is often the case from May to October, when northerly and westerly winds prevail. Small craft can then be beached at Zolo and pulled out of water (Figure 8). Landing at Zolo is not possible when the southeasterly Jugo is

Figure 8. View of Zolo from Salamandrija (2004).

blowing, but then one can usually land at Storo vloka. If Jugo is strong, the sea gets rough around the whole island, prohibiting landing (Kirigin *et al.* 2009: 137).

1.4 Geomorphological changes

Size, height and shape of Palagruža have changed considerably on the long-term geological time scale. Changes kept occurring during the recent millennia, since people began visiting the island, and they continue happening today. Appropriate assessment and interpretation of the archaeological evidence therefore depends upon our knowledge of Palagruža's past appearance.

Sea level changes were of key importance. Those changes are the sum of eustatic, isostatic, and tectonic factors. The first is global, while the latter two vary with location. The isostatic part exhibits a well-defined pattern and is readily predictable, while the tectonic component exhibits a less regular pattern and is less predictable. Together, these components result in a complex spatial and temporal pattern of relative sea-level change within a region (Lambeck *et al.* 2004: 1567).

On the time scale of the glacial cycles, the global fluctuations in sea level are caused primarily by the exchange of water mass between the ice sheets and the oceans (Lambeck *et al.* 2004: 1580; 2014: 15296; Surić 2009: 182). The cyclical expansion and contraction of glaciers is driven by climatic fluctuations between cold and warm periods. Some twenty thousand years ago, during the Last Glacial Maximum, huge masses of water were locked in glaciers, while the global sea level was up to 130 meters lower than today (Surić *et al.* 2005: 164; Surić 2009: 182; Lambeck *et al.* 2014: 15301).

Dynamics of the global sea level rise since the Last Glacial Maximum are well known (Fairbanks 1989: Figure 2; Lambeck *et al.* 2014: Figure 4a). During the main phase of deglaciation at the time of Pleistocene to Holocene transition, over a period of about ten thousand years (roughly, between 14.500 and 5000 years BC) the sea level rose at an average rate of about 12 millimeters per year. Around 12.500 years BC, at the beginning of the Bølling-Allerød interstadial it rose even faster, at a rate of 40 millimeters per year or greater. Since year 4700 BC it rose only four more meters, including only one meter after year 2200 BC (Lambeck *et al.* 2014: 15302).

Eustatic sea levels are much modified locally by glacio-hydro-isostatic effects (Surić 2009: 182). Isostatic adjustment is a complex response of the Earth's crust (continents and ocean floor) to glacial cycles. To simplify, isostasy maintains the hydrostatic equilibrium among different parts of the Earth's crust that 'float' upon the viscous mantle. Near the polar regions, ground sinks or is uplifted due to increased or decreased load of glaciers. Sea floor and continental shelf respond in the same way to the additional loading and unloading of water (van Andel 1989: 734). Deformation of the crust caused by those processes, as well as the associated gravitational changes, complicate the pattern further. To those one should add the lesser isostatic components such as global changes in the planetary shape, rotation and gravity (Lambeck *et al.* 2004: 1580-1581; 2014: 15296).

Taking into account all of the abovementioned factors and numerous field observations, Lambeck *et al.* proposed a model of eustatic-isostatic sea level change for central Mediterranean, including the Adriatic (Lambeck *et al.* 2004: 1595, Figure 12). According to their model, the sea level in the centre of the Adriatic would have been about 133 meters lower than today during the Late Glacial Maximum (19.000 years BC). During the transition to farming (6000 years BC) it would have been about 16 meters lower than today, and at the time of the ascent of early elites (3000 years BC) about four meters lower than today (Figure 9).

Establishing the sea level change relative to the neighboring land is complicated further if the land itself is rising or falling due to tectonics (van Andel 1989: 734). Vertical tectonic movement may be very uneven in space, while its average rate may reach a few millimeters per year. For instance, some sections of Italian coast are uplifting, other sections are sinking, while still other remain stable (Valloni 2000: 43, Figure 1; Lambeck *et al.* 2004: 1570-1580). Recent investigations along the eastern Adriatic coast hint at a similarly complex situation (Surić 2009; Surić *et al.* 2014). Furthermore, average uplift rates may change over extended periods of time (Lambeck *et al.* 2004: 1568, 1595).

Cemented talus and detached boulders that are present all across the island (Korbar *et al.* 2009: 77), modern seismological data (Bognar 1996: 88-89; Kuk and Skoko 1996), as well as historical written sources (Fortis 1984: 248; Burton 1879: 180; Mardešić 1993: 199) testify of recent tectonic activity in Palagruža's neighborhood. Geologists use various geomorphological markers in order to quantify tectonic movement and isostatic fluctuation (Lambeck *et al.* 2004: 1569-1570; Surić *et al.* 2005; Surić 2009). Among those geomorphological markers that were recorded on Palagruža are marine terraces, paleobeaches, and pelagosite (Korbar *et al.* 2009: 87-88). Marine terraces and paleobeaches have not been dated, but judging by their high elevation above the current sea level, most of them are probably older than the Pleistocene-Holocene transgression, which means that they predate the times of human presence on the island. As opposed to that, pelagosite offers a possibility of temporal control of tectonic movement and isostatic change during the last several millennia.

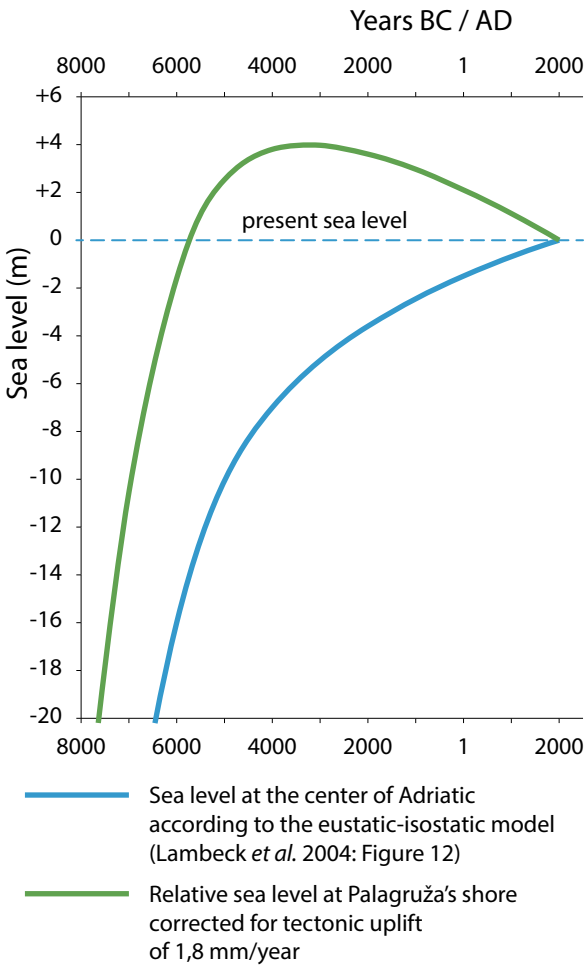


Figure 9. Sea level change in central Adriatic during the last 8000 years.

Pelagosite is a pisolithic aragonite that owes its name to Palagruža. It is produced by cyanobacteria that live on supralittoral rocks frequently wetted by sea aerosol (up to a couple of meters above tide line) and is solidly attached to the rocky substratum (Korbar *et al.* 2009: 88). Thanks to its biogenic origin, it can be dated by direct radiometry. Preliminary uranium-thorium dating of samples from Palagruža indicated an age of about 2200 years for samples collected from between three and four meters above the sea level, and about 6500 years for a sample collected from six meters above the sea level.[3] Based on this, the average rate of the island's uplift was estimated to around two millimeters per year (Montanari *et al.* 2007), or 1,5 millimeter per year (Korbar *et al.* 2009: 88). If one presumes that the dated samples of pelagosite were created at one meter height above the sea level, and if one accounts for the sea level change around Palagruža according to the eustatic-isostatic model (Lambeck *et al.* 2004: Figure 12), the average uplift rate for Palagruža would be about 1,8 millimeters per year. The corrected curve of relative sea level change at Palagruža (Figure 9) relies on the abovementioned eustatic-isostatic model and the estimated average rate of tectonic uplift.

Last, but not least, local factors sometimes cause changes of microtopography that may be of decisive importance to people. For instance, fertile plateaus may be reduced or even disappear due to collapse of coastal cliffs, while landslides may bury protected coves and beaches suitable for landing, or create them in places where they did not exist before. Since Palagruža is surrounded by open sea, it is exposed on all sides to heavy marine erosion that is actively breaking up its shores (Bognar 1996: 94). If one adds to that the faults that dissect the island, and the fragmented character and relative brittleness of some of its rocks, it comes as no surprise that large landslides are not uncommon. The largest one in memory occurred in the second half of the 18th century, when cliffs collapsed above the eastern end of Zolo, burying two dozen fishermen from the island of Hvar (Burton 1879: 180; Božanić 1983: 98; Kovačić 1997: 42, 45, footnote 15). That landslide reduced the size of the beach usable for beaching fishing boats. The location is known today as 'Pol Forane' ('below the people from Hvar').

Based on the combined evidence outlined above, the appearance of Palagruža at times that are crucial for understanding human presence and activity on the island may be roughly reconstructed, with a caveat that we rely on the currently available model of isostatic adjustment of the sea level and a preliminary estimate of the rate of tectonic uplift. Continued geological research should improve and correct the scenario proposed below.

During the Last Glacial Maximum (about 19.000 years BC), eustatic-isostatic sea level in the center of Adriatic was about 133 meters lower than today (Lambeck *et al.* 2004: Figure 12). At first glance it would seem that Palagruža was connected to the mainland at that time, since the channel that separates it from Gargano today is 128 meters deep at its deepest spot (Državni hidrografski institut 1994). However, if that area is uplifting at a rate similar to the neighboring Gargano and Palagruža, it would have been deeper at the time by additional 35 meters. It follows that when the sea level was at its lowest during the Late Glacial Maximum, Palagruža would have been separated from Italy by a channel some 30 meters deep. It would have been a relatively low but fairly large island, roughly the size of Šolta in middle Dalmatia. It would have been the largest island of an open-sea archipelago, some 35 kilometers distant from either shore of a much narrower Adriatic. All islands of that archipelago are submerged today, aside from the topmost parts of the former 'greater Palagruža'.

[3] There is also mention of pelagosite at 10 meters (Montanari *et al.* 2007) and 13 meters above the sea level (Korbar *et al.* 2009: 88), but those occurances were not dated.

Figure 10. Cliff collapse caused by marine erosion at the eastern end of Vela Palagruža, below Jankotova njiva (2004).

After the Last Glacial Maximum, flooding of Palagruža proceeded at a rate of around 10 millimeters per year, taking into account eustasy, isostasy and tectonics. The sea-level rise slowed down considerably around year 6200 BC (Lambeck *et al.* 2014: 15302), at the time when transition to farming began in the middle Adriatic (Forenbaher *et al.* 2013: 594-598). At the time, the relative sea level at Palagruža's shores was only one or two meters lower than today (Figure 9), but one should remember that marine erosion kept breaking up and devouring those shores over the next eight millennia. Palagruža therefore must have been somewhat larger than today, although it did not rise much more above the sea.[4] It would be useful to know how much different were its size and shape. Were its coves more or less protected? Were its beaches larger or smaller, and did their location coincide with the current one? Were the flat areas of cultivable land larger than today? What did the eastern end of the island look like, given the clear evidence of recent landslides triggered by marine erosion (Figure 10)? The answer to the last question directly bears upon the interpretation of the Early Neolithic site at Jankotova njiva.

Around year 4700 BC, the rate of sea-level rise slowed down abruptly (Lambeck *et al.* 2014: 15302). During the fourth millennium BC, it become counterbalanced by tectonic uplift, and flooding of Palagruža stopped at the highest relative sea level of about four meters higher than today (Figure 9). Around the middle of the third millennium BC, at the time of the most intensive prehistoric activity, the relative sea level at Palagruža's shores was still almost four meters higher than today. The island probably was not any smaller, because it must have lost some of its area since then due to marine erosion. As for its microtopography, the most interesting question might refer to the size of Zolo, which with the sea level at +4 meters may have been much smaller than today.

Since then, tectonic uplift has outpaced the very slow sea-level rise, and Palagruža is again slowly emerging from the sea.

1.5 Research history

Although almost a century and a half have passed since the traces of prehistoric visitors were first recognized on Palagruža, only scanty and more or less accidentally collected archaeological information was available until the 1990s. Different explorers were fascinated primarily by numerous flaked stone arrow points and blades, and by human skeletal remains, some of them possibly prehistoric. Those finds augured that Palagruža might harbor unusually rich and interesting archaeological evidence.

[4] In some of my earlier writings I hypothesized that, about 6000 years ago, all constituent parts of Palagruža archipelago (except Galijula) may have formed a single island, possibly twice as large as today's Palagruža (Forenbaher 2009b: 79; 2013: 89). According to the recent geological research that has been taken into account here, that almost certainly was not the case.

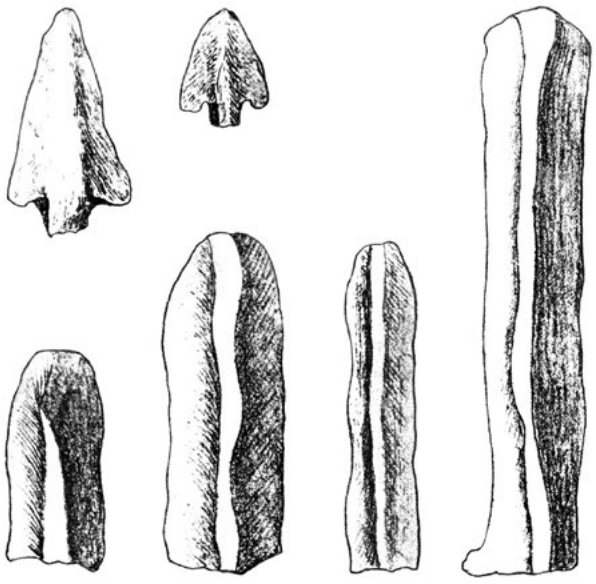


Figure 11. Objects made of flaked chert collected from Palagruža; not to scale (after Marchesetti 1876: Plate 2: 1-6).

Investigation of Palagruža's prehistory began in September 1876, with a four-day visit paid by Carlo de Marchesetti and Sir Richard Burton immediately after the lighthouse was built on the island (Kirigin 2012: 38-40). Both were explorers of broad interests. Together with geology, paleontology, climate, flora and fauna, archaeology was just one of their fields of interest (not the most important one by any means). They soon published descriptions of their visit, which mention prehistoric finds only briefly and in passing, without specifics of their provenience.

In his *Description of the Island of Palagruža,* Marchesetti states that the finds collected from the quarry (Kova) during construction of the lighthouse indicate that the island was inhabited since the Stone Age (Marchesetti 1876: 287-289). Judging by the quantity of the recovered stone weapons, he presumes that the island must have supported a substantial population. He draws attention to flaked stone points and blades (Figure 11) and mentions an intriguing find, a stone point 'stuck in a skeleton'. If his description is taken literally, this would represent a prehistoric burial. Unfortunately, the find in question was left on Palagruža due to superstition of the workers who claimed that the bones belonged to the patron saint of the island, who certainly would punish them by chasing away the fish that provided livelihood to the local fishermen. Marchesetti writes that those finds were recovered near St. Michael's church at a depth between 0,5 and 2 meters, and in some caves near the quarry, where they were covered by black soil and broken stones. Burton's *Visit to Issa and Pelagosa* contains even less archaeological information. He writes only that one of the finds suggests a battlefield and burial ground of men of the Stone Age, and leaves a careful inspection of the sites where the finds appeared for some future occasion that never materialized (Burton 1879: 179, 181).

A few years later, Šime Ljubić wrote that the Archaeological division of the National Museum in Zagreb obtained 'from Professor E. Gasparini of Split... a knife and a flint arrow that he himself had found in the upper deposit of the black soil that covers the middle part of Palagruža. According to his report, many similar objects had been excavated already. Most of them are now kept by Mr. Topić at Vis, while the rain keeps uncovering new ones. He thinks that systematic exploration of the aforementioned sediments would be very fruitful' (Ljubić 1885). A few more years later, Don Frane Bulić writes that 'human bones and skulls' as well as 'flint weapons of diverse sizes' were found on Palagruža during the lighthouse construction. They were collected by Božo Poduje, a merchant from Komiža who directed the construction work, and who later gave them away to different people. He gave some of the finds to Marchesetti, while other finds ended up in the Archaeological Museum in Zagreb (Bulić 1893).

A small assemblage of finds from Palagruža, kept by the Archeological Museum in Zagreb, consists of 43 flaked chert artifacts, weighing a total of 250 grams.[5] Among them are two small bifacial points, 34 prismatic blade segments and seven flakes. All of those objects were bought from Anton Godac, a teacher in Lembach (today, Limbuš near Maribor), except for the one that was donated by Mijo Kišpatić. Both points have covering (or almost covering) bifacial retouch, a tanged base, and are missing their distal end (Figure 12: 1, 2). One of them must have been over 50 millimeters long when it was complete, which would make it unusually large. Prismatic blades usually have trapezoidal, sometimes triangular, and rarely polygonal section (Figure 12: 3-9). Their width is between 11 and 30 millimeters (19 millimeters on the average), while the only complete blade 70 millimeters long and 13,5 millimeters wide (Figure 12: 7). A few examples have a cortical dorsal facet along a lateral edge. More or less discontinuous microretouch that extends along the edges of most of the blades probably is related to their use. As opposed to that, rough edge damage probably is postdepositional, judging by differential patination. Formal tools include four unilaterally or bilaterally retouched blade segments (Figure 12: 3, 4), two notches on blades and a backed blade. Also present is a core rejuvenation element akin to a crested blade (Figure 12: 9). Flakes include a couple of secondary flakes and a retouched core rejuvenation flake. Their edges also are frequently modified by a more or less discontinuous microretouch.

[5] I am grateful to the Expert Committee of the Archaeological Museum in Zagreb, which granted me the permission to analyze and publish these finds.

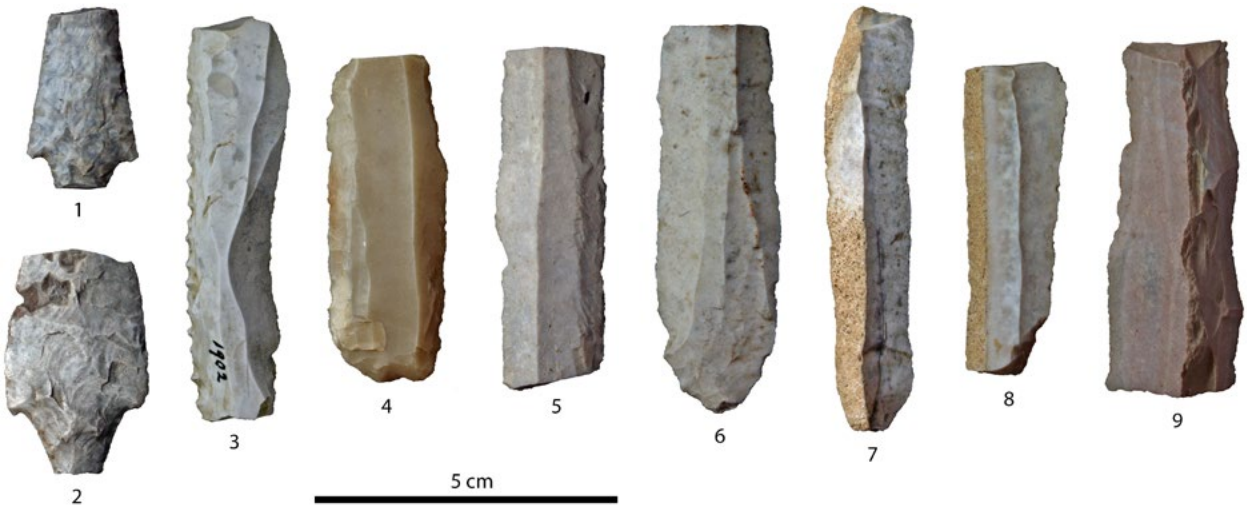


Figure 12. A selection of flaked chert objects collected from Palagruža, from the Archaeological Museum in Zagreb.

Another small assemblage of finds from Palagruža is kept by the Archaeological Museum Split. Antonio Radmilli had compared the 'three large scrapers on blades' from that assemblage with similar finds from Tremiti, and had attributed them to the Neolithic 'Scaloria culture' (Radmilli 1970: 440). The assemblage consists of 28 flaked chert artifacts.[6] Among them are 25 segments of prismatic blades, two large flakes and a small core fragment (Figure 13: 19). Blades in general are very similar to those from the Archaeological Museum in Zagreb. They also usually have trapezoidal, sometimes triangular, and rarely polygonal section (Figure 13: 1, 10-18). Their width is between 11 and 25 millimeters (18 millimeters on the average), the longest complete blade is 76 millimeters long, and one of them has a cortical dorsal facet along a lateral edge (Figure 13: 14). Among them is a single core rejuvenation element (Figure 13: 20). Discontinuous microretouch along their edges probably is use-related, while most of the coarse edge damage probably is postdepositional, judging by differential patination (Figure 13: 10). Formal tools include three blades with retouch along one lateral edge (Figure 13: 8, 9), three blades with bilateral retouch converging to a more or less well defined point (Figure 13: 2, 5, 6), two end scrapers on blades (Figure 13: 3, 4), and a blade segment with flat retouch along its entire perimeter (Figure 13: 7).

These points, blades and flakes are somewhat larger on the average then the finds that were later systematically recovered from Palagruža. That is not surprising, since they have been picked up arbitrarily and selectively. Their other typological, technological and raw material characteristics correspond fully to those of the systematically recovered flaked stone artifacts that will be discussed extensively in the next chapter.

The first archaeologist to visit Palagruža after Burton and Marchesetti was Nikša Petrić, who spent a day on the island in July 1975 and published a short report about it in *Arheološki pregled* (Petrić 1975). Following a brief presentation of earlier finds, Petrić writes that he also had collected from the surface 'two stone objects' and several fragments of badly worn prehistoric pottery from near St. Michael's. He found a few more such potsherds 'in the garden-shelter to the west from the lighthouse'. Based on their fabric, he ascribed some of them to the Neolithic, and others to 'later periods'. In a small cave 'below the southern spur of St. Michael's' he excavated a small trench, but 'without attractive results'. About a decade ago, he published ten bifacial points from Palagruža (Figure 14), without providing details of their provenience and other circumstances of their recovery (Petrić 2004: 188, 188, Figure 8).

A new era of archaeological research began in August 1992, when a team of Archaeological Museum Split and the University of Birmingham archaeologists spent a day on Palagruža while working on the international 'Adriatic Islands' research project. Extensive surface survey of much of Vela Palagruža and intensive survey of the northern slope of Salamandrija were carried out on that occasion (Kirigin 2012: 40). Due to the unusual richness of finds, members of the same project continued investigations in May 1993. Fieldwork led jointly by the Archaeological Museum Split and the Royal Ontario Museum from Toronto lasted one week. A series of small test trenches were excavated on the northern slope of Salamandrija, at Salamandrija itself, and at Jankotova njiva. Extensive surface survey of the eastern end of Vela Palagruža was completed, and Mala Palagruža was surveyed (Forenbaher *et al.* 1994: 36-45).

[6] I am grateful to Damir Kliškić, director of the Archaeological Museum Split, for permission to analyze and publish these finds.

Figure 13. A selection of flaked chert objects collected from Palagruža, from the Archaeological Museum Split (photo: Tonči Sreser).

Due to a police alert about a find of numerous fragments of fine Greek pottery, a three-day rescue excavation was carried out in November 1994 at the spot where the main island trail cuts into the southern edge of the Salamandrija plateau (Kirigin and Čače 1998: 65, 82-83). After two years' pause, two-week excavation of the remains of St. Michael's church on Salamandrija followed in August 1996. It was prompted by archbishop Štambuk of Hvar, funded by Split-Dalmatia County, and carried out under the lead of the Archaeological Museum Split (Kirigin and Katunarić 2002; Kirigin 2012: 43, 105-107). That excavation already followed the square grid that was laid out across the entire site in anticipation of systematic area excavation.

From year 2002 until 2009, Archaeological Museum Split conducted the area excavation at Salamandrija, the most important site on the island. Fieldwork was

Figure 14. Bifacial points made of flaked chert, collected from Palagruža; not to scale (after Petrić 2004: Figure 8).

done either in June or in September (sometimes, both), during a total of ten campaigns, their duration limited to maximum three weeks due to organizational constraints (Kirigin 2003; Kirigin *et al.* 2004; 2005a; 2005b; 2006; 2007; 2010; 2011). The whole western part of the plateau was excavated, as well as several smaller areas near its middle.

Between year 1992 and 2009, archaeological teams spent a total of about five months on Palagruža. They completed extensive surface survey of the entire Palagruža archipelago, and intensive survey of about 5500 square meters of the two most important sites. They excavated eighteen test trenches with a combined area of 20 square meters, and carried out an area excavation of about 300 square meters. By no means did they exhaust the island's archaeological potential, but they did produce large and representative samples of archaeological evidence, allowing us to claim that Palagruža's archaeological record is now well known.

2

Sites

2.1. Salamandrija

The most important archaeological site on Palagruža is centrally positioned on the ridge that extends along the entire length of the island (Figure 2). Some fifty meters in diameter and covering an area of just under 2000 square meters, the small oval plateau of Salamandrija (Božanić 1996a: 104; Gaffney and Kirigin 2006: 75) lies directly above Zolo at an altitude of 55 meters (Figures 15 and 16). Due to its convenient location, this plateau has been used since the earliest times for various activities. During Classical and Hellenistic Greek periods, a sanctuary devoted to Diomedes existed on Salamandrija (Kirigin and Čače 1998; Kirigin 2012: 58-73). A massive fortress replaced the sanctuary in Late Roman times. Over the last few centuries, several fishermen's huts, a small church dedicated to St. Michael, and a couple of cisterns with a large rainwater catchment surface were built at the location of the abandoned fortress. Those buildings were destroyed by artillery fire from Austrian warships during World War I. Finally, two small concrete structures were erected there by the Italian army that controlled the island between the two world wars (Kirigin 2012).

While these events obliterated most of the traces of earlier prehistoric activities on the plateau, numerous prehistoric finds lie scattered on the surface of the steep northern slope that descends from Salamandrija to the sea at an angle of 25°, and the even steeper, rocky and broken southern slope.

2.1.1. Archaeological investigations 1992-2009

During the first visit in year 1992, when the intensive survey of the northern slope of Salamandrija was carried out, Salamandrija was recorded as 'Locality Palagruža 1' (Forenbaher *et al.* 1994: 40-42, Figure 16). Later, a series of test trenches was excavated on the northern slope, while an area excavation was carried out on the plateau itself.

Figure 15. Position of Salamandrija relative to Zolo and Lanterna (2002).

Figure 16. Salamandrija before the beginning of area excavation, with Lanterna in the background (1996.).

2.1.1.1 Surface survey

The intensive surface survey encompassed a fifty-meter wide segment of the northern slope, stretching to the east of the rainwater catchment surface, and to the north of the remains of St. Michael's church (Figure 17). Particularly high density of surface finds, such as small potsherds and flaked stone artifacts, was noted along that part of the slope during the preliminary survey. An area of 3500 square meters was intensively surveyed. Artifacts were picked up in transects that were five meters wide and laid horizontally across the slope in order to provide rough information about spatial distribution and density of surface finds.

2.1.1.2 Test trenching

A year after the intensive survey was completed, ten small test trenches with a total area of 11, 5 square meters were excavated at Salamandrija (Figure 18). The largest one, a 1x2 meter trench excavated at the southwestern end of the plateau, did not yield any prehistoric finds. The remaining nine trenches were excavated roughly in a straight line that cut across the densest part of the surface scatter, beginning at the northeastern edge of the plateau and continuing downslope (Figure 17). The choice of individual trenches' location was limited by the dwarf trunks of tree spurges that grow over parts of the slope. The purpose of test trenching was to check whether any archaeological deposits or features existed below the surface. The size of all of those trenches was 1x1 meter, except for the 1x1,5 m trench that was located just under the edge of the plateau.

Stratigraphy was very similar in all trenches. Below the surface was a 0,1 to 0,25 meters thick layer of dark soil, containing numerous prehistoric potsherds and flaked stone artifacts, as well as many small finds from later periods. Below it was a 0, 3 to 0, 5 meter thick layer of archaeologically sterile colluvial deposit. This lay on top of scree, or directly on bedrock. Structural remains or undisturbed archaeological features were not observed in any of the trenches.

2.1.1.3 Area excavation

An area excavation exposing almost 300 square meters was carried out on the plateau itself (Figure 17) during a series of field campaigns that lasted from year 1996 until 2009. Excavation followed natural layers, and all excavated soil was sieved. Finds were recorded according to a 2-meter square grid (Figure 19).

In its middle, limestone bedrock showed at the surface or was encountered immediately underneath a thin layer of topsoil. As opposed to that, relatively thick

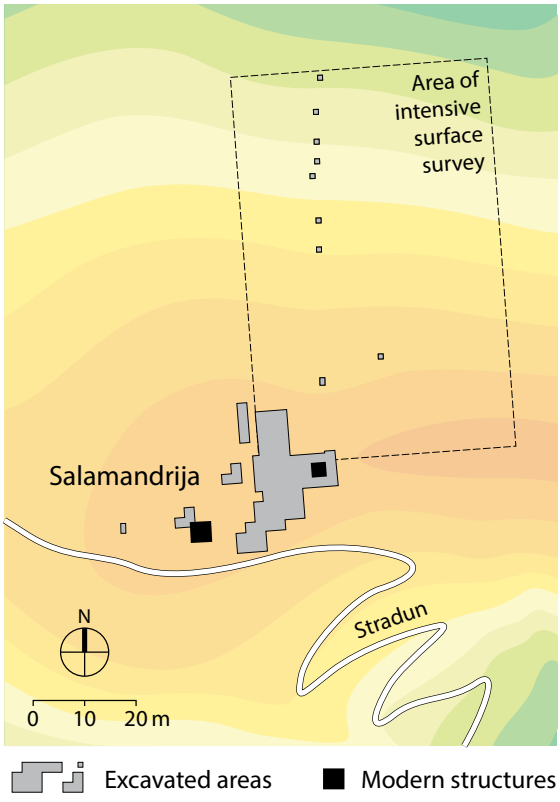


Figure 17. Salamandrija, plan of the site indicating the explored areas.

Figure 18. Test trenches on the northern slope of Salamandrija (1993).

anthropogenic deposits were present along the edges of the plateau, containing abundant archaeological finds. In those deposits, prehistoric artifacts always were found in secondary contexts, together with finds from later historic periods. This leads to the conclusion that the deposits in question were created by pushing the soil from the middle of the plateau to its periphery in order to make room for later structures.

Most of the prehistoric finds (84% of all potsherds and 64% of all flaked stone artifacts by weight) were recovered from six stratigraphic units (4050, 4051, 4055, 8140, 9300, and 9710). The richest among them was Stratigraphic Unit 4050, which yielded 33% of all flaked stone artifacts and 60% of all prehistoric potsherds. It should be noted that not a single undisturbed stratigraphic unit was recorded that would have contained only prehistoric finds, nor could any structure or feature be attributed to prehistory. Formation of stratigraphic units that contained a mixture of prehistoric and Greco-Roman finds probably is related to the activities in the Greek-Hellenistic sanctuary and the erection of the Late Roman fortress. Analysis of the stratigraphic sequence of those deposits therefore lies beyond the scope of this book. Since none of the excavated stratigraphic units was formed in prehistory, it would be useless to divide prehistoric assemblages by stratigraphic contexts from which they were recovered. All prehistoric finds from Palagruža are residual finds, collected from layers that formed long after those objects had been deposited.

Aside from prehistoric pottery and flaked stone artifacts, those layers contained a relatively small number of animal remains and charcoal fragments, but their value for zooarchaeological and archaeobotanical analysis is severely limited due to the mixed character of their context. For the same reason, these directly datable remains cannot be used for dating the associated archaeological finds. For instance, radiocarbon age of a charcoal sample from Stratigraphic Unit 4050 is slightly over two thousand years (UBA-10495: 2052±19 BP). Clearly, that date is unrelated to prehistoric activities at Salamandrija, although prehistoric finds outnumbered the later historic finds in the dated context.

The inconvenient conclusion is that a total disturbance of the prehistoric site prevents us from establishing relative ages of prehistoric finds based on their stratigraphic relationships and rules out their absolute dating based on association with directly datable materials. For assessing their approximate age, we are left with traditional archaeological methods that rely on typology and cross-dating of characteristic, temporally sensitive objects.

Figure 19. Area excavation at Salamandrija (2004).

2.1.1.4. Spatial distribution of finds

Prehistoric finds are distributed rather unevenly across the site. Systematic excavation has shown that they are abundant in anthropogenic deposits near the plateau's edges, while they are absent from its center, where the layer is very thin (Figure 20). Thanks to intensive surface survey and test trenching, changes in find densities can be monitored down the entire northern slope (Figure 21). Finds are present from top to bottom of the slope, but none of the indicators exhibit a clear pattern, except possibly a hint at a slightly higher density of finds in its lower part. To some extent, the variation in data collected by intensive survey reflects the uneven surface visibility on the slope that is partially overgrown by tree spurge.

Several indicators show that archaeological finds had been transported downhill. Among them is the evidence of mechanical wear on edges and surfaces of potsherds, their much smaller dimensions (416 fragments per kilogram, compared to only 205 fragments per kilogram on the plateau), as well as differences in relative quantity of pottery versus stone artifacts. While quantity of flaked stone artifacts from the plateau roughly equals that from the slope, over 80% of the pottery was collected from the plateau, the rest coming from the slope. This may be a consequence of differential resilience of these two find categories to mechanical wear during transport. Tillage may be another source of disturbance and wear, independent of transport. In 16th and 17th centuries, when leaseholders from Hvar grew wheat on Palagruža (Kovačić 1997: 41), the northern slope below Salamandrija probably was under cultivation.[1]

We conclude that prehistoric deposits that probably used to cover Salamandrija were removed from that area by later human activities. They were redeposited along the edges of the plateau and transported farther down the slopes by a combination of natural processes and human action. Little could have been retained by the steep and rocky southern slope, but the gentler northern slope held up many worn and broken small objects. Their presence all the way to the bottom of the slope indicates that part of the finds ended up in the sea.

[1] There is mention of seven hectares (0,07 square kilometers) of cultivable land, which would imply that almost the entire northern slope of Palagruža was tilled.

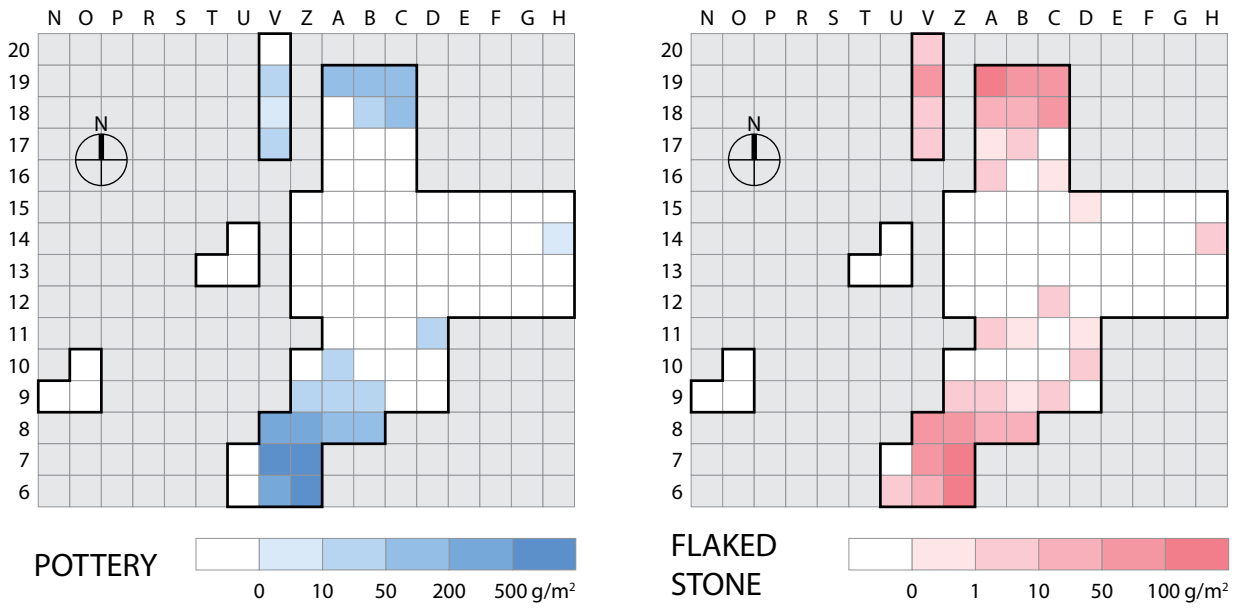


Figure 20. Salamandrija, spatial distribution of prehistoric potsherds and flaked stone artifacts.

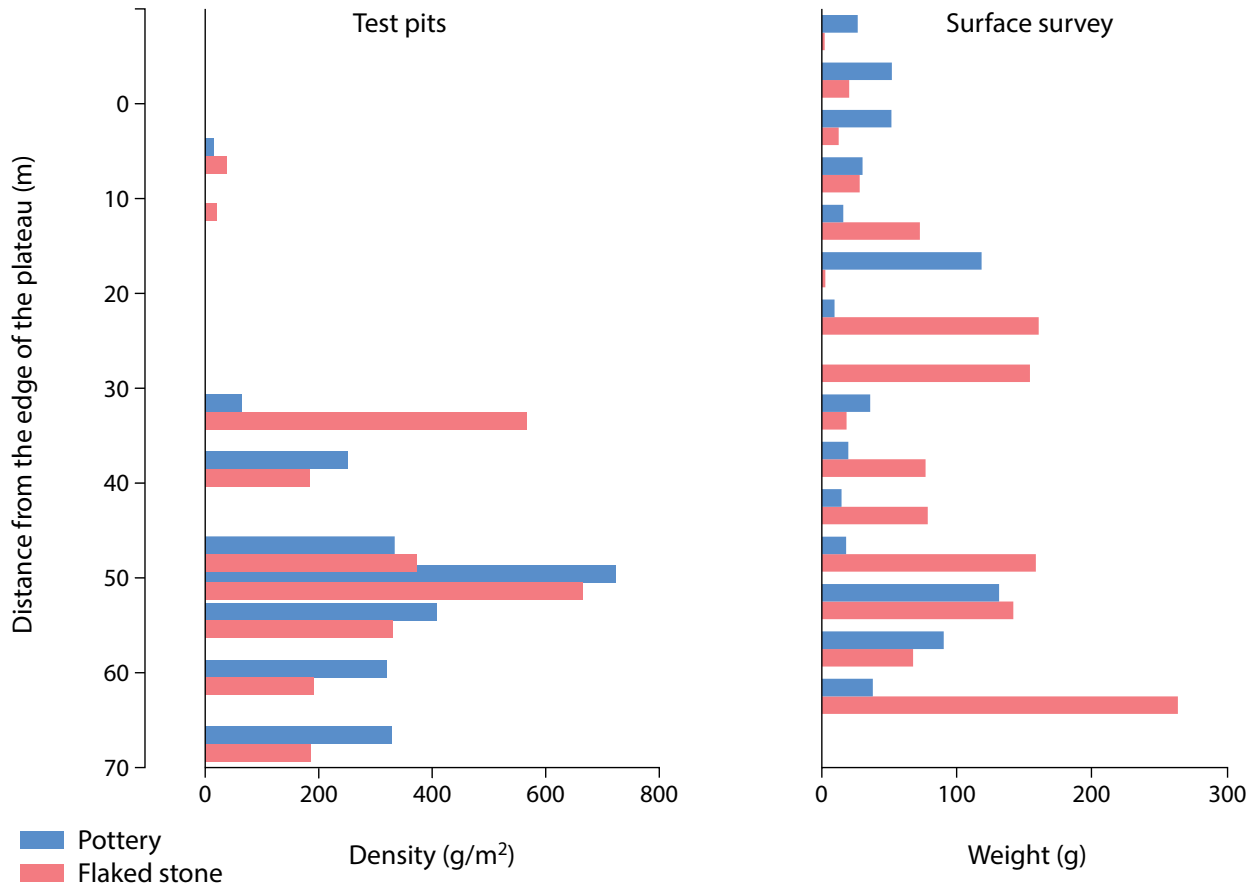


Figure 21. Northern slope of Salamandrija, left: density of finds in test trenches, right: quantities of finds by intensive surface survey transects.

2.1.2. Pottery

We attributed to prehistory around 4600 potsherds from Palagruža, weighing about 20 kilograms in total. These include all fragments of vessels built by hand from unrefined clay and probably fired in the open. Of the 4508 fragments with reliable provenience information, 4426 pieces (98%) were recovered from Salamandrija (Table 1). We added to them the 86 chance finds from the lighthouse keepers' collection. Their exact provenience is not known, but according to the lighthouse keepers, most were picked up at Salamandrija. Thus defined, the prehistoric pottery assemblage contains 4512 potsherds. Among them, 758 sherds are considered diagnostic (potsherds that provide information about vessel shape or decoration), while 732 are temporally sensitive (attributable to a specific prehistoric period, based on their shape or decoration) (Table 2).

2.1.2.1 Pottery from sixth to fourth millennium BC

Only fourteen potsherds (less than 2% of all temporally sensitive sherds) can be attributed to the period from the sixth to the fourth millennium BC. The most characteristic one is a body sherd of a relatively thick-walled vessel, decorated across its entire surface by parallel impressions of the edge of a *Cardium* shell (Figure 22). Large grains of crushed limestone protrude from its heavily worn surface, but its attribution to Impressed Ware is beyond doubt. Such decoration is usually considered as characteristic for the older, 'Impressed Ware A' phase of that pottery style (Batović 1979; Müller 1994; Čečuk and Radić 2005). Judging by the radiocarbon dates available from other sites, this kind of pottery appears in the Adriatic region about year 6000 BC. Currently, the duration of the 'Impressed Ware A' style cannot be determined precisely. Generally speaking, Impressed Ware went out of use in the eastern Adriatic around the middle of the sixth millennium BC (Forenbaher *et al.* 2013: 597-598), while in the western Adriatic it remained in use until the end of the sixth millennium BC (Skeates 2003: 170).

Simple, round-bellied bowls with slightly restricted rim, roughly between 10 and 20 centimeters across, are represented by eight fragments (Figure 23: 1-5, 8). Similar vessels, sometimes with a slightly emphasized lip (Figure 23: 1, 3-5) or a barely hinted neck (Figure 23: 2), are common in the eastern Adriatic from the sixth until the fourth millennium BC, throughout the Neolithic and the older part of the Copper Age (Batović 1979; Forenbaher and Kaiser 2008: Figure 10). A sherd decorated by several parallel incised lines (Figure 23: 6) probably belongs to the same general period. Similar decoration is common in the second half of the sixth millennium and in the fifth millennium BC on Danilo and Hvar style pottery (Korošec 1958; Forenbaher and Kaiser 2008). The preserved part of the motif is too small to be attributed more specifically.

A small bowl with a clearly defined low neck, about 15 centimeters across, is represented by a single sherd (Figure 23: 9). It shape resembles simple, plain Nakovana style bowls of the fourth millennium BC (Forenbaher 2000). The plain fragment of some larger vessel with a tall, clearly defined neck (Figure 23: 7) and a couple of

SITE	n	Weight [grams]
Salamandrija	4426	18298*
Lighthouse keepers' collection	86	365**
Jankotova njiva	20	305
Pod lozje	3	37
Vartli	8	31
Stradun	51	870
Mala Palagruža	1	24
TOTAL	4595	19930***

* weights of 8 sherds are missing; **weights of 40 sherds are missing; ***weights of 48 sherds are missing

Table 1. Quantities of collected pottery by site

PERIOD	n	%
6th – 4th millennium (Neolithic and Early Copper Age)	14	1,9
3rd millennium (Late Copper Age and transition to Bronze Age)	662	90,5
4th – 2nd millennium (Copper Age or Bronze Age)	41	5,6
2nd – 1st millennium (Bronze Age and Iron Age)	15	2,0
TOTAL	732	100,0

Table 2. Temporally sensitive diagnostic potsherds from Salamandrija by period

Figure 22. Salamandrija, an Impressed Ware sherd.

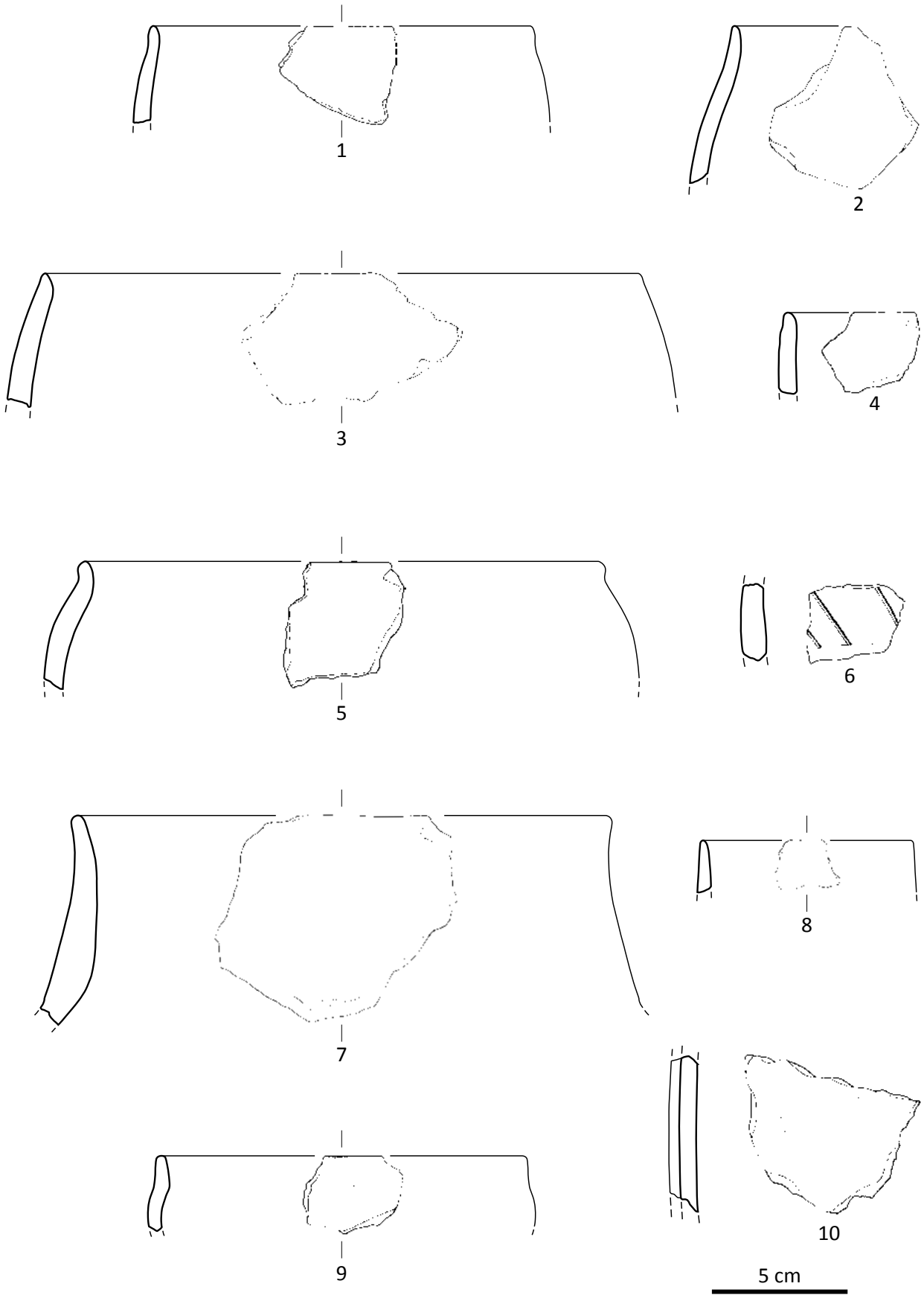


Figure 23. Salamandrija, a selection of diagnostic potsherds, 6th-4th millennium BC.

body fragments decorated by parallel plastic appliqué ribs (Figure 23: 10) may belong to the same period.

2.1.2.2 Pottery from third millennium BC

More than 90% of all temporally sensitive potsherds are attributable to the third millennium BC, that is, to either Ljubljana-Adriatic or Cetina pottery styles (Table 2). Extended discussion of the definition, distribution and dating of those styles will follow in Chapter 3.3, while the current chapter focuses on description of the finds from Salamandrija.

Aside from the 662 temporally sensitive finds, we presume that the greatest majority of nondiagnostic, temporally indeterminate sherds also belong to the third millennium BC. We therefore included in our analyses the 41 sherds from our category '4th-2nd millennium (Copper Age or Bronze Age)' , as well as 26 temporally indeterminate diagnostic sherds (plain rim, handle and lug fragments, as well as tiny decorated sherds with unrecognizable motifs). Thus defined, our assemblage contains 729 potsherds, or 96% of all diagnostic sherds from Salamandrija.

2.1.2.2.1 Vessel shapes and sizes

High fragmentation of the finds is the main obstacle to analysis of vessel shape. Most of the potsherds are less than 3 centimeters long. Their fragmentation, expressed as the number of fragments by the unit of weight, is 136 sherds per kilogram for pottery collected during the survey, 207 sherds per kilogram for finds from the area excavation, and 505 sherds per kilogram for finds from test trenches on the northern slope. Not a single complete vessel was recovered, and none of the refitted vessel profiles reaches all the way from the rim to the base.

Inevitably, the discussion that follows is based on small, isolated fragments. Examples where a larger part of a vessel could be put together from several fragments are exceptional. Most of the information about vessel shape was inferred from rim fragments, and much less often from fragments of bases, necks and handles. As a consequence, all of the proposed vessel reconstructions are hypothetical, that is, more or less probable or possible. They rely heavily on what is known about the more completely preserved, similarly shaped and decorated pottery from other sites. All of the proposed conclusions about shapes of vessels from Salamandrija therefore must be taken with caution.

2.1.2.2.1.1 Open bowls with wide rim

Most of the rim sherds come from shallow, open bowls with a flat rim that is much wider than the wall of the vessel (Figures 34-39). Almost two thirds of all fragments that provide information about vessel shape were attributed to this type. These bowls usually have a conical or a slightly convex profile. Sometimes they have a rounded belly, but the small fragment size usually prevents the curvature to be determined with any precision. The flat top side of the rim may be horizontal or inclined towards the center of the bowl, the latter being twice as common as the former. The rim is usually thickened on the inside (two thirds of all cases), much less often it is bilaterally thickened, while 3% of the specimens are thickened on the outside only.

The above description makes it clear that this basic vessel type subsumes many variants (Figure 24: 1.1-1.16) that cannot be clearly demarcated and quantified. Their shape spans a continuum from saucers to shallow bowls to deep bowls, including a single example of a bowl that is widest at its belly and has a slightly restricted rim (Figure 24: 1.16). Almost all of these variants may be conical, slightly convex or rounded, while their wide rims may be differently shaped.

Shape of the base of these vessels represents an unresolved problem, since we did not recover any complete profiles. We can only presume that the most common base shape belongs to this most common vessel shape. Following this assumption, most of the wide-rimmed bowls would have had a low ring base (Figure 24: B5.1, B5.2), but other base shapes should not be excluded (Figure 24: B1-B7), high pedestal base being one of them (Figure 24: B6). The last mentioned base shape presents an additional problem, since an isolated pedestal fragment is practically indistinguishable from an isolated rim fragment. Assuming that the decoration was often placed on top of the wide rim in order to be in plain sight, most of the decorated specimens probably are rim fragments rather than pedestal fragments. One should be cautious, however, since little is known about the exact function of these vessels; some may have served as covers. Furthermore, similar complete vessels have been published that carry decoration on the outer side of their base (*e.g.,* Primas 1996: Figures 5.3 and 5.4). It is quite possible, therefore, that some of the fragments that have been classified as open bowl rims (especially, the undecorated ones, as well as those whose curvature hints at a very small vessel diameter) in fact are high pedestal fragments (Figure 37: 14, 15, Figure 38: 11).

Some of these vessels had handles. Apparently, these were short strap handles, located just below the rim, or (less commonly) near the base. Most sherds preserve only a small fraction of the handle (Figure 34: 11, Figure 36: 6, Figure 37: 1, Figure 38: 5). At least two of the bowls had narrow perforations pierced vertically through the rim before the vessel was fired (Figure 38: 11, Figure 39: 8). Based on the presented data, we propose several possible reconstructed vessel shapes of this vessel type (Figure 25: 1a-1h). They reflect only a part of the

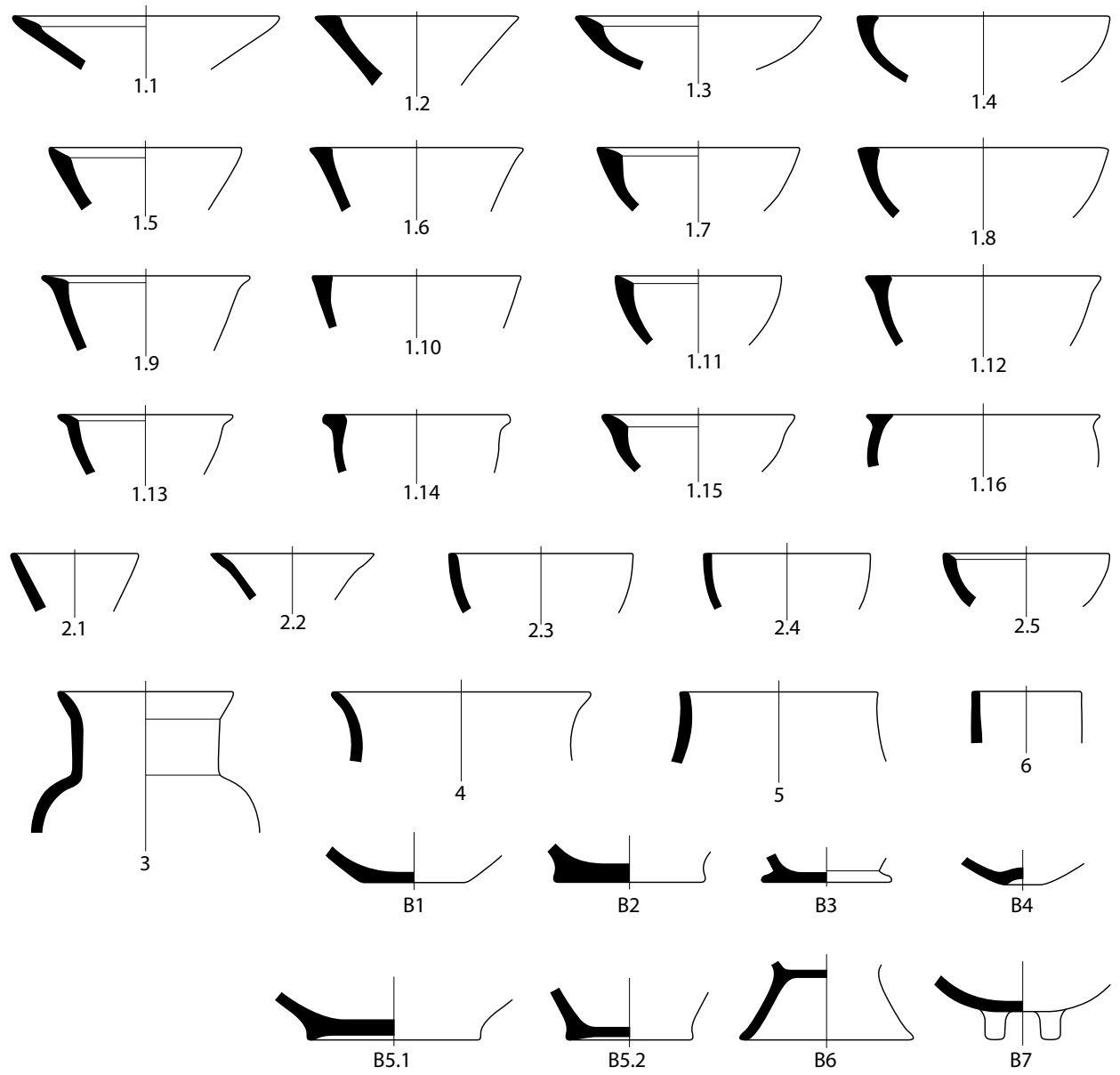


Figure 24. Partial vessel shape reconstructions of 3rd millennium BC pottery.

variability represented in the Salamandrija pottery assemblage.

Most of the wide-rimmed bowls were small or medium-size. Based on potsherd curvature, rim diameter could be estimated for slightly over half of all of the specimens. Their average diameter was about 12 centimeters. About 90% of the vessels were between 8 and 16 centimeters in diameter, the smallest one was only 6 centimeters across, while the largest measurable bowl had a diameter of 22 centimeters (Figure 26).

Based on rim diameter data, we attempted to estimate the volume of these vessels. Estimates are based on the proportions of a conically shaped bowl (Figure 37: 7), one of the very few vessels with an almost complete profile. While these estimates necessarily are coarse due to variability of shape and proportions, they provide rough orientation values (Figure 26). Volume of about a third of these vessels was less than 0,1 liter, the smallest ones having a volume of less than 0,05 liter. Another third could hold about 0,1-0,2 liters. Volume of most of the rest was less than 0,5 liter, while the largest measurable specimen may have contained about 1 liter. Put simply, wide-rimmed bowls cover the span from what today would be called tiny schnapps cups to large vine glasses. One should keep in mind, however, that some of the small specimens may be misclassified pedestals.

Almost all (94%) of the vessels of this type were decorated, 75% below the rim and around the body, 73%

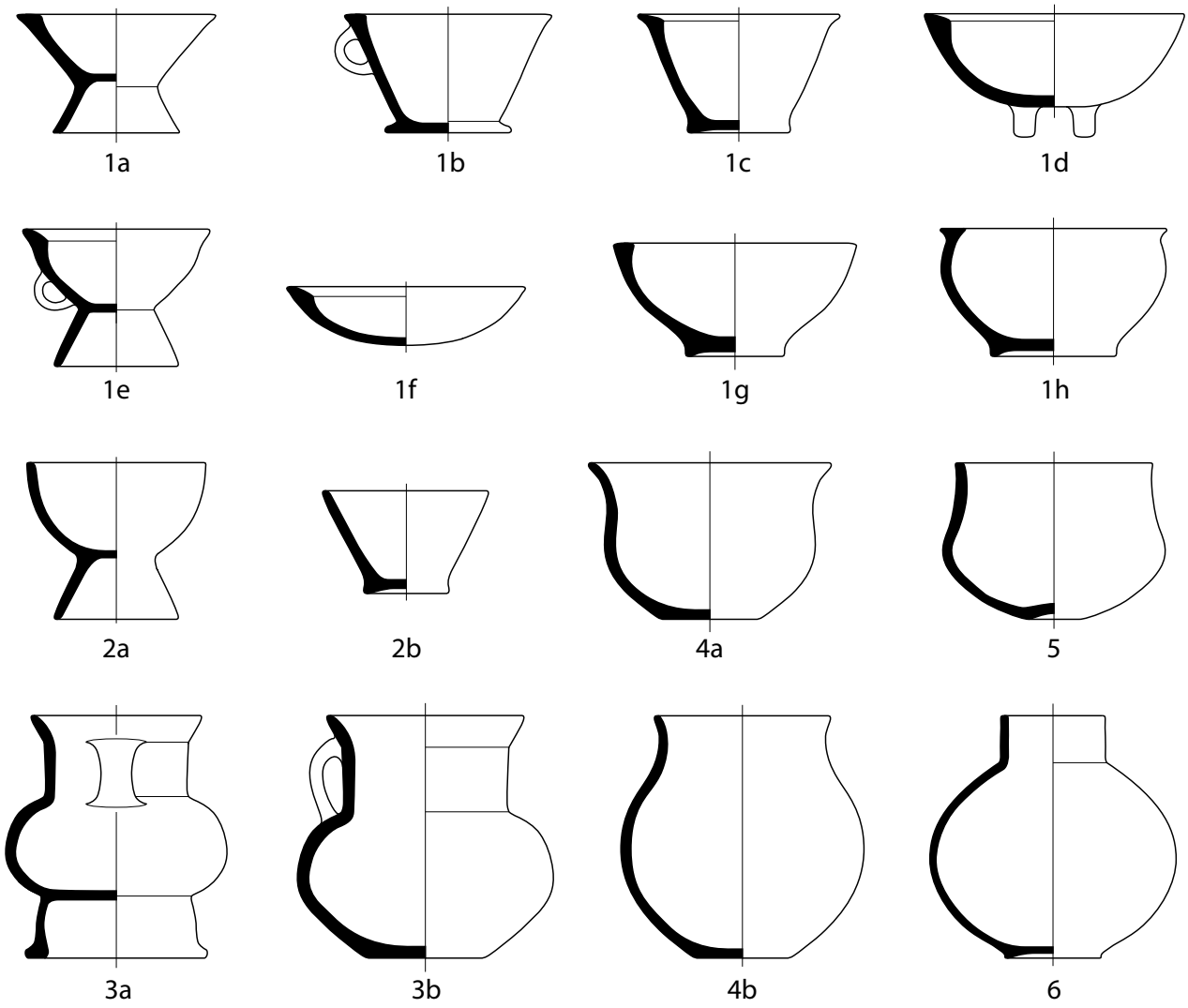


Figure 25. Ideal complete vessel reconstructions of 3rd millennium BC pottery.

VESSEL SHAPE	MNV*	decorated
Open bowls with wide rim	100	94
Open bowls with simple rim	15	15
Tall-necked beakers with everted rim	20	18
Vessels with everted rim	8	0
Deep carinated bowls or beakers	5	5
Vessel with constricted cylindrical neck	1	1
Unclassified vessels	20	14
TOTAL	169	145

*MNV = estimated minimal number of vessels

Table 3. Estimated minimal number of vessels and decorated vessels from the 3rd millennium BC

along the top of the wide rim, and 58% on both of those surfaces. Detailed discussion of decorative techniques and motifs will follow in a later part of this chapter. Based on the number of diagnostic potsherds and the variability of their shape, size and decoration, we estimate that the pottery assemblage from Salamandrija contains fragments of about a hundred open bowls with wide rim (Table 3).

2.1.2.2.1.2 Open bowls with simple rim

A much smaller number of rim sherds come from shallow, open bowls that differ from the previous type only by the fact that the width of their rim corresponds to the thickness of the vessel wall (Figure 40). Of all fragments indicative of vessel shape, 13% were attributed to this type. Like bowls with wide rim, their profile may be conical, slightly convex, or rounded, although profile curvature often cannot be determined precisely. The rim terminates in a simple, rounded or (less often) flat lip which in a single example is inclined towards the middle of the vessel. This type likewise subsumes several variants (Figure 24: 2.1-2.5) that are difficult to demarcate clearly.

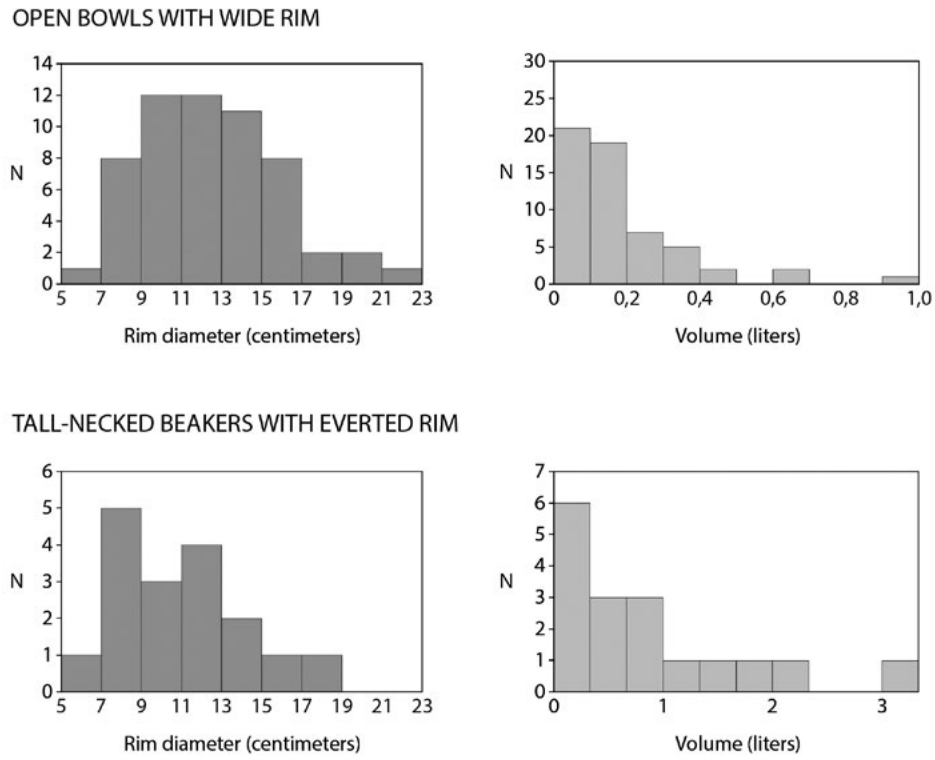


Figure 26. Estimated vessel sizes.

All of the abovementioned dilemmas about the shape of the base also apply to the bowls with simple rims. An additional problem is that many of these sherds actually may be fragments of bowl or jug pedestals, not of bowls themselves (Figure 40: 16-18). This possibility is supported by the fact that, in most cases, the top surface of the rim is plain, and none of the sherds preserves any trace of a handle. High fragmentation prevents us to distinguish unequivocally pedestal sherds from rim sherds. One of the fragments has a pair of narrow horizontal perforations pierced just below the rim before the vessel was fired (Figure 40: 12). Due to incomplete information, we propose only two of the many different possible reconstructions of this type of vessel (Figure 25: 2a, 2b).

Bowls with simple rims do not differ much by size from bowls with wide rims. Rim diameter, which could be estimated for slightly over half of all of the specimens, is around 11 centimeters on the average, the smallest bowl is 7 centimeters across, while the diameter of the largest one is 18 centimeters. Their volumes were comparable to the volumes of bowls with wide rims.

All vessels of this type were decorated on the exterior side (below the rim and around the body), but only two were decorated also along the top of the rim (Figure 40: 7, 11). The assemblage from Salamandrija might contain at most about twenty vessels of this type, but since some (possibly, many) of the fragments likely come from pedestals, the actual number of simple-rimmed bowls should be lower (Table 3).

2.1.2.2.1.3 Tall-necked beakers with everted rim

A relatively small number of fragments of neck with slightly everted rim, and a few fragments of neck and shoulder, were attributed to this type. Together, they constitute about 15% of all fragments indicative of vessel shape (Figure 24: 3). A break in profile, often enhanced by an incised horizontal line, clearly separates the neck from the rim (Figure 41). Judging by the better-preserved fragments, the neck is fairly tall and usually cylindrical, but it can also be slightly conical or funnel-shaped. The neck-and-shoulder sherds that probably come from this type of vessel (Figure 42: 3-8) suggest a wide and rounded belly, the specifics of its lower part remaining undetermined since none of the fragments preserves that part of the profile. The same is true for the base, where all of the present variants may be considered, from simple flat bases to high pedestals. A few of these vessels had a strap handle (or handles), slightly restricted near the middle and expanding towards its ends. The handle was placed on the neck, with its upper end just below the rim and its lower end near the base of the neck or at the shoulder. Due to fragmentation, the proposed reconstructions (Figure 25: 3a, 3b) rely heavily on what is known about the shape of similar, more completely preserved vessels from other sites.

Among beakers of different sizes, small and medium-size ones predominate. Rim diameter, which could be estimated for almost three quarters of all specimens, is about 10 centimeters on the average, the smallest one is 6 centimeters, while the largest is 17 centimeters (Figure

26). Estimates of their volume must be considered with appropriate caution, since they rely on proportions of the ideal reconstruction of a complete beaker (Figure 25: 3b). Volume of about a third of the beakers would have been less than 0,33 liter, the smallest one having a volume of 0,15 liter. Another third could hold up to one liter. Volume of most of the rest was less than two liters, while the largest measurable specimen may have held about three liters (Figure 26). In other words, two thirds of the tall-necked jars cover a span from small glasses to large mugs, while the rest may be compared to table jugs for pouring drinks.

It seems that over 90% of these vessels were decorated. All parts of the vessel probably supported decoration (neck, shoulder, belly and pedestal, if present), but only one specimen has decoration on the top (inside) rim surface (Figure 41: 11). The assemblage from Salamandrija contains fragments of about twenty vessels of this type (Table 3).

2.1.2.2.1.4 Vessels with everted rim

A few slightly everted rim sherds (about 4% of all fragments indicative of vessel shape) differ from the previous type by their softer profile (a gradual transition from neck to rim) and the absence of decoration (Figure 42: 9-12). These rims, with an average diameter of about 14 centimeters, come from vessels whose shape cannot be reconstructed (Figure 24: 4). One can only presume that these were fairly large and probably plain deep bowls, or medium-size jars (Figure 25: 4a, 4b). The assemblage contains fragments of less than ten vessels of this type (Table 3). It is possible that some of them (conceivably, all) actually belong to a later period of the fully developed Bronze Age.

2.1.2.2.1.5 Deep carinated bowls or beakers

Less than 5% of all fragments indicative of vessel shape came from vessels with a tall, fairly wide and slightly concave cylindrical neck, and an upright or slightly outwards-leaning rim. A few rim sherds belong to this type, as well as a single fragment of neck and shoulder (Figure 42: 13-16), and possibly a few more neck fragments (Figure 42: 17-19). All of them are decorated, while the only measurable rim diameter is around 10 centimeters. The lower part of these vessels cannot be determined with any degree of certainty (Figure 24: 5). They may be relatively small and deep carinated bowls (Figure 25: 5), or relatively narrow vessels not unlike Bell Beakers. The assemblage contains fragments of five or six vessels of this type (Table 3).

2.1.2.2.1.6 Vessel with constricted cylindrical neck

A single rim sherd came from a vessel with a restricted and relatively tall cylindrical neck, and an upright rim girded by two horizontal parallel incised lines (Figure 42: 20, Figure 24: 6). This may be a constricted neck of a round-bellied jar (Figure 25: 6), but one can only guess about the shape of its lower part.

2.1.2.2.1.7 Unclassified vessel parts

For a certain number of potsherds we could determine the part of the vessel, but could not attribute them to a specific vessel type. Among them are 32 rim fragments that are too small for shape determination (Figure 42: 21-28), or do not correspond to any of the recognized vessel shapes, while not providing enough information to define additional shapes with any degree of reliability (Figure 43). One should therefore reckon with the fact that the assemblage contains fragments of at least about twenty vessels of unknown shapes. These include several fairly large vessels, with rim diameters of around 20 centimeters.

Only two of the 35 recovered base sherds can be ascribed with certainty to a specific vessel shape. Both are fragments of bowls with wide rim on a ring foot or a high pedestal (Figure 35: 2, Figure 37: 7). All other bases may have come from vessels of any type.

Simple flat bases (Figure 24: B1) and clearly demarcated bases (Figure 24: B2) are not particularly common (Figure 44: 1-6). All of them are plain, and it is possible that some of them belonged to Neolithic vessels (primarily, the more massive and clearly demarcated ones). The distinctively shaped protruding bases, which are wider than the bottom part of the vessel (Figure 24: B3, Figure 44: 7-9), are fairly rare and they belonged to relatively small vessels.

More than half of all base fragments belonged to ring foot bases (Figure 24: B5.1, B5.2, Figure 44: 10-19) and high pedestal bases (Figure 24: B6, Figure 45: 1-5). Although these two types sometimes cannot be distinguished due to fragmentation, the ring foot is more common than the high pedestal base. The greatest majority of these fragments is decorated near the bottom, and one ring foot base is decorated on the outside (Figure 44: 10), in a characteristic manner that is clearly time-indicative (Figure 44: 10). Judging by the estimated diameters, high pedestal bases belonged to relatively small vessels, while ring foot bases came from small and medium-size vessels.

Navel-shaped (*omphalos*) bases (Figure 24: B4, Figure 45: 6-8) are fairly rare and very small (from 2 to 5 centimeters in diameter), suggesting that they belonged to small vessels, although they sometimes may appear on larger vessels as well. Finally, a single peg-shaped foot (Figure 45: 9) indicates that at least one vessel was supported by such feet (Figure 24: B7).

One should note that the total of 35 base fragments is disproportionate to the assessment by which the assemblage contained fragments of more than 150 different vessels (Table 3). This may be a consequence of fragmentation, due to which we may have missed many small base fragments. It is also possible that many vessels had a rounded base. Such base fragments are very hard to recognize, especially if pottery is heavily worn and fragmented.

Almost a third of the 43 fragments of handles belonged to strap handles that are more or less restricted at the middle and expanding towards ends (Figure 45: 10-16). Most of them were decorated, usually by an incised line that follows the handle's edges. Small and plain tunnel-shaped handless are much less common (Figure 45: 19), while more than half of the handle fragments is indeterminate due to fragmentation. Orientation could be established for half of the fragments; in all of those cases, the handles were upright.

The discrepancy between the number of handle fragments (43) and the assessed total number of vessels (more than 150) suggests that many vessels did not have handles. Tall-necked beakers with everted rim often had them, while handles were much less common on open bowls. There is no information about handles for vessels of other shapes, which does not mean that they did not have them, since we do not know to which vessel shape the majority of handles belonged. In addition, two lug handle fragments and a vertically pierced lug were recovered. One of the lug handles was placed horizontally and pierced before firing by a pair of small vertical perforations (Figure 45: 20).

2.1.2.2.1.8 Other objects made of fired clay

A tall, flat and hollow object with flat base, decorated all over by a complex geometric design, was partially reconstructed from several conjoining sherds (Figure 45: 25). This may be the bottom part of an anthropomorphic figurine, or some unusually shaped special-purpose vessel, which technologically does not differ from other pottery.

Sherds of a clay plaque decorated by impression and incision (Figure 45: 21), small perforated clay plaques (Figure 45: 23), and a gently bent flat sherd of rectangular section, decorated on three sides (Figure 45: 24), are fragments of objects (possibly, vessels) of unknown shape. The small, oval, lengthwise perforated object made of fired clay (Figure 45: 22) probably is a part of a bead.

2.1.2.2.2 VESSEL DECORATION

Fragmentation of finds greatly restricts the possibilities of decoration analysis. Since not a single design has been entirely preserved, one can only discuss decorative techniques, parts of decorative designs and basic elements that constituted them.

Table 4. Frequency of decorative techniques on potsherds from the 3rd millennium BC

TECHNIQUE	n	%
Incision	547	82,1
Impression	466	70,0
Incrustation	4	0,6
Plastic application	6	0,9
Coarse incision	3	0,5
TOTAL	666	100,0

Incision and impression are the most common decorative techniques by far (Table 4). Very often, both techniques are combined together within the same decorative motif. Only a few sherds preserve traces of what may have been white incrustation, but it is quite possible that many motifs had been filled with incrustation, which has disappeared due to exposure to aggressive environment of the shallow and thoroughly disturbed cultural deposit. Motifs composed of fine incisions and tiny impressions appear much more striking if they are filled with white incrustation that highlights them against the dark background. Apart from these decorative techniques, plastic applications and isolated channels are extremely rare but present.

2.1.2.2.2.1 Basic decorative elements

Almost all motifs were created by combining one, two, or (rarely) three of the four basic decorative elements: dots, elongated impressions, triangular impressions, and incised lines (Figure 27).

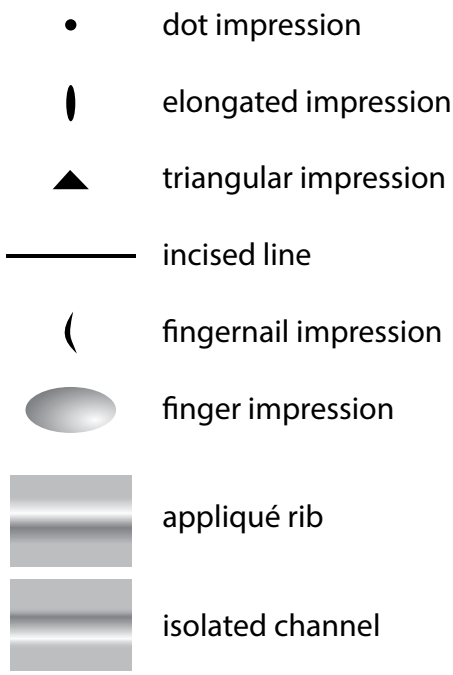


Figure 27. Basic decorative elements.

Dot impressions, made by a blunted end of a small, round-sectioned stick, are present on 214 potsherds (32,1% of all decorated sherds). We distinguished three size-categories of such impressions: small dots, less than 1,8 mm across (found on 78% of all sherds decorated by dot impressions), medium-size dots, from 1,8 to 3,5 mm across (20%), and large dots, more than 3,5 mm across (4%).

Elongated impressions are present on 122 potsherds (18,3% of all decorated sherds). They were probably made by a blunted end of a small, flat stick, or by a tool akin to a screwdriver (Dimitrijević 1979a: 322), that had been driven into wet clay at a right angle. The impression usually is less than 2 mm wide and can be more or less elongated. Most often, its curved contours produce an elliptical outline; exceptionally, its shape may be rectangular.

Triangular impressions are present on 135 potsherds (20,2% of all decorated sherds). Apparently, most of them were also made by a blunted end of a small, flat stick or some similar tool, which had been pressed into clay while held almost parallel to the surface of the vessel, leaving a triangular impression with a single impressed tip and two clearly defined sides. Only exceptionally it seems that triangular impressions were made by a blunted end of a small, triangular-sectioned stick. The impressions are usually isosceles right triangles, but the less carefully executed ones may be of irregular shape, or have curved contours. We distinguished three size-categories: small triangles, with the longest side shorter than 2,7 mm (found on 52% of all sherds decorated by triangular impressions), medium-size triangles, with the longest side from 2,7 to 6 mm long (45%), and large triangles, with the longest side surpassing the length of 6 mm (3%).

Incised lines are present on 547 potsherds (82,1% of all decorated sherds). Usually, their width is between 0,5 and 2 mm. They were created by a relatively sharp tool. In many cases, that may be the same tool that was used for making impressions. The preserved segments of the incised lines usually are straight (70% of all sherds decorated by incision), angular (26%), or much less frequently curved (8%). Presumably, many of the short 'straight' lines actually are sections of angular lines, which renders precise quantification impossible due to small size of the fragments.

Aside from these four basic decorative elements, exceptionally rare but present are tiny fingernail impressions (one sherd), plastic appliqué ribs (five sherds), finger impressions (four sherds) and isolated channels (three sherds).

2.1.2.2.2.2 Basic decorative motifs

Basic motifs were created by multiple impression of one of the three basic impressed elements (dot, elongated impression or triangle), or by combining incision with one of those elements, while keeping the size and the shape of impressions constant. This suggests that only a single tool was used for creating most of the basic motifs, except in rare examples where a thin line is combined with large impressions, although even that can be achieved easily by using a single tool with two differently shaped ends. One should point out that the basic motifs usually are parts of more complex designs, which cannot be discerned due to fragmentation.

As a rule, incision preceded impression, which is clearly visible in places where impressions and incised lines overlap. Aside from that, it would be hard to achieve the observable degree of precision in reverse order, since the incised lines can serve as a frame or as guidelines, with impressions distributed within them, next to them, or along them. Most often, the motif was created by careful free-hand incision and impression. Exceptionally, it may have been produced by impressing a special tool akin to a comb or coil. The regular, partially overlapping series of impressions on a fragment of an open bowl with wide rim (Figure 34: 2) and the dense, parallel series of impressions on a belly fragment (Figure 46: 23) were made almost certainly with such a tool; other possible examples are those in Figure 34: 6, 10 and Figure 46: 20.

Depending on combination of the basic elements, the basic decorative motifs may be classified into six groups (Figure 28): surfaces, series, series along lines, bands, series along bands, and geometric shapes.

Surfaces are areas of indeterminate shape, filled by densely distributed impressions or incisions (Figure 46: 1-17). Often they are delimited by an incised line that may be straight, angular or (rarely) curved. A surface filled by impressions sometimes extends on both sides of an incised line.

Series of impressions may be single or multiple (Figure 46: 18-24). Orientation of impressions may vary, but it remains constant within a series. Impressions that make up a series may be combined in various ways, resulting in a great variability.

Series along lines differ from the previous group of motifs by the fact that impressions of various kinds and combinations extend along an incised line (Figure 46: 25-34). Sometimes the impressions are threaded on the line, but much more often they extend along one or both sides of the line in a single or double row. Only exceptionally (on two potsherds), impressions extend along plastic appliqué ribs.

Bands are defined by two parallel incised lines. The area between them may be plain, or densely filled by parallel incised lines that extend along the band, or by a series

SURFACES

SERIES

SERIES ALONG LINES

BANDS

SERIES ALONG BANDS

GEOMETRIC SHAPES

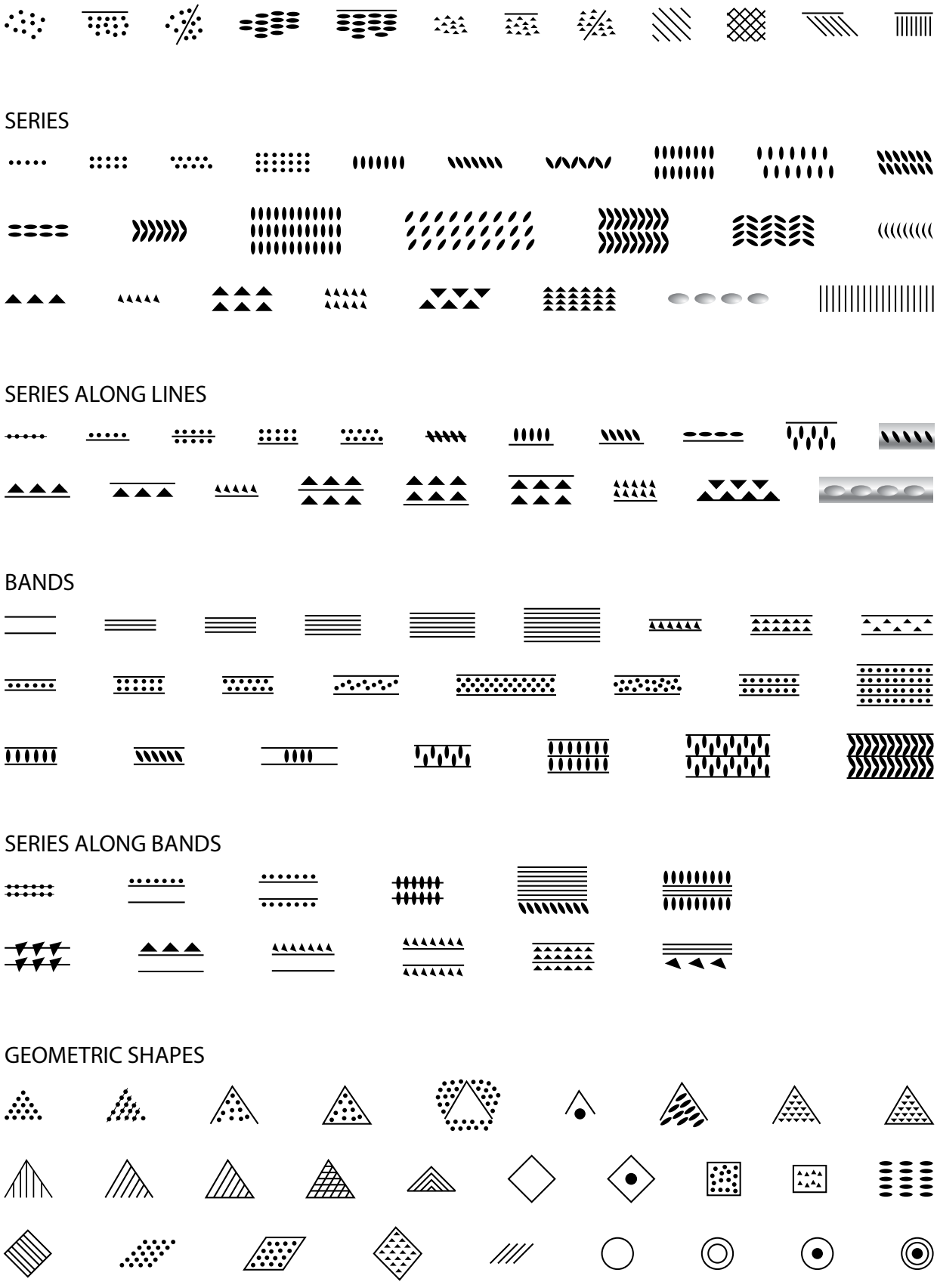


Figure 28. Basic decorative motifs.

of impressions that may be single, multiple, or (rarely) irregular (Figure 47, Figure 48: 1-11). The band-shaped motif may be composed of several identical parallel bands, pressed next to each other.

Series along bands differ from the previous group of motifs by the fact that impressions of various kinds and combinations extend along a band (Figure 48: 12-16). Sometimes the impressions are threaded on the lines that define the band, but much more often they extend along one or both sides of the band. Bands and series usually extend in straight lines, less often they are broken in angular segments, while only exceptionally they are curved; they may be horizontal, slanting, or vertically oriented.

Geometric shapes include triangles, quadrilaterals and circles (Figure 48: 17-29). They may lack clear borders, or may be partially or completely bounded by an incised line; they may be plain, or filled by impressions, incised lines, or a combination of impressions and incisions. Usually they are rather small (1-2 centimeters), but there are also much larger examples. Triangles represent the most common shape (64 sherds). Usually, these are isosceles right or equilateral, while less often they are obtuse or acute. Much less common are irregular quadrilaterals (23 sherds), lozenges (12 sherds), rectangles (6 sherds), squares (5 sherds), and regularly shaped circles (10 sherds).

The possibility of motif recognition depends entirely on accidents of fragmentation. For example, one may presume that many basic motifs that have been classified as series are in fact parts of bands. A series of dots on a small fragment may be a part of a series along a line, or a band filled with dots, or a series of dots along a band, etc. An ample number of sherds indicate, however, that even the simplest series sometimes stand alone. Surfaces present the same problem: in many cases, these may be indeterminate parts of geometric shapes. Since the small parts of basic motifs usually cannot be classified with certainty, quantifying the frequency of their variants would be pointless.

2.1.2.2.2.3 Complex decorative designs

Complex decorative designs are composed of several different or identical basic motifs. While none of them has been preserved completely, the available sherds testify of their extraordinary diversity (Figures 29 and 30, Figure 48: 28-33, Figure 49). Identical designs have been recorded only on sherds that almost certainly were parts of the same vessel, suggesting that the potters aimed at their distinctiveness. An exception is the design composed of a series of incised triangles filled with dots that appears on several vessels, but that composition is sometimes just a constituent part of an even more complex, unique design.

Complex designs were usually executed by combining incision and impression, less often exclusively by incision, and very rarely exclusively by impression. On two sherds, an incised-and-impressed design runs parallel to a horizontally oriented isolated channel (Figure 42: 8, Figure 49: 32). All impressions within a complex design usually are of the same size and shape, but there are exceptions. About 5% of the cases contain groups of dots and triangles, dots and elongated impressions, triangles and elongated impressions, or dots of two different sizes. There is even greater variability among different designs found on the same vessel. For example, if a vessel supports one decorative design on its belly, and another on its wide rim, about 10% of the cases will contain groups of impressions of different size or shape. While several different tools may have been used for their execution, many complex designs could have been made by just one simple 'universal tool', a round-sectioned stick with one blunted end (for dot impressions), and the other flattened end (for making elongated impressions and triangles). Either end could have been used for incision.

2.1.2.2.2.4 Location and frequency of decoration

Only the external side of the vessel and the top surface of its rim supported decoration. Any part of the vessel (rim, neck, shoulder, belly, base, pedestal, handle) may have been decorated. Decorative design often covered a large part of the available surface.

The top surface of the open bowls' wide rim was commonly decorated by a single or double series of triangles that were delineated by an incised line and filled with impressions or incisions, or made by triangular impression. In a double series, triangles usually face each other, while their points are offset, forming between them a zigzag band. Much less common decoration of the wide rim involves a series of lozenges, a double series of impressed dots, series of elongated impressions, or various other distinctive designs composed of the same basic elements.

As a rule, the exterior side of open bowls often was decorated near the rim, the decoration apparently extending all the way to the base. In most cases, it consisted of serial impressions or bands that usually extended horizontally, but also may be slanted or (rarely) vertical. Recognizable among the partially preserved designs are series of triangles, a series of squares touching at corners, and checkerboard design.

Most of the tall neck fragments of everted-rim beakers are sparsely decorated, primarily by incision, and only rarely by both incision and impression. Their most common decoration consists of a horizontal line that separates the rim from the neck. Below that line, a part of a complex decorative design may be glimpsed

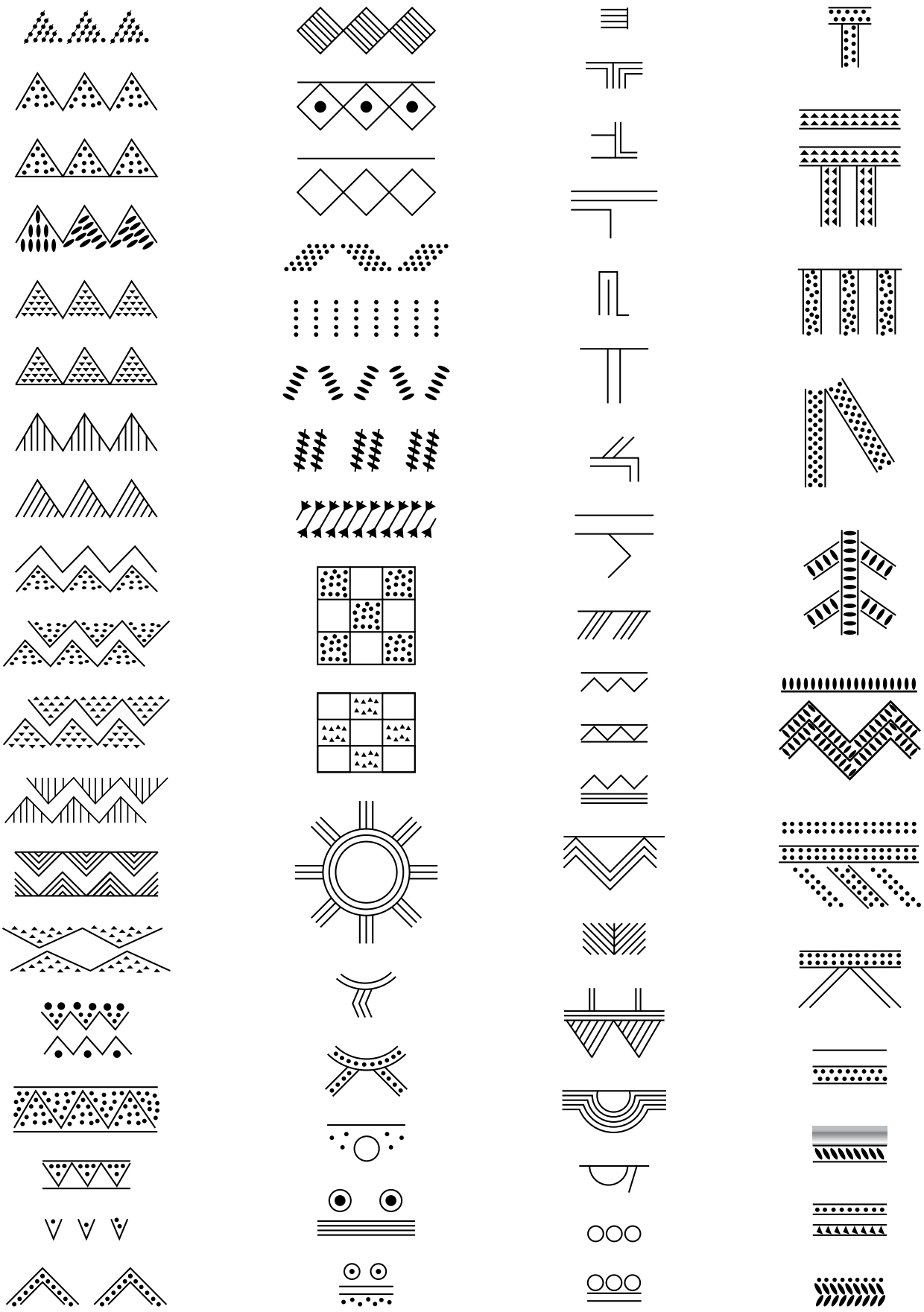


Figure 29. Partially preserved complex decorative designs.

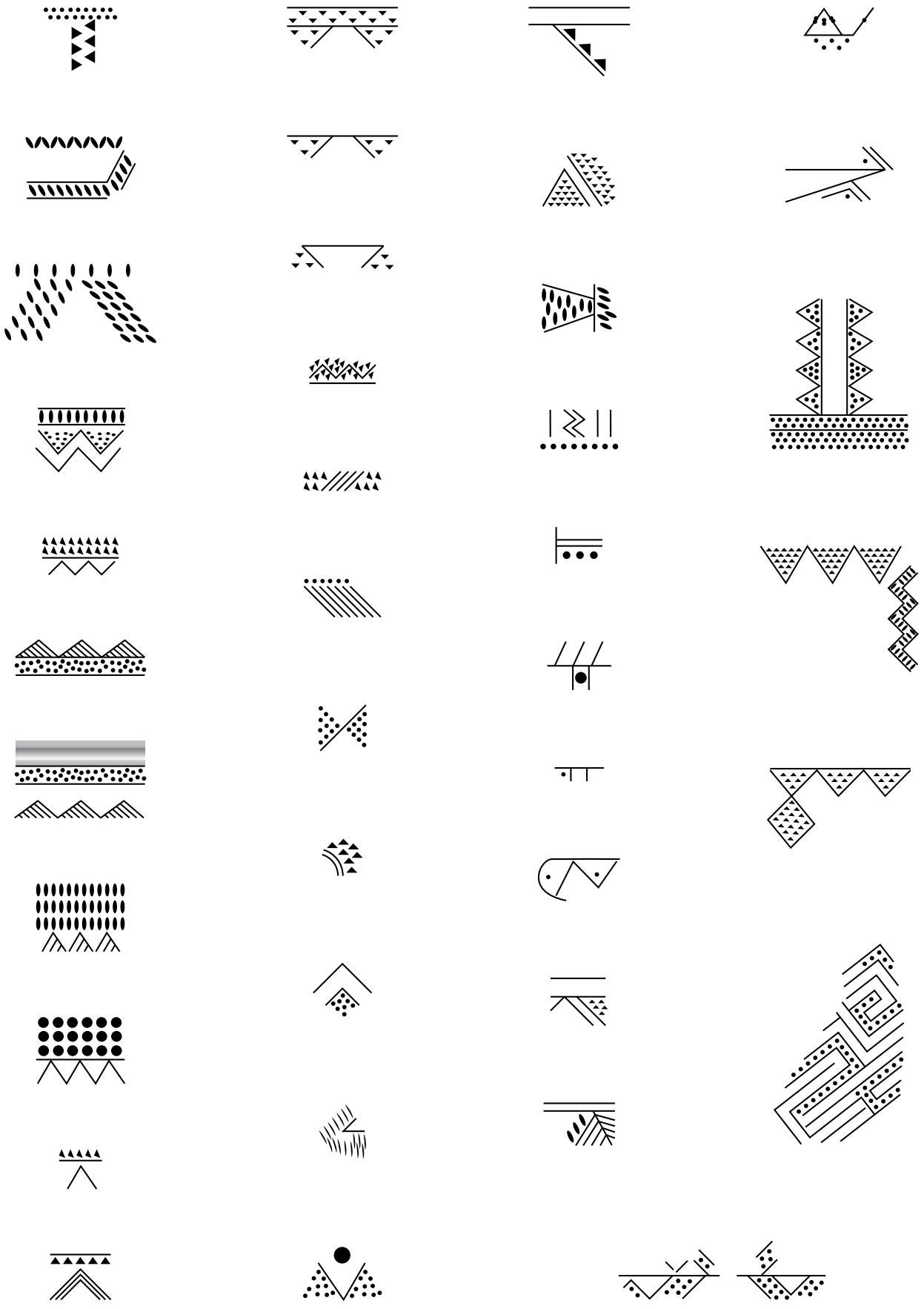


Figure 30. Partially preserved complex decorative designs.

on the neck, and sometimes also on the handle, but it can rarely be recognized due to fragmentation. Many of the richly decorated fragments of cylindrical necks, shoulders and bellies that cannot be attributed with certainty to a specific vessel shape probably came from tall-necked beakers with everted rim.

Nothing specific can be said about the decoration of other vessel types due to small sample sizes. Some of them were decorated all the way to their base, and occasionally on the outer surface of the base itself (Figure 44: 10). Some of the navel-shaped bases were decorated by radial designs (Figure 45: 6-8).

We tried to express the frequency of pottery decoration in two ways, first by estimating the proportion of decorated sherds in the total pottery assemblage, and second by estimating the proportion of decorated vessels within the total minimal number of vessels.

The sample attributed to the third millennium BC contains 666 decorated potsherds. Their relative frequency can be determined only approximately, however, since we do not know exactly how many of the 3754 nondiagnostic, plain sherds from Salamandrija actually belong to this period. Based on typological criteria, about 95% of the temporally sensitive sherds had been attributed to the third millennium BC. Under the assumption that a similar proportion of nondiagnstic sherds belonged to that period, the frequency of decorated potsherds would be around 15%, which has to be taken as a minimum value.[2]

Analysis of shapes has indicated that the potsherds come from at least 170 different vessels. About 85% of those vessels were at least partially decorated (Table 3). Decorative designs sometimes enveloped the entire vessel, and other times only a part of it, which means that many plain fragments came from partially decorated vessels.

2.1.2.2.3 Concluding remarks about the third millennium BC pottery

Results of our analyses suggest that potters aimed to make each decorated vessel distinctive and different from other vessels, while following certain general rules of shaping and decoration. Stylistic unity is evident in the narrow repertoire of characteristic shapes, consistent use of the four basic decorative elements, uniformity of those elements within individual motifs, and common ways of motif combination. Designs comprised of series of triangles, zigzag lines, and bands that run along the top surface of the bowls' wide rims are particularly popular and conspicuous. Necks, shoulders, bellies and pedestals were decorated by complex designs, only small fragments of which have been preserved; most of them were comprised of series and bands, sometimes in combination with geometric shapes. All of those motifs may have been filled with white incrustation which did not survive.

Two basic vessel shapes dominate the pottery assemblage, which contains parts of at least 170 different vessels. Numerous simply shaped open bowls with wide rim are followed by the tall-necked beakers with everted rim. Most of them are fairly small, with a volume that spans the range from small glasses to large mugs. Only a few vessels would correspond by size to table jugs, while even larger vessels are extremely rare.

The greatest majority of vessels were decorated, many of them across almost their entire exterior surface, and often along the top surface of the rim. Those small, richly decorated vessels, sometimes provided with a handle and a pedestal, suggest individual use as drinking vessels, and would have been appropriate to use for consumption or spilling of liquids in ceremonial contexts. Small perforations that were observed on several potsherds may have served for suspension, or for fixing something onto the vessel (Figure 38: 11, Figure 39: 8, Figure 40: 12). All of those holes were made before firing by piercing the wet clay. Notably, not a single drilled hole has been recorded. Such secondary holes, made in order to mend cracked vessels, usually appear on about 1% of potsherds from general-purpose prehistoric sites (Forenbaher and Kaiser 2006: 179, 192), which means that we could expect our assemblage to contain at least several dozen mending holes. Their total absence indicates that the vessels were intact (one might say, 'new') before they were deposited, which does not mean that they may not have been broken during the act of deposition.

According to their stylistic traits, diagnostic potsherds were classified into five groups (Table 5). We followed the criteria that are provided below, in the chapter on pottery styles of the third millennium BC. Half of the sherds are stylistically ambiguous, although their general traits allow them to be attributed to the third millennium BC. In most cases, those are tiny fragments with very small parts of decorative motifs that may have come from either Ljubljana-Adriatic or Cetina style vessels. A much smaller number of sherds were included among the stylistically indeterminate due to peculiar motifs that differ from the common Ljubljana-

[2] The number of sherds that under the aforementioned assumption would have belonged to the third millennium BC was calculated in the following way: the total number of nondiagnostic sherds was reduced by 5% and augmented by the number of plain diagnostic sherds attributed to the third millennium BC. Since most of the scarce, temporally diagnostic Neolithic, earlier Copper Age and later Bronze Age pottery was plain, it seems likely that more than 5% of all nondiagnostic sherds belong to those periods. If that is true, than less than 95% of all nondiagnostic sherds belongs to the third millennium BC, which means that the actual frequency of decorated third millennium BC sherds is greater than 15%.

STYLE	n	%
Characteristic Ljubljana-Adriatic	11	1,5
Closely comparable to Ljubljana-Adriatic	106	14,6
Characteristic Cetina	102	14,0
Closely comparable to Cetina	146	20,0
Not determinable precisely	364	49,9
TOTAL	729	100,0

Table 5. Third millennium BC pottery assemblage breakdown by pottery style

Adriatic or Cetina motifs (Figure 31). More than a third of all diagnostic sherds were attributed to Cetina style, including over a hundred very characteristic sherds (Figure 32). Finally, about 16% of all diagnostic sherds was attributed to Ljubljana-Adriatic style, but only about a dozen of them are very characteristic (Figure 33).

The main features of Ljubljana-Adriatic style and Cetina style will be described in Chapter 3.3. Here, we shall discuss only a few relatively uncommon details of Salamandrija's pottery shapes and decoration. For instance, navel-shaped bases (Figure 24: B4) appear on Ljubljana-Adriatic pottery (Korošec and Korošec 1969: Plate 34: 2), Cetina pottery (Marović 1991: Figure 2: 12), and stylistically indeterminate fragments from burial mounds in which Cetina style finds predominate (Marović 1991: Figure 11: 11, Figure 47: 5, Figure 49: 2), or mix with Ljubljana-Adriatic finds (Marović 1991: Figure 32: 9, Figure 39: 22). Peg-shaped feet (Figure24: B7) appear on Ljubljana-Adriatic vessels: on an open bowl from Grotta del Pettiroso (Korošec, P. 1956: Plate 1: 1) and a shallow bowl with a slab handle from Rubež (Benac 1955: Plate 1: 6); on open bowls from Bell Beaker pottery assemblages, from Sardinia (Atzeni 1998a) to the Netherlands, Germany, Czechia, and Poland (Harrison 1980), and on Vučedol dishes (Schmidt 1945: Plate 40: 1, 2; Durman 1988: 110, 111).

Vertical perforations pierced through the rim before firing (Figure 38: 11, Figure 39: 8) appear on Ljubljana-Adriatic open bowls from Tumulus 1 at Ograđe (Marović 1980b: Figure 28: 1), Tumulus 70 at Lukovača (Marović 1991: Figure 48: 5), Otišić (Milošević and Govedarica 1986: Plate 8: 6, Plate 9: 6, Plate 12: 1), and Vela Cave (Čečuk and Radić 2005: Plate 87: 3a). Some of them resemble vertical subcutaneously pierced lugs. Horizontal perforations pierced immediately below the rim (Figure 40: 12) appear on Ljubljana-Adriatic open bowls from Otišić (Milošević and Govedarica 1986: Plate 7: 1) and Založnica (Velušček and Čufar 2003: Plate 4: 8), as well as on a Cetina style bowl from Tumulus 26 at Rudine (Marović 1991: Figure 19: 7). A constricted handle with a pair of round perforations near its end (Figure 45: 13) resembles the handle of a Cetina style beaker from Vrtanjak (Čović 1970: Plate 1: 1), while the handle of a Cetina style beaker from Grotta dei Ciclami has on only a single similar perforation (Gilli and Montagnari Kokelj 1993: Figure 18: 475). Series of small fingernail impressions, which are exceptionally rare on pottery from Salamandrija, sometimes appear together with incision and other kinds of impressions at Gudnja, in Layer 5 that was attributed to developed Copper Age (Marijanović 2005: Plate 50: 5).

The lower part of a fairly high, flat and hollow object, richly decorated by incision and impression (Figure 45: 25), resembles anthropomorphic figurines from Ig at Ljubljansko barje (Korošec and Korošec 1969: Plate 1 and Plate 2, especially Plate 2: 6). Finally, the elongated oval bead of fired clay (Figure 45: 22) may be compared to a flattened oval bead from Zelenovića ogradice, from Tumulus 2 that contained a substantial number of Cetina potsherds (Marović 1991: Figure 63: 15).

When did Ljubljana-Adriatic and Cetina pottery reach Palagruža? While neither of those styles can be dated with precision, it seems that the Ljubljana-Adriatic style covers roughly the first half of the third millennium BC, while the Cetina style covers its second half. It is quite possible that the two styles overlap around the middle of the third millennium, or slightly later (an extended discussion of their dating follows in Chapter 3.3). Pottery of both styles is present at Salamandrija, with Cetina style being better represented. There are, therefore, two equally plausible answers to our question. Ljubljana-Adriatic and Cetina pottery may have arrived at Palagruža during the period when both styles overlapped, around or soon after year 2500 BC, maybe within relatively short time period, or even during a single, intensive episode of activity. On the other hand, the same pottery may have been arriving at Palagruža gradually, over a period of several centuries, beginning before year 2500 BC with a relatively few Ljubljana-Adriatic style vessels and continuing with larger quantities of Cetina pottery during the second half of the third millennium BC.

2.1.2.3 Pottery from second and first millennium BC

Based on their general typological characteristics, only about fifteen potsherds (around 2% of all diagnostic sherds) may be attributed to the developed Bronze Age and the Iron Age, that is, the later second millennium and first millennium BC (Barbarić 2011). Most of them are plain or very simply decorated. Among them are fragments of two jars with a short, constricted neck and an everted rim that in one of the examples is beveled on the interior side (Figure 50: 9, 12), fragments of two bowls with wide everted rims (Figure 50: 10-11), three fragments of oval-section horizontal handles (Figure 50: 5-6), a single fragment of a characteristically shaped vertical handle (Figure 50: 4), and a couple of potsherds with nubs (Figure 50: 1-2). Some of the strap handles

Figure 31. Salamandrija, a selection of peculiar, stylistically indeterminate potsherds from the 3rd millennium BC.

Figure 32. Salamandrija, a selection of characteristic Cetina style potsherds.

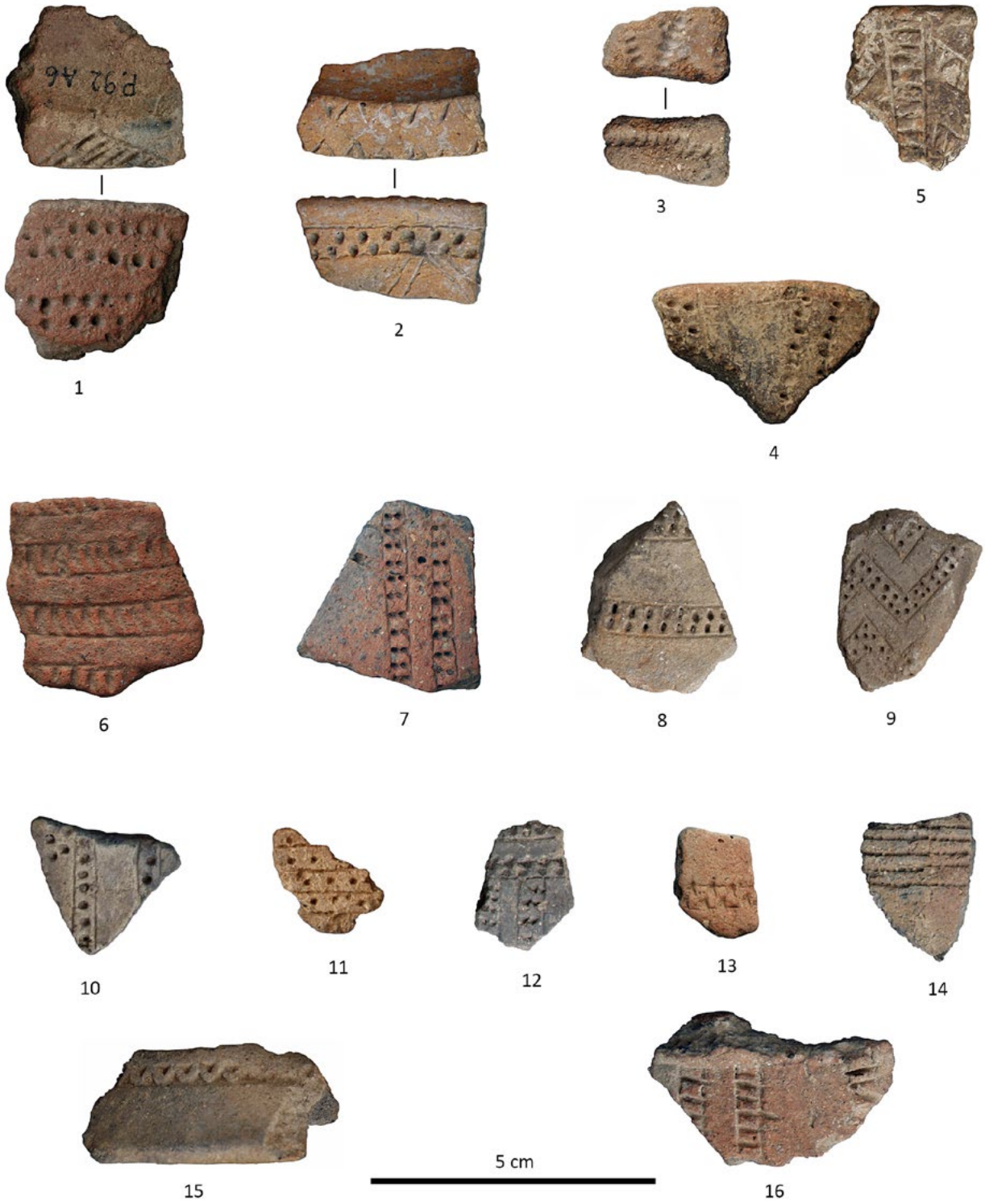


Figure 33. Salamandrija, a selection of characteristic Ljubljana-Adriatic style potsherds.

(Figure 50: 3), as well as a few fragments of beakers and cups (Figure 50: 7-8) probably also belong to this period.

2.1.2.4 Whence the pottery on Palagruža?

Simple common pottery vessels are heavy and fragile, and their production does not demand rare raw materials or particularly complicated knowledge and skills. Majority of prehistoric pottery therefore was made locally and destined for local use. Among exceptions are places affected by unusual circumstances, such as small islands with limited resources. Good examples are the island of Lipari, which during the Neolithic imported not only pottery vessels, but also potting

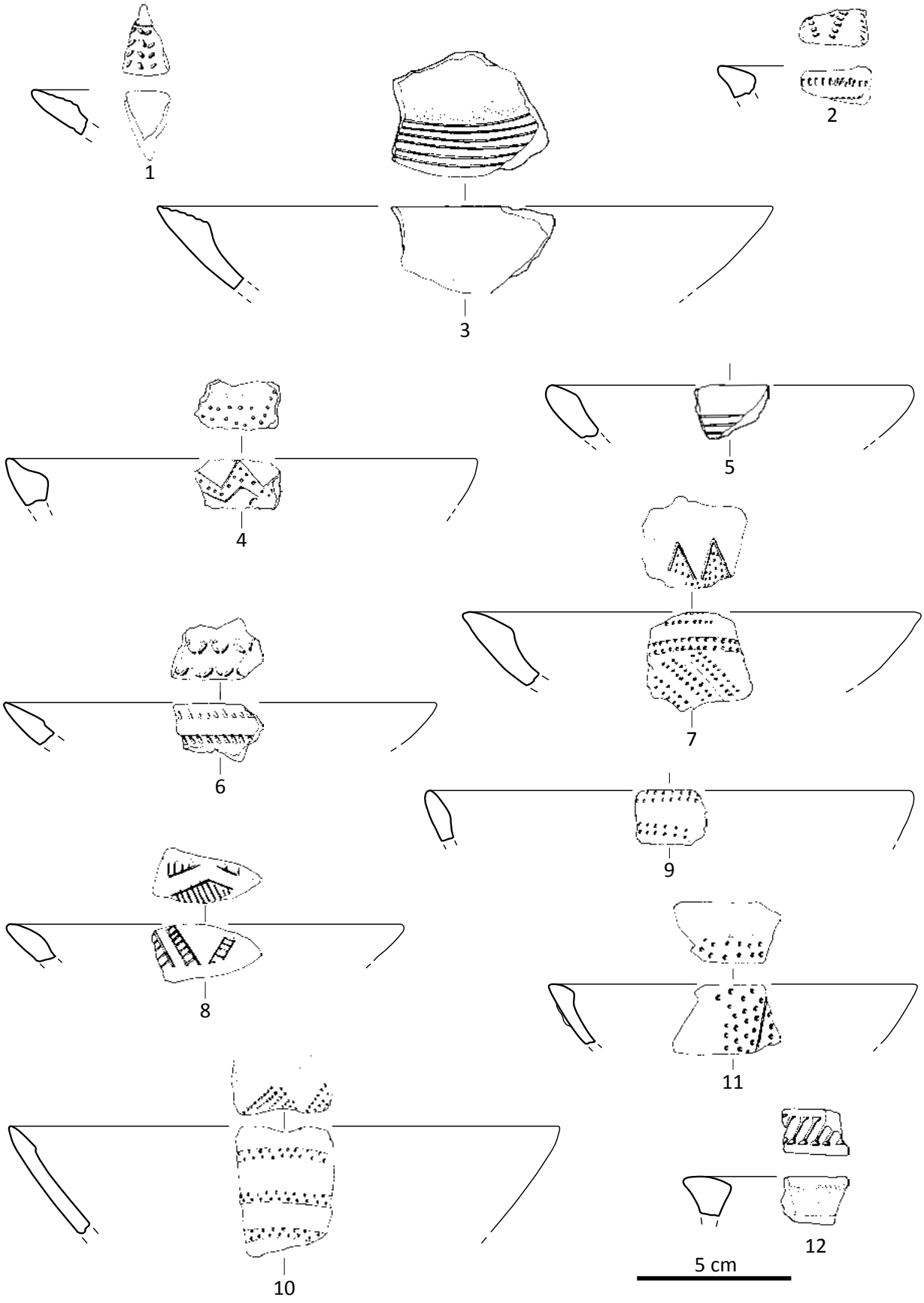


Figure 34. Salamandrija, a selection of diagnostic pottery, 3rd millennium BC. 1-12 fragments of open bowls with wide rim.

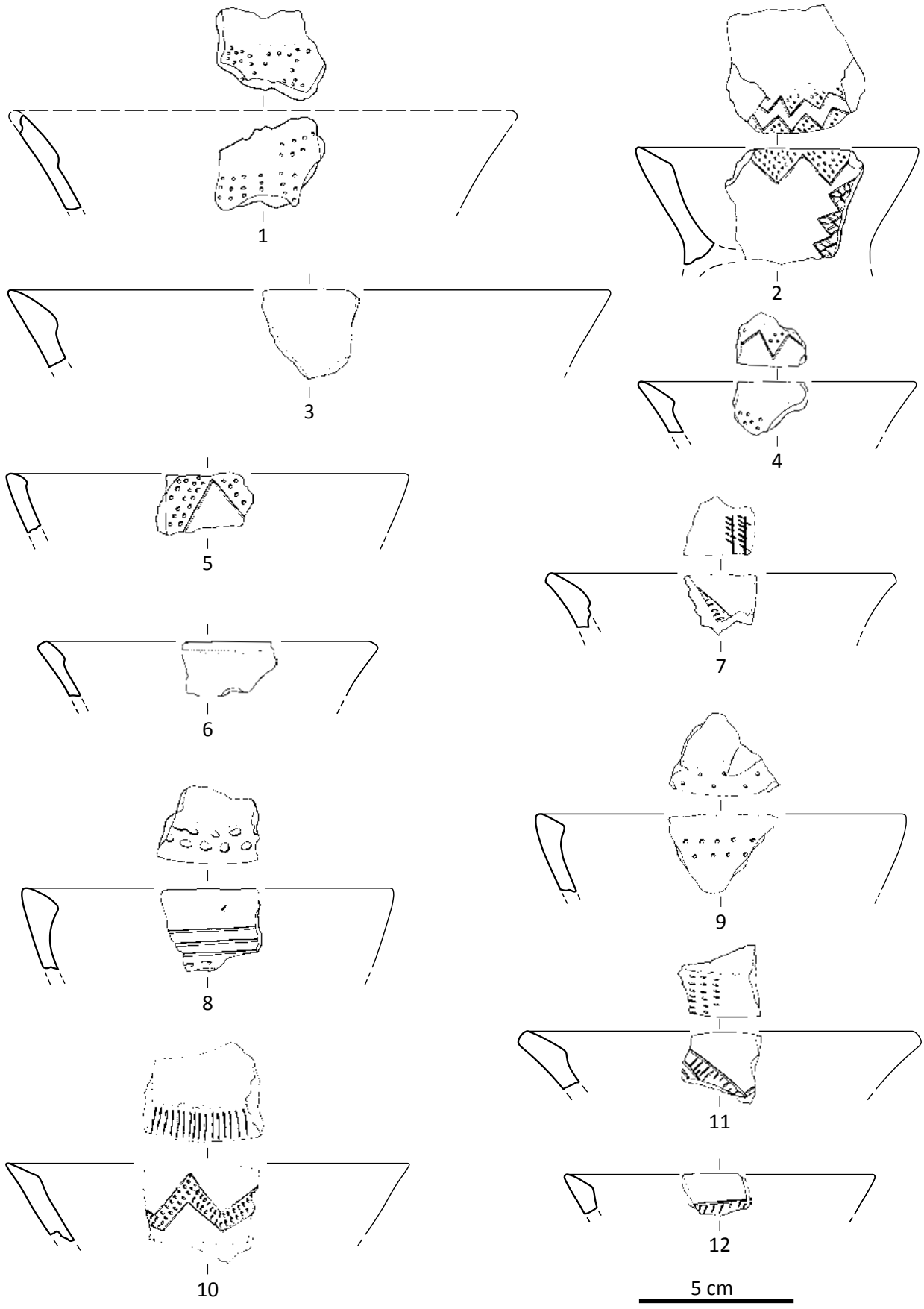


Figure 35. Salamandrija, a selection of diagnostic pottery, 3rd millennium BC. 1-12 fragments of open bowls with wide rim.

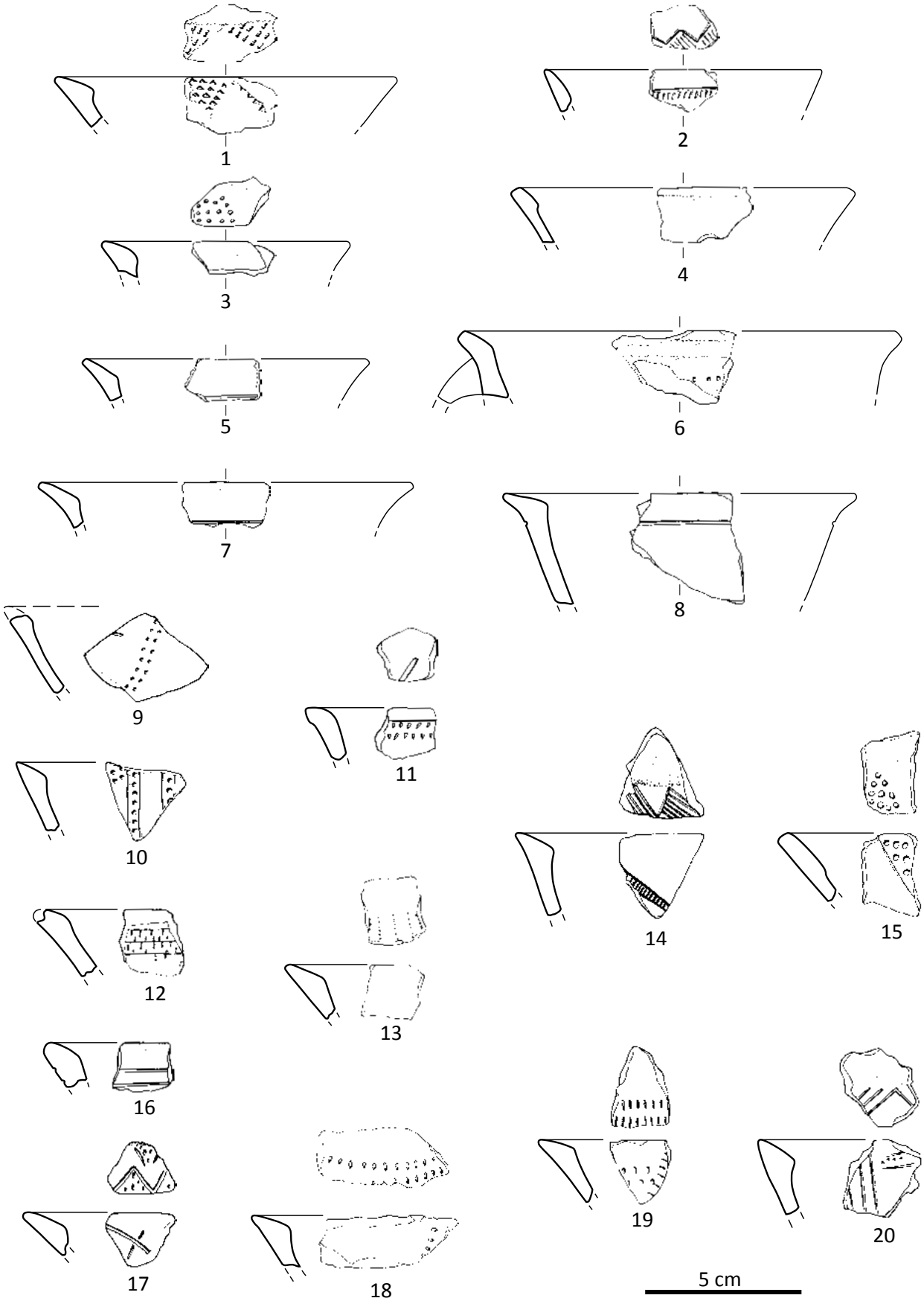


Figure 36. Salamandrija, a selection of diagnostic pottery, 3rd millennium BC. 1-20 fragments of open bowls with wide rim.

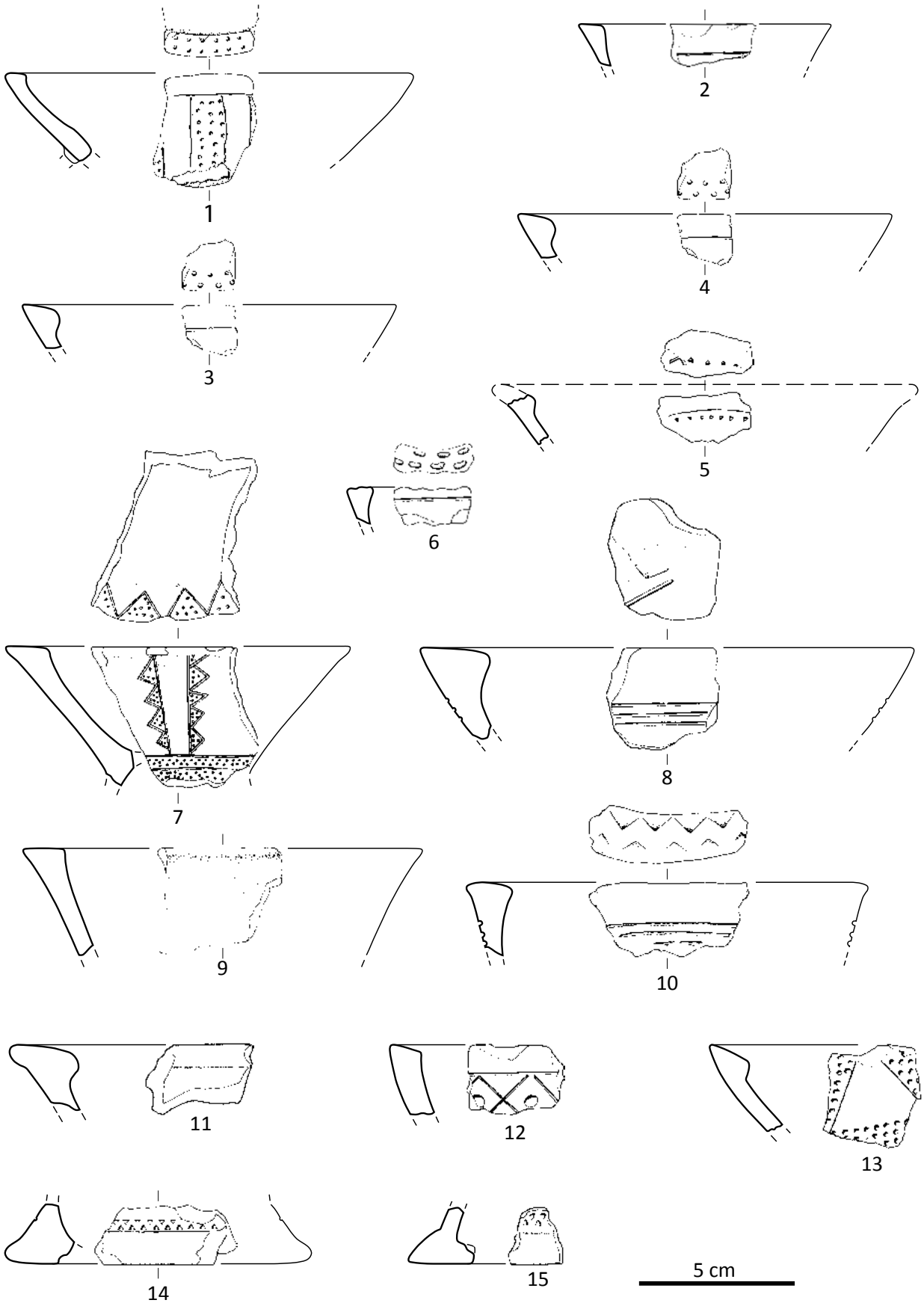


Figure 37. Salamandrija, a selection of diagnostic pottery, 3rd millennium BC. 1-15 fragments of open bowls with wide rim.

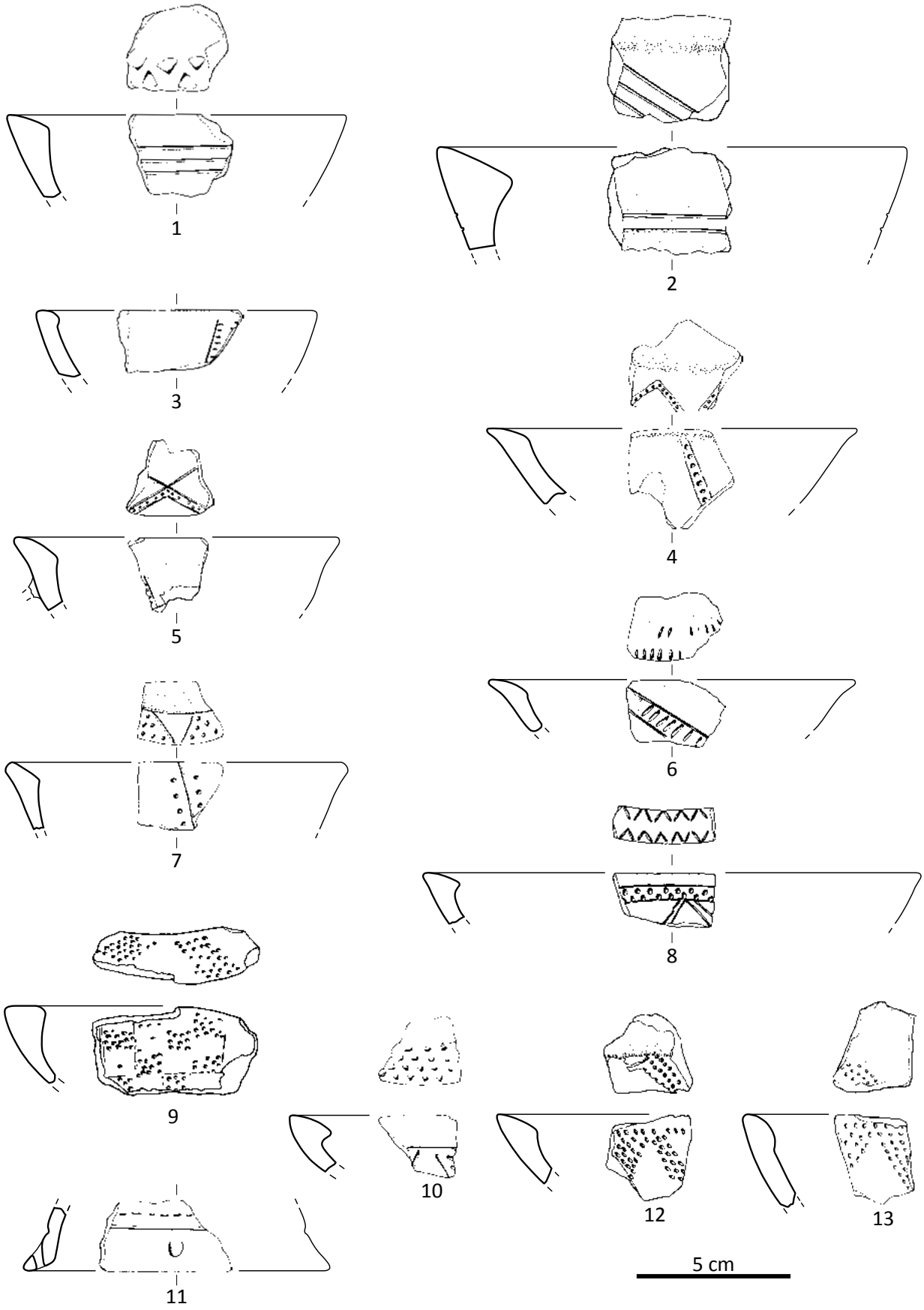


Figure 38. Salamandrija, a selection of diagnostic pottery, 3rd millennium BC. 1-13 fragments of open bowls with wide rim.

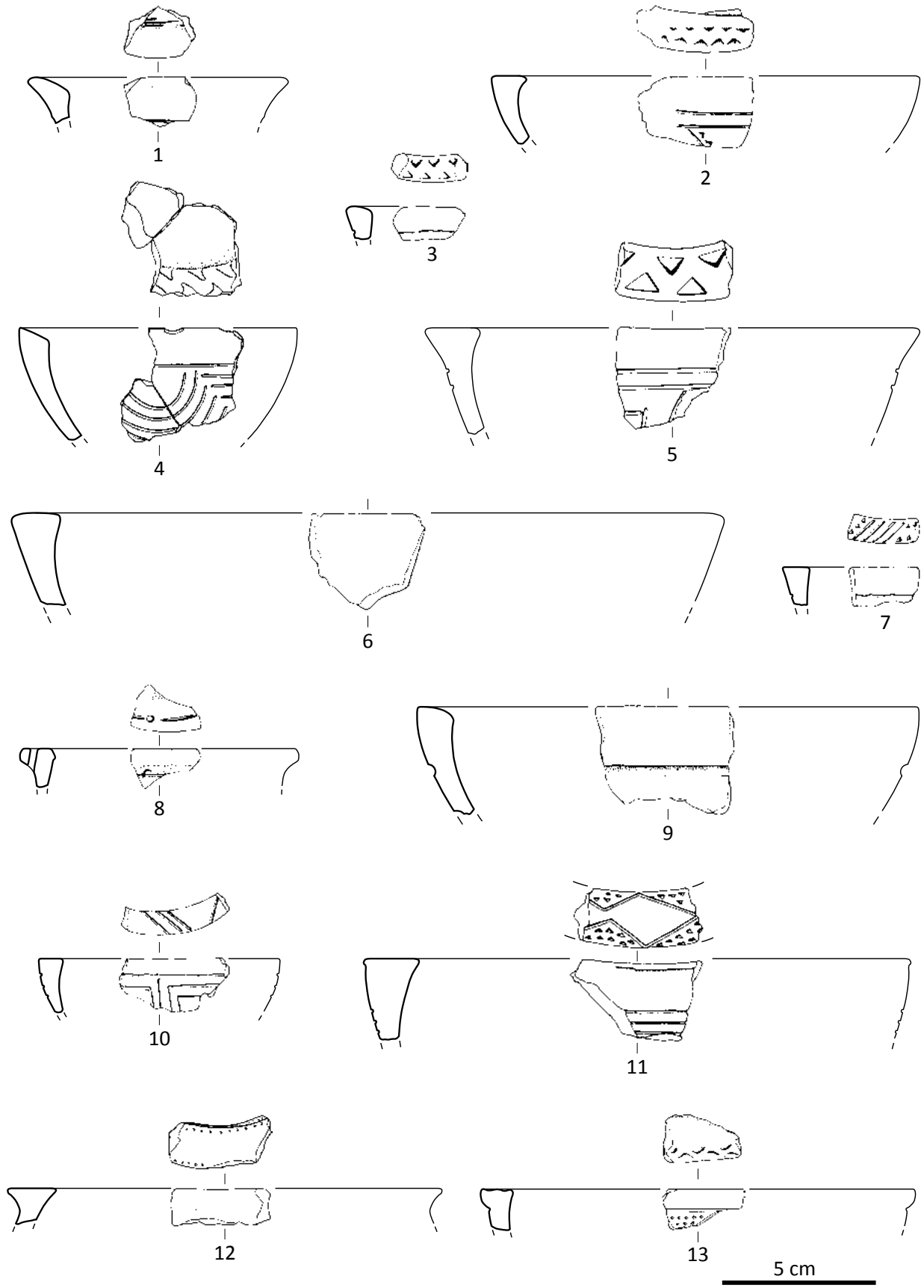


Figure 39. Salamandrija, a selection of diagnostic pottery, 3rd millennium BC. 1-13 fragments of open bowls with wide rim.

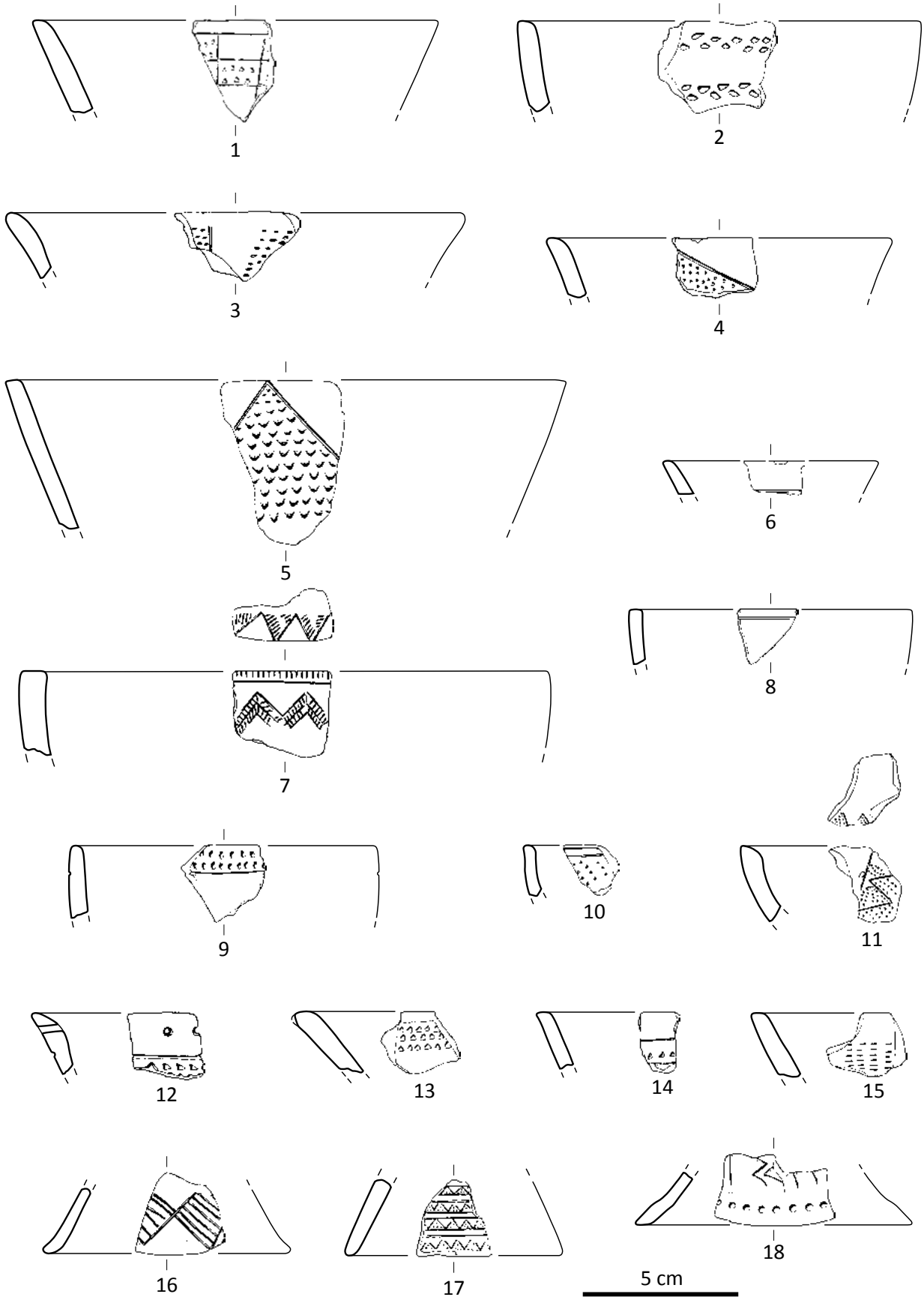


Figure 40. Salamandrija, a selection of diagnostic pottery, 3rd millennium BC. 1-18 fragments of open bowls with simple rim.

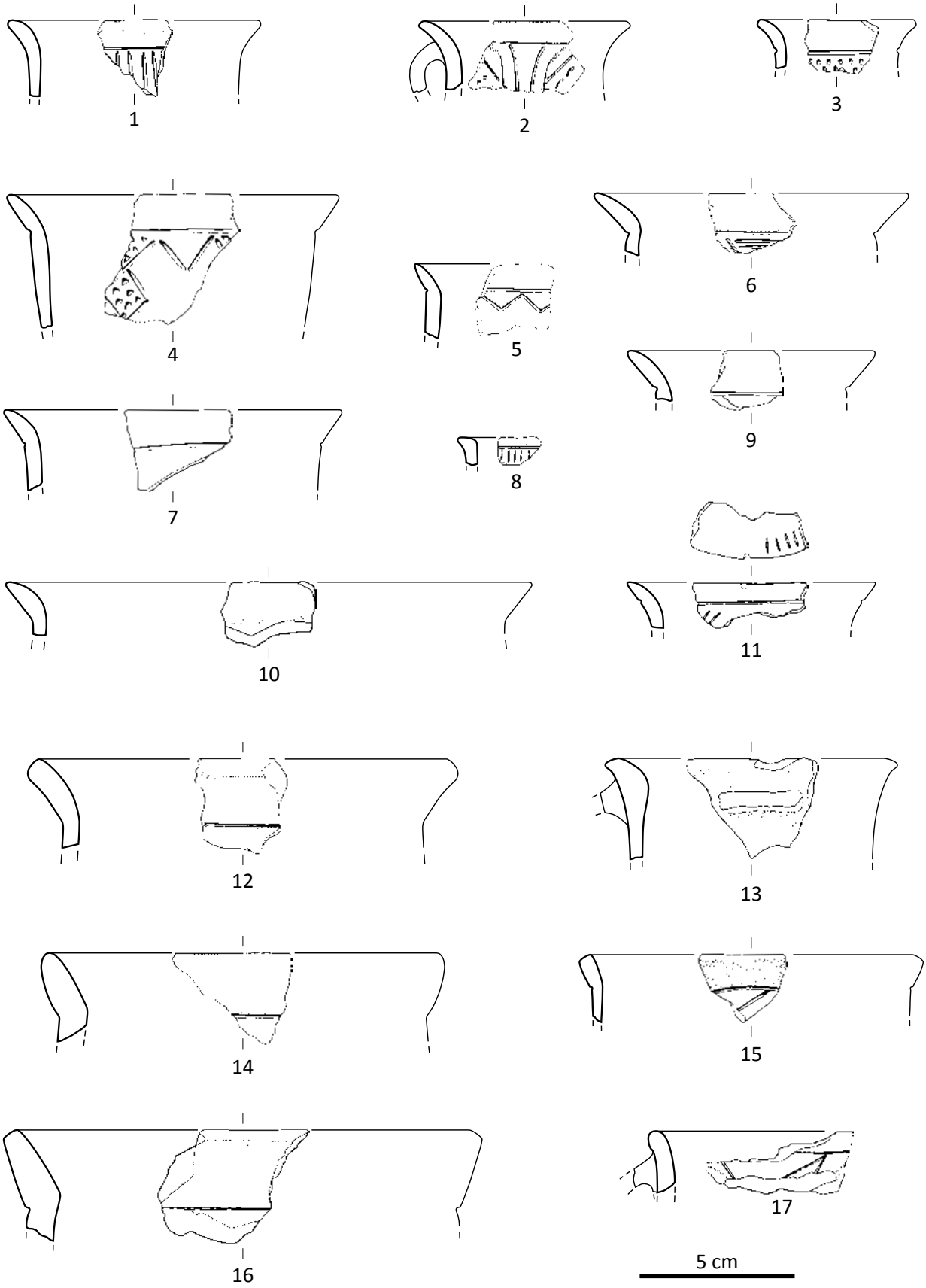


Figure 41. Salamandrija, a selection of diagnostic pottery, 3rd millennium BC. 1-17 fragments of tall-necked beakers with everted rim.

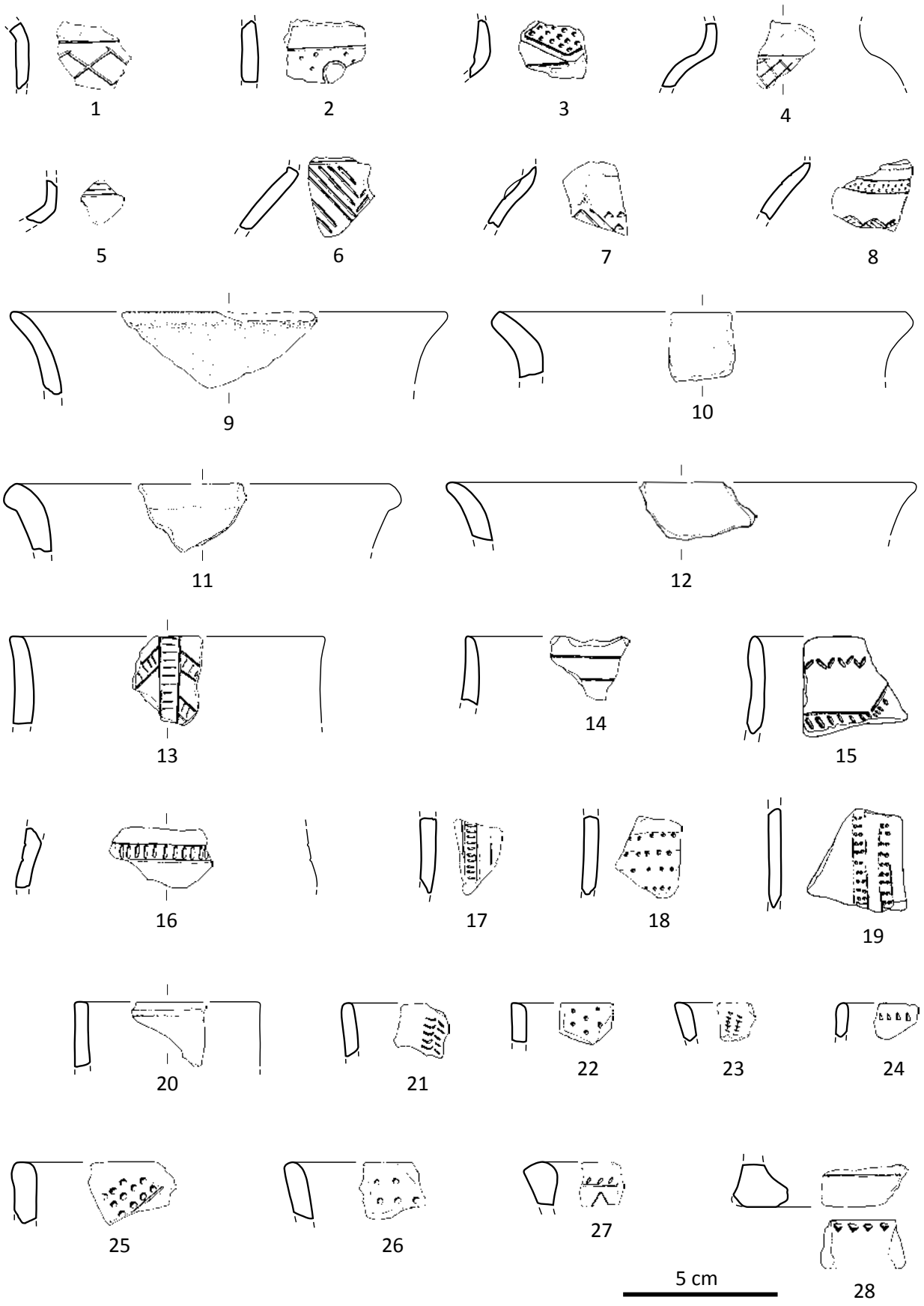


Figure 42. Salamandrija, a selection of diagnostic pottery, 3rd millennium BC. 1-8 fragments of tall-necked beakers with everted rim, 9-12 fragments of vessels with everted rim, 13-19 fragments of deep carinated bowls or beakers, 20 fragment of a vessel with constricted cylindrical neck, 21-28 unclassified vessel parts.

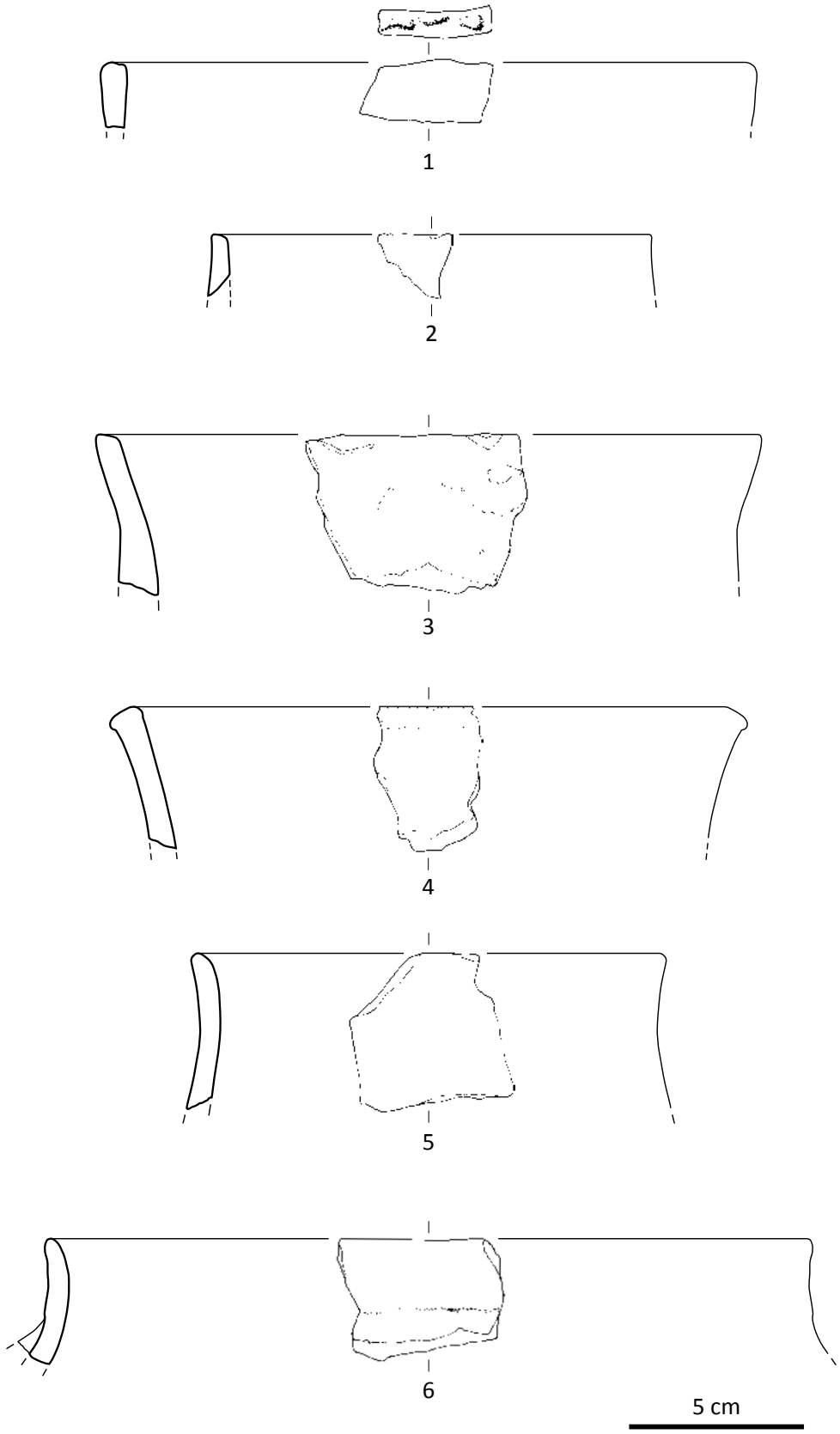


Figure 43. Salamandrija, a selection of diagnostic pottery, 3rd millennium BC. 1-6 fragments of vessels of indeterminate shape.

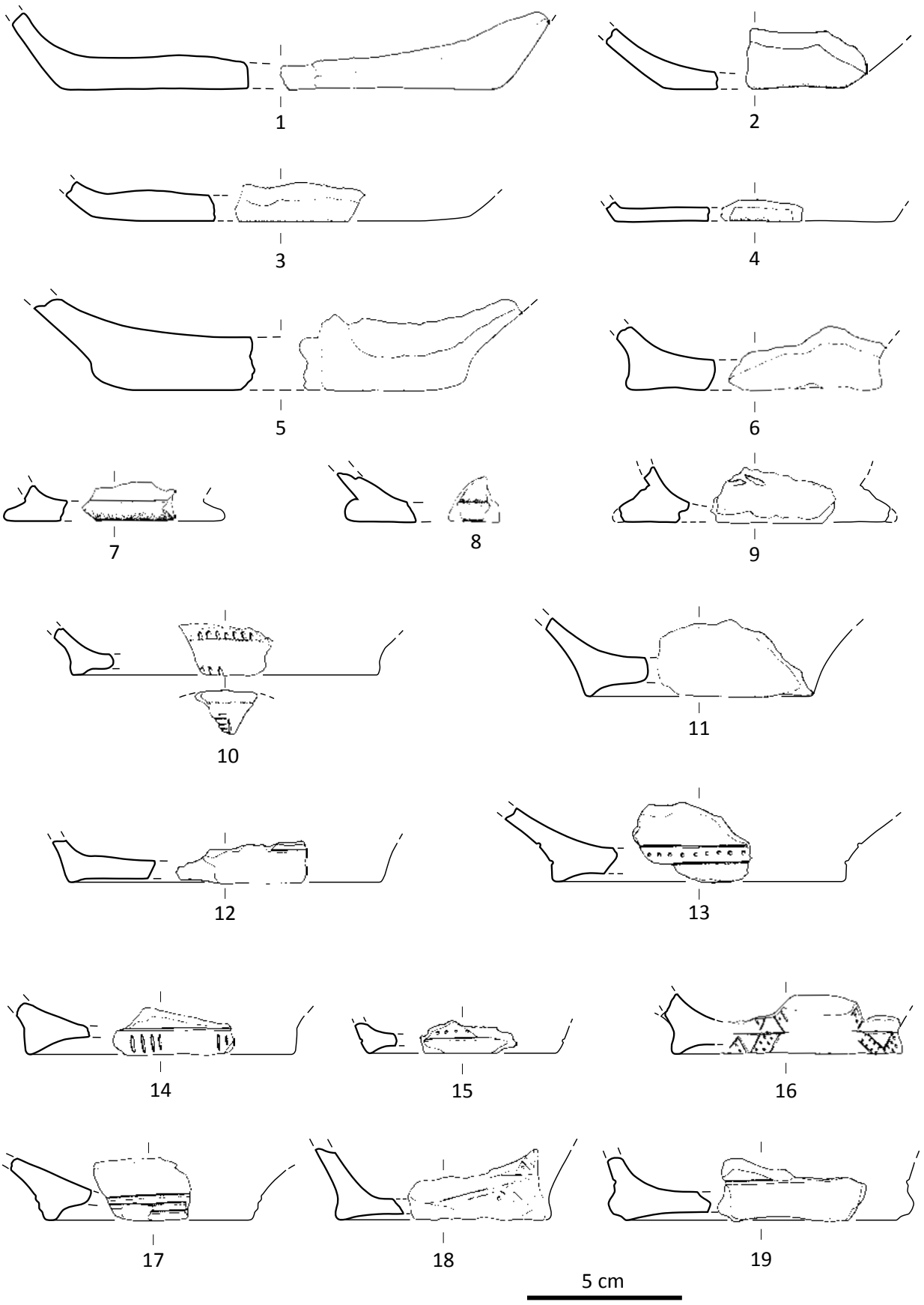


Figure 44. Salamandrija, a selection of diagnostic pottery, 3rd millennium BC. 1-6 fragments of flat bases, 7-9 fragments of protruding bases, 10-19 fragments of ring-foot bases.

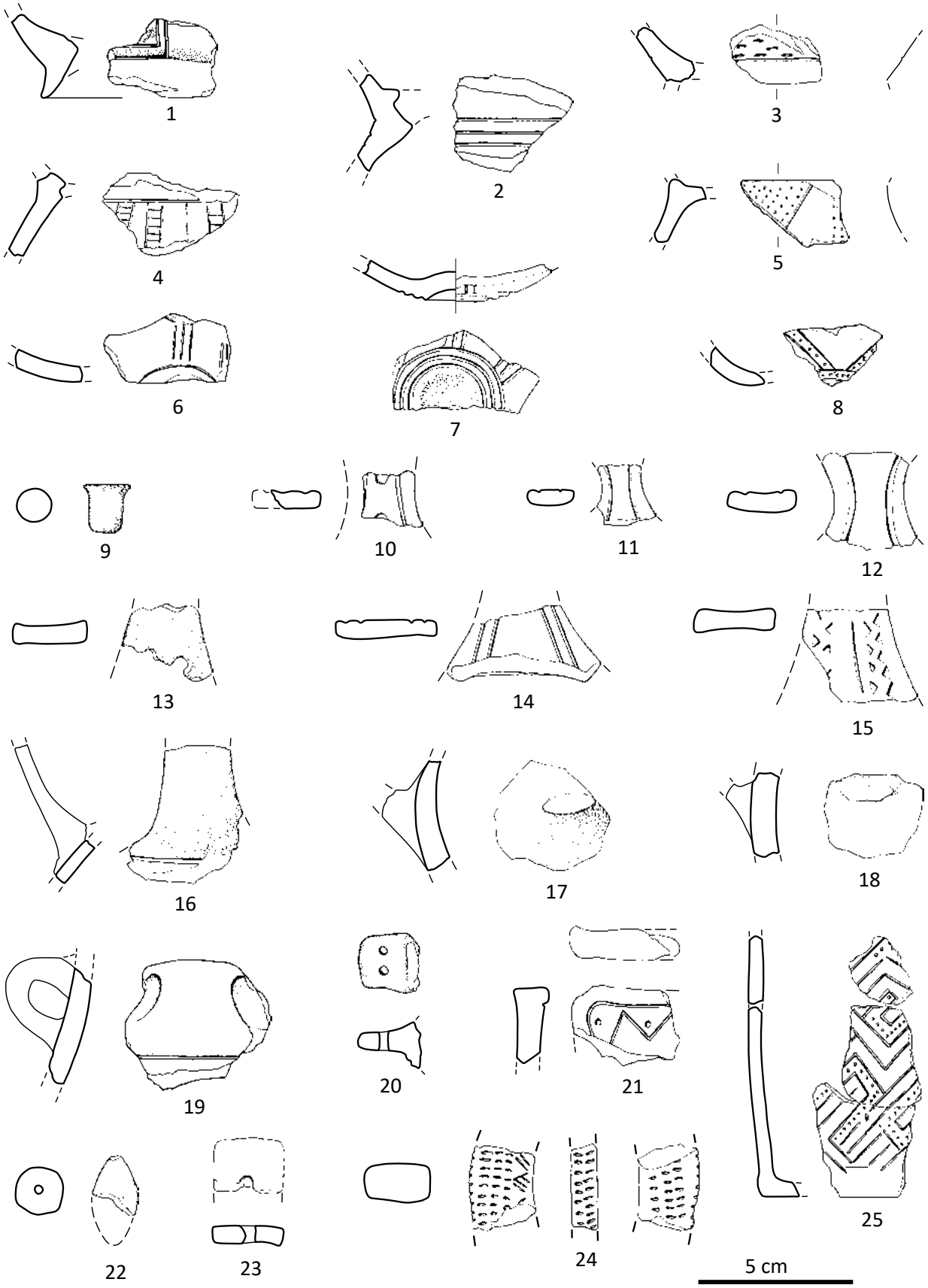


Figure 45. Salamandrija, a selection of diagnostic pottery, 3rd millennium BC. 1-5 fragments of high pedestal bases, 6-8 fragments of navel-shaped bases, 9 peg-shaped foot, 10-19 handles, 20 lug handle, 21-25 other objects made of fired clay.

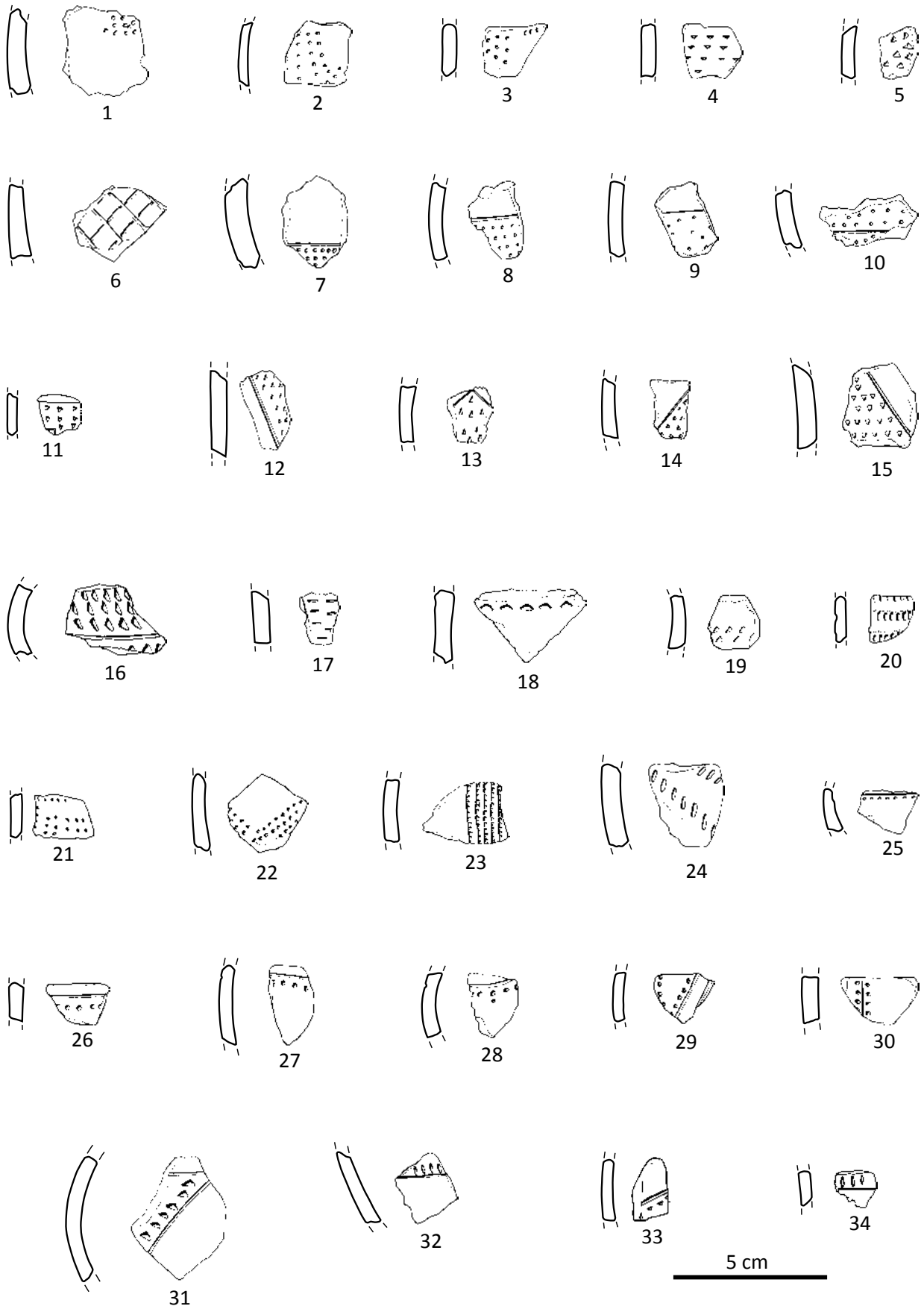


Figure 46. Salamandrija, a selection of diagnostic pottery, 3rd millennium BC. Basic decorative motifs: 1-17 surfaces, 18-24 series, 25-34 series along lines.

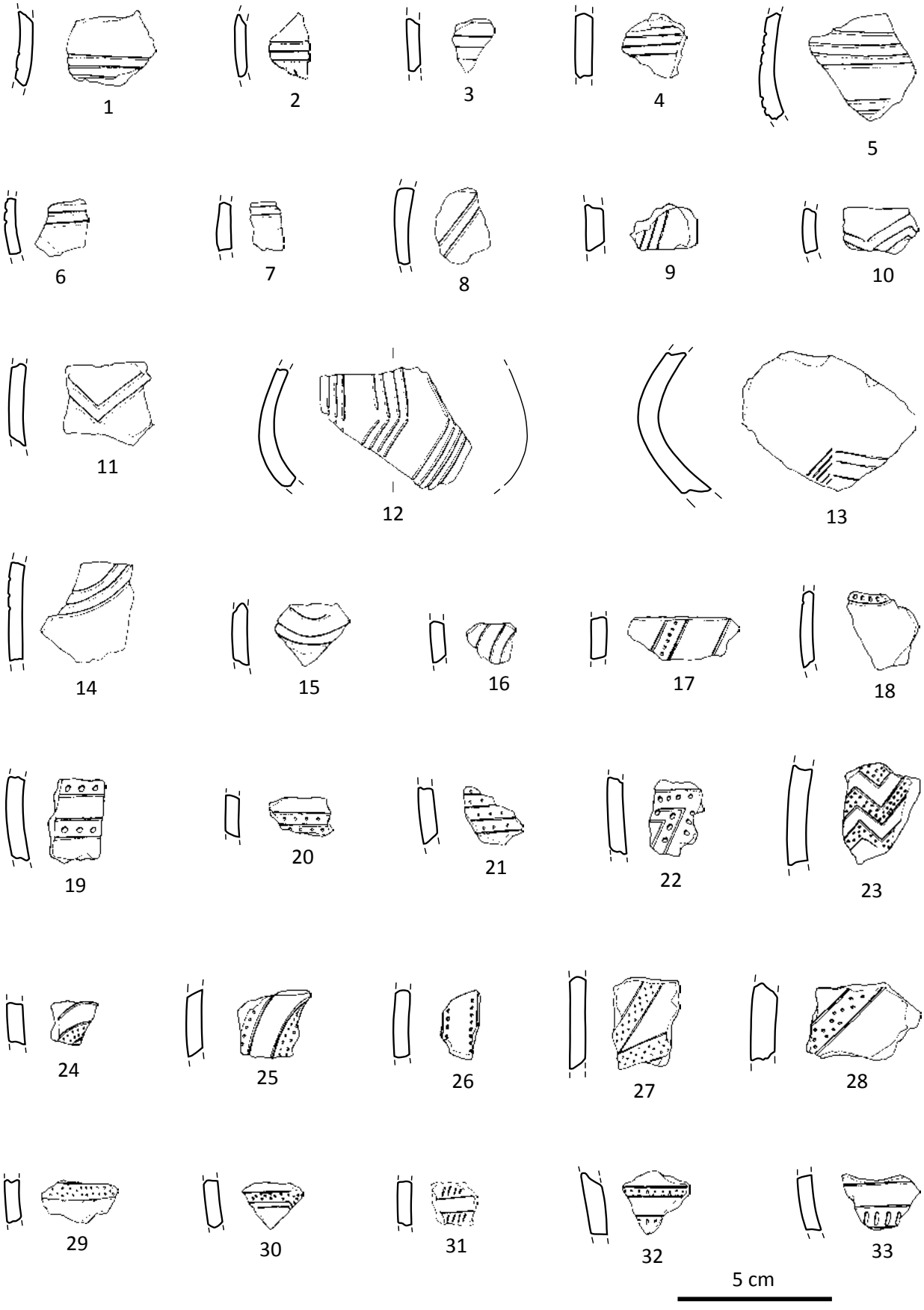


Figure 47. Salamandrija, a selection of diagnostic pottery, 3rd millennium BC. Basic decorative motifs: 1-33 bands.

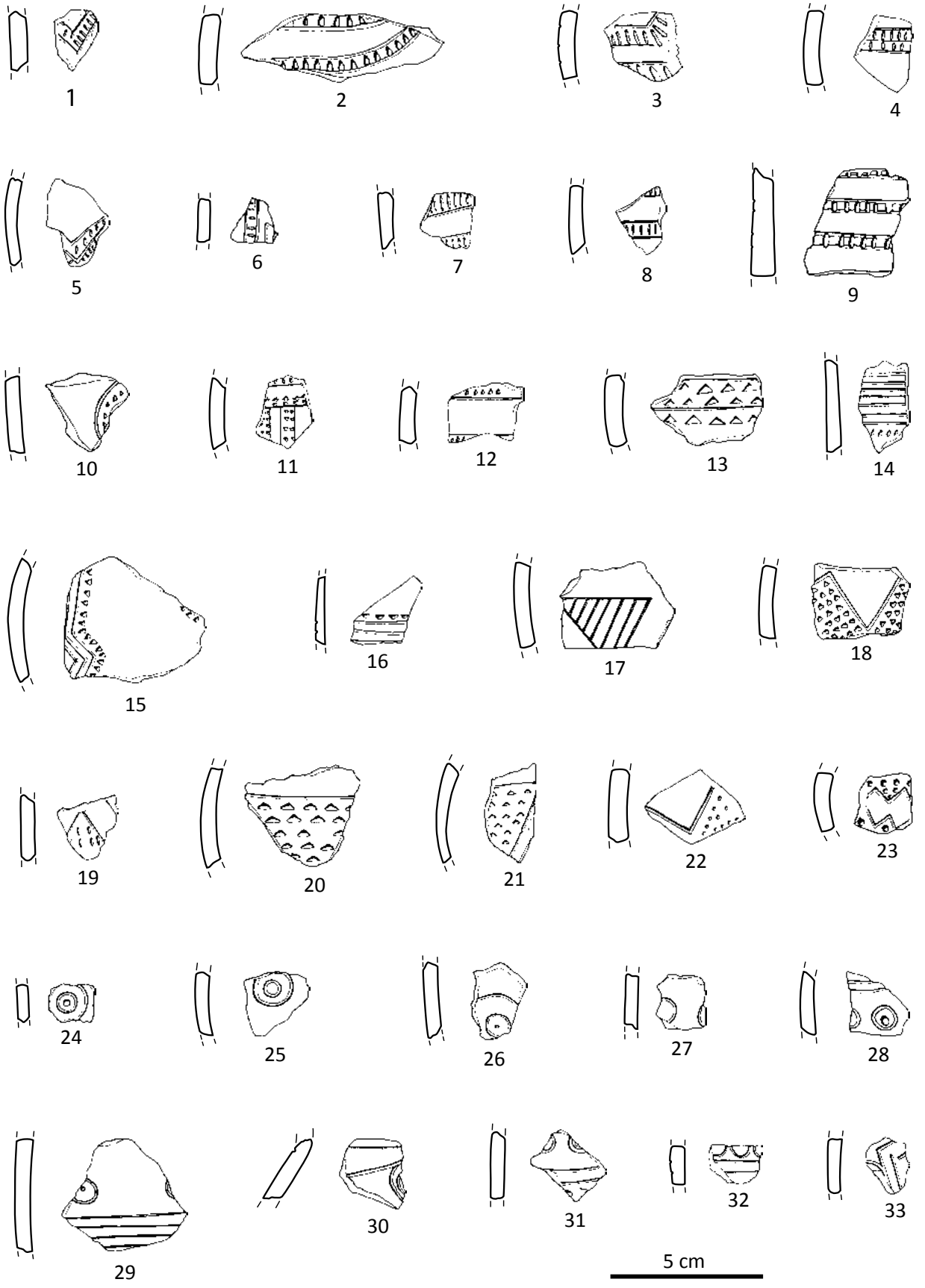


Figure 48. Salamandrija, a selection of diagnostic pottery, 3rd millennium BC. Basic decorative motifs: 1-11 bands, 12-16 series along bands, 17-29 geometric shapes; 30-33 parts of complex decorative designs.

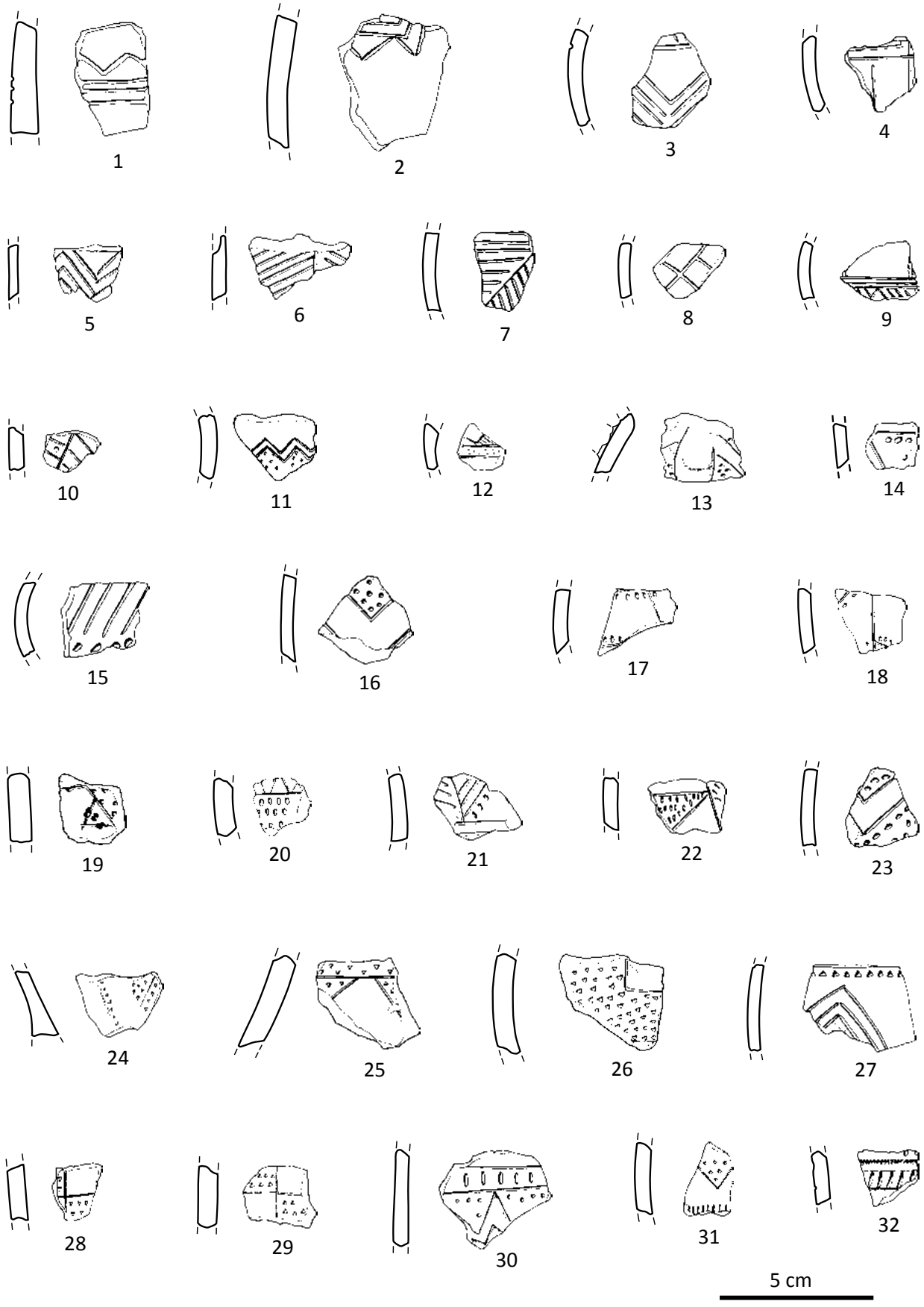


Figure 49. Salamandrija, a selection of diagnostic pottery, 3rd millennium BC. 1-32 parts of complex decorative designs.

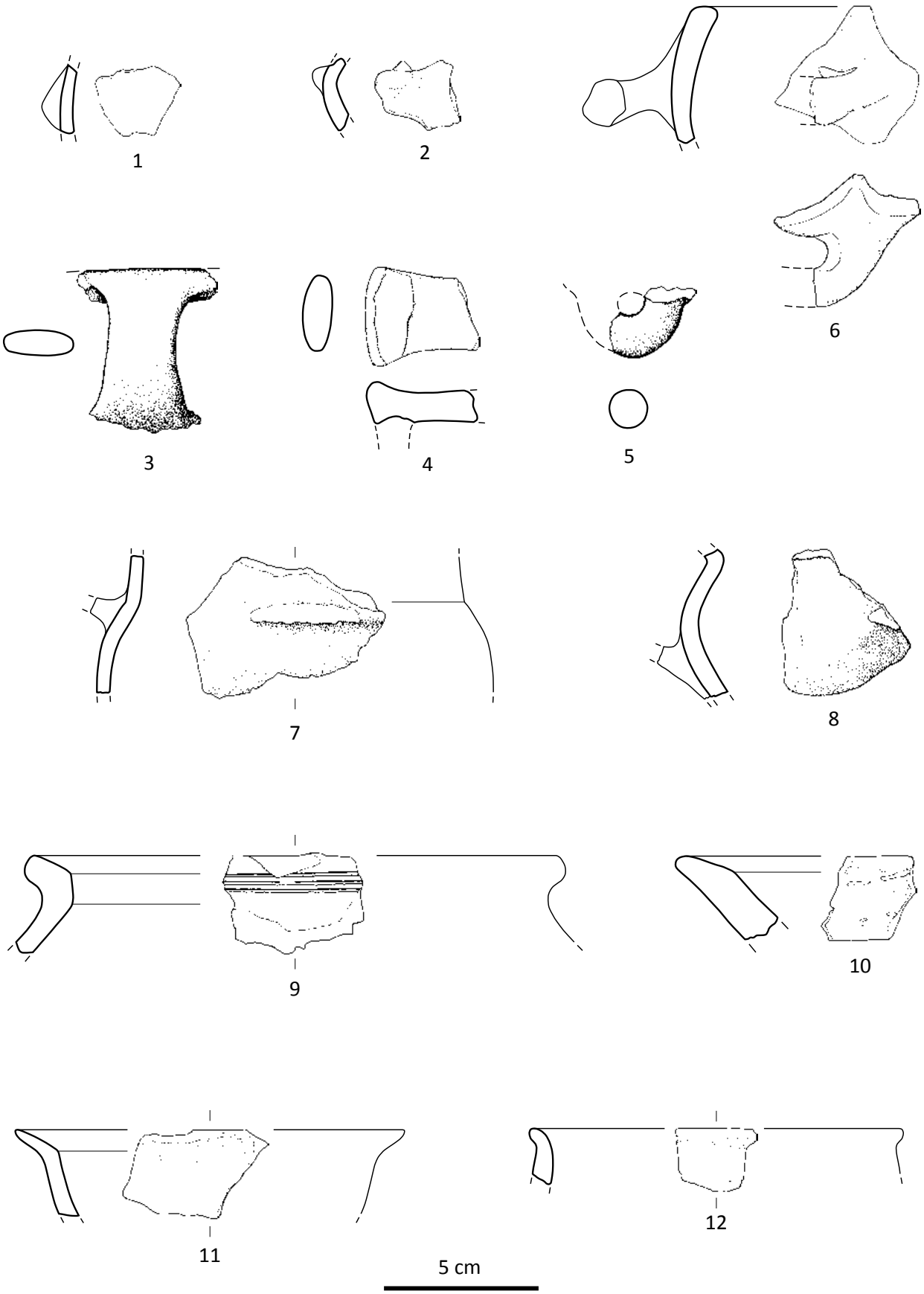


Figure 50. Salamandrija, a selection of diagnostic pottery, 2nd millennium BC.

clay (Robb and Farr 2005: 30), or Daskalio Kavos on the Aegean island of Keros, where almost all pottery was imported (Broodbank 2013: 323).

In absence of systematic raw material analyses, the place (or, more likely, places) where the pottery from Palagruža was made remain unknown. It seems improbable that it was made on Palagruža, although such a possibility should not be dismissed out of hand. Geological survey of the island (Korbar *et al.* 2009) identified presence of clay that may be serviceable for making pottery. Tiny bits of chert embedded in some of the potsherds are of some interest, given the existence of chert outcrops on Palagruža. That does not mean, however, that those vessels must have been made locally, since chert can be found elsewhere, and is particularly common and abundant in the area of Gargano. Most of the potsherds contain aplastic inclusions of ground limestone and calcite that are common in pottery from eastern Adriatic sites.

Aside from clay, one needs water and fuel to make pottery (Orton *et al.* 1993: 114-116). Both of those resources are scarce on Palagruža, although the salty sea water sometimes is utilized for making pottery (Arnold 1985: 26-27; Rice 1987: 119). The biggest direct cost of pottery production is the acquisition of substantial quantity of fuel (most often, wood) necessary for firing (Rice 1987: 174-175; Sinopoli 1991: 34-35). Fuel must have been particularly precious on the small, bare island. Furthermore, controlled conditions needed for gradual drying of pots would have been hard to maintain due to high exposure to sunshine and winds, while the need for constant supervision would have required the potters to spend days or even weeks on Palagruža (Arnold 1985: 61-70).

If most of the pottery vessels were not made on Palagruža, where were they brought from? For now, we can only rely on its stylistic traits. In all of the represented periods, those traits allow the possibility of importation from both Adriatic shores, but for the majority of diagnostic sherds from the third millennium BC, the prevalent number of closely similar analogues is to be found on the eastern side of the Adriatic Sea. This topic is discussed further in Chapter 3.3 on pottery styles.

2.1.3 Flaked stone artifacts

The assemblage from Palagruža consists of more than 4400 flaked stone artifacts, weighing in total over ten kilograms. Of the 4293 pieces for which reliable provenience information is available, 4224 pieces (98%) were recovered from Salamandrija (Table 6). To those we have added the 134 unprovenanced chance finds, which most likely also were picked up at Salamandrija. The assemblage thus defined contains 4358 flaked stone artifacts. Among them are 53 obsidian artifacts, weighing in total 25 grams. We deal with them separately near the end of this chapter. The remaining 4305 artifacts, weighing 10342 grams, are made of chert.

SITE	n	weight [grams]
Salamandrija	4224	10128*
Jankotova njiva	19	114
Pod lozje	17	40
Stradun	33	84
Chance finds	134	239
TOTAL	4427	10605*

* weights for 15 artifacts are missing

Table 6. Quantities of flaked stone artifacts by site

2.1.3.1 Origin of the raw material for flaked stone artifacts by Zlatko Perhoč

Investigation of the origin of stone from which Palagruža's lithic artifacts were made gains particular importance due to the central location of Palagruža in the open sea, halfway between the eastern Adriatic and the western Adriatic regions, the island's rich prehistoric record, and the existence at Mala Palagruža of a geological formation containing cherts. Material analysis of prehistoric lithic artifacts indicated that most of them were made of raw materials originating from the western Adriatic (more specifically, Gargano). This finding opens many complex questions. What can stone artifacts teach us about prehistoric navigation in the Adriatic? Were the earliest Adriatic seafaring visitors to Palagruža providers of the lithic raw material, or did they just use it? Does the origin of that raw material coincide with the origin of its providers or users? How to interpret the presence at Palagruža of western Adriatic raw materials and the absence of those from the eastern Adriatic? In short, how can investigation of the origin of raw materials that were used for Palagruža's lithic artifacts contribute to the Adriatic prehistoric archaeology? This contribution is an attempt to provide tentative answers to some of those questions.

2.1.3.1.1 METHODS

Archaeometric interpretation of prehistoric lithic artifacts is based on material analysis of 4284 artifacts weighing a total of 10475 grams (Table 7), or more than 95% of all

SITE	NUMBER		WEIGHT	
	n	%	grams	%
Maiolica cherts	2930	68,4	7671,0	73,2
Maiolica conglomeratic cherts	20	0,5	101,5	1,0
Scaglia cherts	17	0,4	49,0	0,5
Silicified calcarenites	21	0,5	119,5	1,1
Palagruža cherts	12	0,3	157,0	1,5
Radiolarites	5	0,1	5,5	0,1
Indeterminate rock types	1279	29,9	2371,5	22,6
TOTAL	4284	100,0	10475,0	100,0

Table 7. Assemblage break-down by main raw material categories

lithic finds that were recovered from Palagruža. Aside from chert artifacts, which dominate the assemblage, Palagruža also yielded a small number of artifacts made of silicified calcarenites, radiolarite, and obsidian.

Our approach to investigation of raw material origin is based on correlation between artifacts and geological samples from presumed sources (Forenbaher and Perhoč 2015; Vukosavljević and Perhoč 2017). All artifacts larger than 15 mm were analyzed. Artifacts with specific primary and secondary characteristics were selected as representative of material types, and all lithic artifacts were classified according to those types. Customary categories determination was checked and corrected, if necessary, by microscopic examination of polished sections and microfacial analysis of thin sections of individual samples. Geological rock samples were analyzed following the same procedure. Material types of Palagruža lithics were correlated to geological samples by comparison of the collected data. Descriptions of particular material types are accompanied by a selection of photos and microphotographs of the correlated archaeological and geological samples. Comprehensive photographic documentation of samples of all types has been stored as a part of our comparative geoarchaeological collection.

We used the customary categories for rock morphology (nodule, pebble, nodule fragment), cortex (nodular cortex, pebble cortex), nodule core structure (homogeneous or speckled, stained, banded, laminar, layered), transparency (opaque, semitranslucent, translucent, transparent) and gloss (dull, porcelain, waxy, glassy) for macroscopic characterization of the material types. Chert texture was determined by analogy to texture of the host rock, following the classification of limestones (Flügel 1978). Microfacial analysis relied on publications by Barić and Tajder (1967), Flügel (1978), Pichler and Schmitt-Riegraf (1993), Adams and MacKenzie (2001), Premoli Silva and Verga (2004), Rönnfeld (2008), and MacKenzie and Adams and (2009). We used loupes of 10, 20 and 30 power with integrated light source. Microscopy was carried out by Carl Zeiss Polarization Axioskop 40 A Pol microscope, in transmitted light (thin sections) and reflected light (polished sections). Color was determined according to Geological Society of America (1995). While deciding on specific elements of our methodology, we relied on the experience of several authors (Affolter 2002; Bressy and Floss 2006; Tarantini *et al.* 2016), adapted it to the specifics of our area, and augmented it by elements tested in the course our own research. Methods used for determination of patinated lithics are explained by examples in section 2.1.3.1.2.2.

We included artifacts from Palagruža and a few other Dalmatian prehistoric sites, which we had determined as of western Adriatic origin, in a chert sourcing pilot study based on macroscopic, colorimetric and chemical analyses that correlated geological samples from Gargano with the lithic artifacts (Tarantini *et al.* 2016). Preliminary results of that study generally confirmed the similarity between the artifacts from Sušac, Nakovana, and Grapčeva Cave and the geological samples with identical structural and textural characteristics from Gargano, but found little correspondence to artifacts from Vela Cave and Palagruža. These results might reflect inadequate sampling (only a small part of geological sources and archaeological finds were sampled) or imperfections of the methods applied, which should be resolved by future research.

Prehistoric providers and users preferred homogeneous raw materials that were technically best suited for production due to their regular fracturing. Unfortunately, homogeneous parts of an otherwise structurally heterogeneous rock usually lack distinguishing characteristics, while material type samples of artifacts cannot always match all traits of their geological correlates. Sedimentary rocks usually are marked by spatial dispersion of characteristics that makes them heterogeneous, while an isolated small artifact made of such rock cannot represent the totality of those characteristics. Artifacts from Palagruža sometimes exhibit only some of the traits of the rock from which they were made. That is why we use the term 'material type' (mt): we aim to identify petrographic type and origin of the rock from which prehistoric artifacts were made by taking into account all primary and secondary petrographic characteristics of artifacts made of similar raw material. Cherts *sensu lato* (Füchtbauer and Müller 1970; Folk 1980; Pettijohn 2004) are among the most common rocks used in prehistoric lithic production, but they lack their specific geological nomenclature, while archaeological terminology is neither precise nor uniform. We follow the authors who tend to name chert types in correspondence to the rock in which they formed (Luedtke 1992). We modify this principle by combining the names of geological

formation, geographic location, chronostratigraphy, and the host rock type in our system of naming material types. We assign codes to those descriptive names in order to avoid repetition of long and cumbersome formulations and allow synthetic overviews of spatial and temporal distribution of the material types.

Material analysis of the Palagruža lithics is hampered by difficult access and impassable terrain of Vela and Mala Palagruža, the absence of publications on Palagruža cherts (Korbar *et al.* 2009), disturbed stratigraphy of the archaeological site, heavy patination of many finds, and imperfect archaeometric analytical methods (Forenbaher and Perhoč 2015). Once we established that the raw material for virtually all Palagruža lithics was neither local nor of an eastern Adriatic origin, we confronted a multitude of chert types and varieties from many autochthonous and allochthonous outcrops in several western Adriatic regions. Determining the provenience of raw materials for Palagruža lithics therefore proved to be very challenging, despite several fieldwork campaigns and the accompanying laboratory analyses.

We base our correlations between raw material sources and artifacts on extensive geoarchaeological investigations and field surveys of chert outcrops in all Adriatic regions, which we have been conducting since year 2006. Our purpose was to produce a topography of rock outcrops that may have been used for prehistoric lithic production, and to recover geological samples and create a comparative geoarchaeological collection with a complex data base. Our ultimate aim was to determine the sources of raw materials that were used in prehistoric lithic production in Dalmatia and the neighboring regions (Perhoč 2009; Forenbaher and Perhoč 2015; Vukosavljević *et al.* 2015; Šošić Klindžić 2016; Vukosavljević and Perhoč 2017; Vujević *et al.* 2017; Podrug *et al.* in press). In the course of that research, we became aware of the topic's many complexities, which advises caution. We are not inclined to define the material types of Palagruža lithics as petrographic types with exclusive origin from specific, geographically limited rock outcrops on Gargano Peninsula. By studying the chert deposits of Gargano, we gained a rough picture that allows us to correlate those cherts with Dalmatian prehistoric artifacts. By using the term 'western Adriatic, Gargano origin', we do not express doubts about our own determination of the examined artifacts' raw material. Rather than that, we wish to avoid presenting our results as absolute. We are aware of the inherent limitations of archaeometric methods that arise from qualitative and quantitative disproportion between archaeological and geological evidence, as well as the incomplete coverage of sources on both sides of the Adriatic. The terms 'eastern Adriatic region' and 'western Adriatic region' are used to indicate the origin from geographically closest sources of raw materials that are neither local nor regional, sources that are more likely than other, even more distant sources. We would argue that our geographically broad determination represents a sufficiently reliable contribution to the reconstruction of mobility of prehistoric populations.

2.1.3.1.2 Material types of Palagruža lithics

The greatest majority of Palagruža lithics is of western Adriatic, Gargano origin (cherts from Maiolica and Scaglia carbonate rock formations, as well as silicified calcarenites). Two types that constitute a tiny fraction of Palagruža lithics originate from Palagruža (chert) and the eastern Adriatic, most likely from Bosnia-Herzegovina (radiolarites).

2.1.3.1.2.1 Indeterminate and thermally altered cherts

Over 70% of Palagruža finds were attributed to specific material types. The remaining are finds of indeterminate material type and thermally altered cherts (Table 7). Artifacts smaller than 15 mm, most often stained by soil particles and colored by agents from the sediment in which they had been deposited, constitute the indeterminate material type. Judging by their conchoidal fracturing, hardness, and negative reaction to the solution of hydrochloric acid, almost certainly these are cherts. Also included in this category are a few fragments of carbonate rock (probably, geofacts) and two pieces made of light brown chert uniformly speckled with whitish and grayish specks for which we did not find geological correlates, although macroscopically they resemble Gargano types.

Thermally altered finds include cherts whose original appearance has been modified by exposure to heat, either by accidental deposition in hearths, or possibly in wildfires (Figure 51). Crazing, potlids, circular cracks,

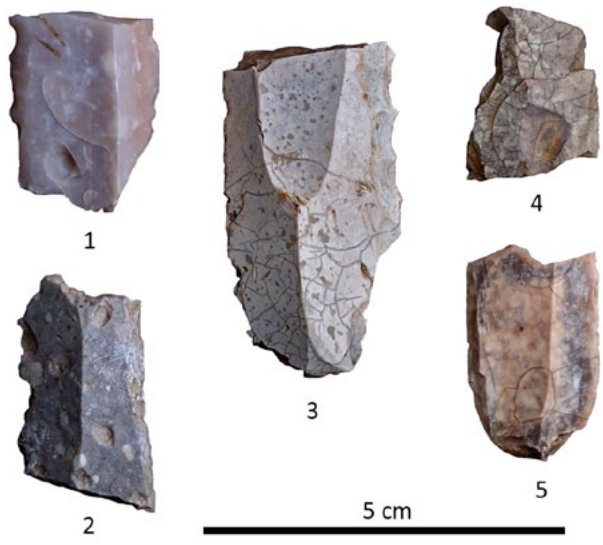


Figure 51. Salamandrija, a selection of thermally altered artifacts, probably made of Gargano cherts.

absence of gloss, and discoloration (usually gray and black, but also bright red) are common indicators of thermal alteration of cherts (Hahn 1991). Thermally altered finds that could be attributed to a material type were classified accordingly.

2.1.3.1.2.2 Patinated cherts

Aside from the thermal and mechanical alterations, we observed three other kinds of changes caused by weathering that affected the rock surface: white patina, yellowish gray patina, and dehydration. Such alterations were absent from radiolarites and Palagruža cherts. White patina was observed on artifacts made of Gargano cherts of the Maiolica and Scaglia group, while dehydration was observed only on silicified calcarenites. Yellowish gray ferric patina is a vestige of iron oxidation (Tišljar 2004) that tends to appear on Palagruža lithics together with white patina and dehydration (Figure 60). Dehydration of artifacts made of silicified calcarenites is conditioned by the porous structure of the rock, leaching of the chemically less resistant carbonate materials, and insolation. Its consequence is increased porosity and bleaching that progresses from the surface of the rock towards its core. Thus created micropores at the dehydrated and porous surface often are filled with soil particles from the sediment that contained them. This occurrence should be distinguished from other kinds of weathering and other material type variability, and should be taken into account during classification.

White patina requires particular attention due to its frequent appearance on Palagruža lithics (2333 pieces with a total weight of 5380 grams, that is, 77,6% by count or 66,4% by weight of all materially determinate finds). Despite much research, the character and diagnostic value of patina for archaeological investigation of prehistoric lithic artifacts have not been properly elucidated. Specialists agree that its appearance depends upon the kind of rock, and on many variable environmental factors that hamper a serviceable typology. White patina is an aspect of rock weathering (geologically, a 'weathering rind') that is specific for cherts (Rottländer 1989; 2013; Luedtke 1992). It is a consequence of modification of quartz crystal structure that causes color change at rock surface. It is generally presumed that this change is caused by insolation weathering. Sunshine and heat affect the crystalline grains of chert by removing the constituent water and dehydrating the rock surface. This causes disintegration of the grainy and scaly structure of quartz crystals, which leads to the change of refraction and creates the perception of a white colored rock surface (Rottländer 2013). Concentration of patina depends on mineral homogeneity and physical compactness of the rock. We noted that, among Palagruža lithics, white patina is more common on highly silicified cherts, usually translucent and transparent varieties with glassy or waxy gloss.

In the course of our investigations we noted that different chert types react differently to their depositional environment by developing different patinas. We observed a number of coinciding characteristics of patina on cherts of the same type. We applied those findings to the analysis of surface finds from Palagruža, Sušac, and Hvar, several Neolithic sites from the hinterland of Šibenik, from Bukovica, and from Ravni kotari, all of which have been exposed to intensive insolation and contact with *terra rossa* over long time periods (Perhoč and Altherr 2011; Podrug *et al.* in press). The method that we present here is empirical and we employ it to differentiate the eastern Adriatic cherts from the western Adriatic cherts, but also to distinguish specific material types of the same origin.

We carried out material type determination of patinated finds by comparing the structure and texture of patinated cherts. This included: (1) macroscopic visual inspection (by naked eye and by loupe) of structure, thickness, and density of patina, and control by reflected light microscopy of the same locations (Figures 53, 54 and 60); (2) macroscopic visual inspection of finds before and after removal of patina by grinding, and control by reflected light microscopy of the same ground locations (Figures 54, 58 and 60); (3) microfacial inspection of thin sections of the same locations in transmitted light (Figures 58 and 60). By comparing the characteristics of the investigated chert finds, and by correlating patinated and non-patinated locations, we realized that patina represented a partial projection of the (internal) texture on the (external) structure of the chert. In that way we deciphered the structure of patina (quartz and quartz-calcite phases, microfossils, and inclusions), and then applied our experience to macroscopic reading of characteristics of all other more or less patinated finds. This enabled us to determine patinated finds in accordance with groups of material types of Palagruža lithics.

White patina does not affect equally all parts of chert. The edges of inclusions (detritus) get patinated first, followed by matrix, where its development is not uniform, but depends on its relief (Figure 53). Thin parts, edges, and corners that are set apart from the massive body of chert are more prone to patination (Rottländer 2013). We observed this phenomenon in microinclusions, lithoclasts, and bioclasts that are invisible in non-patinated matrix (especially in translucent cherts), but are visible by naked eye through the incipient thin layer of patina (Figures 53, 54 and 58). Incipient patina covers the surface only partially, by specks, irregular reticulate aggregations of specks, or a very thin, transparent layer. Homogenous parts of

chert (completely silicified matrix without inclusions) are much less affected by patination. In contrast, calcite-quartz phases (characteristic grayish specks, circles and stains) on Palagruža lithics barely patinate at all, but are more prone to be stained by hematite (Figure 54) (Tišljar 2004). Lithoclasts in cortical and subcortical layers behave similarly, but not those in the completely silicified core part of the nodule. Incipient patina concentrates around them and outlines them clearly at the surface.

We recognized the following patina structures in our sample: (1) thin patina with widely spaced reticular structure (whitish and yellowish brown stains and specks with intervening clear areas); (2) thin patina with dense web-like structure (dense network of whitish and yellowish brown stains and specks that reflects the structure of chert); (3) thick patina (>1 mm or developed across the entire section, the sampled sections varying in thickness from 6 to 15 mm). Finds with thick patina cannot be attributed to a specific chert type and variety, but they can be determined with considerable certainty as of western Adriatic origin. Cherts from the eastern Adriatic regions such as Dalmatia and Dalmatinska zagora can be differentiated macroscopically from the western Adriatic cherts, and their patina is different.

It is important to note that correct macroscopic characterization is not possible for every patinated artifact. That, however, is true for any analysis in which the totality is represented by referent samples, and the extensive macroscopic analysis is controlled by intensive (but reduced) microscopy. In order to minimize the possibility of erroneous attribution, artifacts lacking diagnostic traits were counted among indeterminate finds.

2.1.3.1.3 Artifacts made of western Adriatic raw materials

2.1.3.1.3.1 Maiolica cherts

More than two thirds of Palagruža lithics (97,5% of all materially identifiable finds) were attributed to Maiolica cherts (Table 7). Their western Adriatic, Gargano origin was established according to a number of common structural and textural characteristics.

Heterogeneous structure of these cherts often consists of inclusions visible by naked eye, identifiable by microscope (or, sometimes, macroscopically) as bioclasts or lithoclasts. Chert specialists refer to inclusions of indeterminate origin as 'ghosts' and explain them by recrystallization of matrix microquartz (Bromley and Ekdale 1986) or fossils (Tišljar 2004). Cores of nodules and lenses of Gargano cherts are marked by speckles, circles, stains, and (less often) bands incorporated in a translucent matrix of cryptocrystalline quartz (Figures 52-55). Usually, stains are dense and clearly outlined, but sometimes they are diffuse. These inclusions are quantitatively inferior to the matrix of the nodule core. They follow the concentric structure of the nodule, which is visible on large artifacts and their geological correlates (Figure 56). Regardless of the dominant color and translucency of the surrounding matrix, inclusions are whitish, light gray, or very pale yellowish gray, always opaque and without gloss. Microscopic analyses of those inclusions revealed that the fuzzy whitish stains contained accumulations of quartz and calcite minerals whose optics differ from the surrounding cryptocrystalline quartz matrix (Figures 54 and 56). Maiolica cherts belong to mudstone and wackestone textural types with a correspondent proportion of radiolarian fossils (spicules of sponges that appear with them are calcified), matching the micritic limestones with cherts from the slope and basinal sedimentary environment with which we bring them into connection.

Detritic (conglomerate-breccia-like) texture of the core, and detritic and cavernous habitus of nodule cortex, are specific characteristics of Gargano cherts. Inclusions may be explained in part by incomplete silicification and recrystallization of lithoclasts. We illustrate this phenomenon by comparing macroforms and microforms of inclusions that are partly diffused ('ghosts') and partly clearly outlined, with the interspace between inclusions and the matrix made of a mixture of quartz and calcite minerals (Figure 58). Sometimes it is possible to follow the incorporated lithoclasts from the cortex, through the subcortical layer, to the compact core and cavities within the nodule. Those inclusions, which had been retained from the host rock during chert formation, correspond in size to small pebbles or sand grains. Their shape varies from rare subangular grains to frequent well rounded grains. Large grains are visible by the naked eye, while those less than 1 mm across are visible only by loupe. Cavernous structure of cortex was created by detachment of grains, which is visible at the transition from the cortex to the nodule core (Figure 58). In thin sections, incorporated radiolarians are visible in large grains, indicating that those are intraclasts (Figure 58). In nodule core, those grains are visible as whitish specks and small spheres with diffuse contours in cryptocrystalline quartz matrix.

Some artifacts exhibit a porous and concentric structure of the nodule core (Figure 56). While such artifacts are rare, they provide a welcome additional possibility of correlation with the Gargano raw material. Common characteristics of the featureless, chaotically structured stains and rings, ordered in concentric zones that are visible in nodule section, are their opacity, color (grayish or pale yellowish gray), and a mixed calcite-quartz mineral composition, clearly in contrast with the

surrounding translucent quartz matrix. Porosity of the core might be related to the detritic structure of cortical and core parts of the nodule. Cortex of spherical nodules from deposits of Gargano torrents is worn to the core margin, which is covered by spheroid indentations like a golf ball. Those indentations were created by erosion of pebble grains, while the structure of the surface continues in the texture of grains incorporated in the core. Homogenous core is hollow at petrographically immature locations; these caverns may be explained by incomplete silicification of carbonate mass and leaching of soluble components by pore water. Cavern walls exhibit the same structure as the cortex: a white, chalky, calcite-quartz lining with incorporated grains.

Some of the lithic finds from Palagruža exhibit cortex, a peripheral layer of the nodule that differs clearly from its core by structure and color. Usually, this is a very hard subcortex, less than a millimeter thick. It represents one of the specifics of Gargano cherts, which developed in soft chalky and clayey limestones (Martinis and Pavan 1967; Cremonini *et al.* 1971). This kind of cortex is very susceptible to weathering and dissolution by atmospheric water, and may wear off completely in a short fluvial transport. The examined artifacts have a hard and relatively smooth subcortex with traces of the primary host rock structure: tiny pits from which detritus has been washed out are visible under the loupe. Nodules and their fragments obtain a pebble form when intensive mechanical wear by long fluvial transport or high-energy marine abrasion removes not just the cortex, but also parts of the core, beginning with protrusions to the level of the primary spherical shape, and following with deeper layers of the nodule. Impact fissures in hard subcortex and core part of the nodule also testify of water transport. Since mechanical wear of irregular nodules is uneven, cherts with both nodular and pebble cortex are common in torrent deposits and on beaches. These composite forms of cortex also are present on Palagruža lithics. They are indicative of the type of primary cortex (soft cortex and hard subcortex), short transport distance and, consequently, the type of outcrop, which we recognize as numerous Gargano torrent deposits, and prove by geological samples. Absence of fresh cortex is one of the reasons why we cannot establish whether the raw material was obtained from the well-known Gargano chert mines (Tarantini and Galiberti 2011). Gargano abounds in easily accessible alluvial deposits and similar allochthonous outcrops in which chert quality was not affected despite the long-term exposure to weathering. That notwithstanding, there is no reason to reject the possibility that the raw material for Palagruža lithics came from prehistoric mines of Gargano, which were active since Neolithic until the Bronze Age.

We did not encounter macrofossils in Maiolica cherts of Palagruža lithics, although they have been reported in the cherts' host rocks (Martinis and Pavan 1967; Cremonini *et al.* 1971). Radiolarian microfossils are common, and are accompanied by rare and badly preserved spicules of sponges. Average diameter of radiolarians is 0,2 mm (very rarely 0,5 mm), while the degree of their preservation varies. Their usual fibrous and spherulite structure is evident in thin sections, while well-preserved examples retain their typical denticulate edge (Adams and MacKenzie 2001). They are recognizable in polished sections as milky white spherical shapes (Figures 53 and 54). They also have been observed in large incorporated lithoclasts. Sometimes, radiolarians and spicules of sponges are so badly preserved that they can be spotted microscopically only in polarized light. All of these fossil inclusions have a mud-support (packaging of mudstone type, or sometimes between mudstone and wackestone). Rare fossils of planktonic foraminifers were observed in some of the types, always together with numerous radiolarians (Figure 53). Presence of several genera and species of planktonic foraminifers and other fossils that are rare in cherts of Palagruža lithics has been reported in rocks of Gargano (Martinis and Pavan 1967; Cremonini *et al.* 1971).

Color is a secondary trait of the monomineral chert rock. It originates from a very small proportion of mineral inclusions, water or recrystallized organic inclusions in the dominant mass of colorless quartz (Tišljar 2004). Color variability does not bear upon the basic petrographic determination of chert. While chert color is not linked unambiguously to a chert type or its parent formation (Tarantini *et al.* 2016), in combination with structural characteristics, it provides a simple (but not a sufficient!) possibility of material classification of artifacts. Richness of chert hues and color saturations in a lithic assemblage, as well as the degree of translucency that depends on the thickness of the location at which color is being estimated, prevent precise definition of a material group based only on color (Figure 55). We named each material group by its basic hue, and we provide its color according to Geological Society of America (1995) in our detailed descriptions.

Smooth, continuous, conchoidal surfaces of low curvature, created by controlled fracturing, testify of high technical quality of this raw material and its suitability for production of long and thin prismatic blades. Chert matrix exhibits a high waxy gloss and is translucent even in places that are not very thin. In contrast, the calcite-quartz inclusions in the glassy mass of matrix always exhibit a subdued porcelain gloss and are always opaque (Figure 54).

Three material types of Maiolica cherts are represented in Palagruža lithics: brown (mt 30), gray (mt 32) and black (mt 31). We recognized six varieties of brown Maiolica cherts (Table 8):

MATERIAL TYPE	ORIGIN	NUMBER		WEIGHT	
		n	%	grams	%
Maiolica brown cherts					
30d	Gargano, Maiolica Formation	18	0,6	200,0	2,5
30i	Gargano, Maiolica Formation	18	0,6	61,5	0,8
30e	Gargano, Maiolica Formation	205	6,8	548,5	6,8
30ep	Gargano, Maiolica Formation	1973	65,7	4337,0	53,5
30c	Gargano, Maiolica Formation	119	4,0	444,5	5,5
30cp	Gargano, Maiolica Formation	81	2,7	222,5	2,7
30a	Gargano, Maiolica Formation	39	1,3	92,0	1,1
30ap	Gargano, Maiolica Formation	9	0,3	31,5	0,4
30h	Gargano, Maiolica Formation	50	1,7	53,5	0,7
Maiolica gray cherts					
32b	Gargano, Maiolica Formation	19	0,6	48,0	0,6
32a	Gargano, Maiolica Formation	63	2,1	608,5	7,5
Maiolica black cherts					
31a	Gargano, Maiolica Formation	3	0,1	18,5	0,2
31c	Gargano, Maiolica Formation	83	2,8	317,0	3,9
31dp	Gargano, Maiolica Formation	2	0,1	40,5	0,5
31p	Gargano, Maiolica Formation	248	8,3	647,5	8,0
Maiolica conglomeratic cherts					
33ap	Gargano, Maiolica Formation	20	0,7	101,5	1,3
Scaglia red cherts					
35a, 35ap	Gargano, Scaglia Formation	17	0,6	49,0	0,6
Silicified calcarenites					
39dp	Gargano, silicified calcarenite formations	21	0,7	119,5	1,5
Palagruža cherts					
17b, 17c	Palagruža, cherts	12	0,4	157,0	1,9
Radiolarites					
04b, 04c, 04f	Bosnia-Herzegovina, radiolarites	5	0,2	5,5	0,1
TOTAL		3005	100,0	8103,5	100,0

Table 8. Assemblage break-down by material type

mt 30d – Mostly homogenous and translucent cherts of a subdued yellowish brown color (10YR 5/4) and waxy gloss. Nodular cortex has been washed out and worn away, but subcortex has been preserved, indicating short transport. A few specimens of this type contained structures consisting of rare, fine fibers, as well as rare and barely visible stains and specks in a pale yellowish matrix (10YR 6/2). Microscopic determination: mudstone, rare and tiny (0,1 mm) badly preserved radiolarians in a matrix of cryptocrystalline quartz. Radiolarians are better visible in polarized light, thanks to the spherulite structure of chalcedony. The usual transitional phase of quartz and calcite minerals towards the host rock has been observed in subcortical periphery.

mt 30i (Figure 52) – Cherts marked by two alternating phases, a translucent yellowish brown (10YR 6/2) or yellowish gray (5Y 8/1) phase, and an opaque, dull phase. Both phases are homogeneous and delimited from each other by clear contours, which differentiates them from the typical structure of Gargano cherts with specks and stains. We correlated the artifacts made of this variety to chert samples of nodular type with worn cortex, and with pebbles made of such cherts. The preserved cortex on Palagruža lithics of this group points to allochthonous sources of Gargano, where we collected their geological correlates. Microscopic determination: mudstone. Translucent phases are pure quartz, while the opaque phases are quartz-calcite. Rare radiolarians are better visible in quartz-calcite phase.

mt 30e and **mt 30ep** (Figure 53) – This is the most common material group, containing 2178 artifacts with a total weight of 4985,5 grams. Pale yellowish brown (10YR 6/2), yellowish gray (5Y 8/1) or light

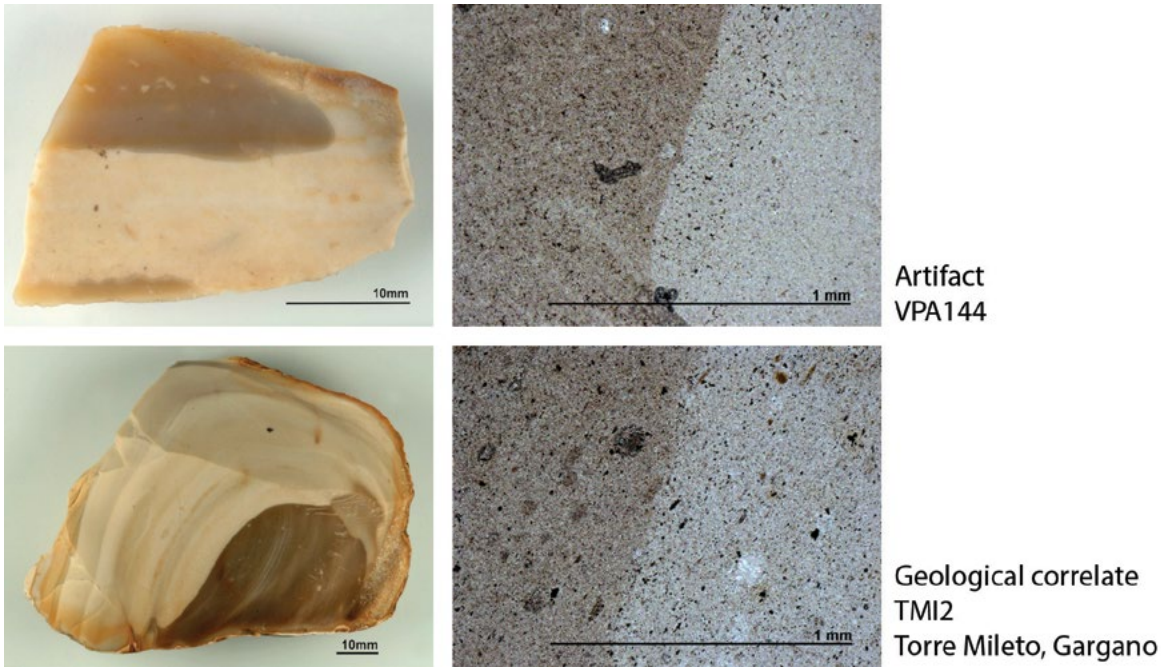


Figure 52. Brown Maiolica chert: mt 30i, photographs (left) and microphotographs of thin sections in transmitted polarized light (right).

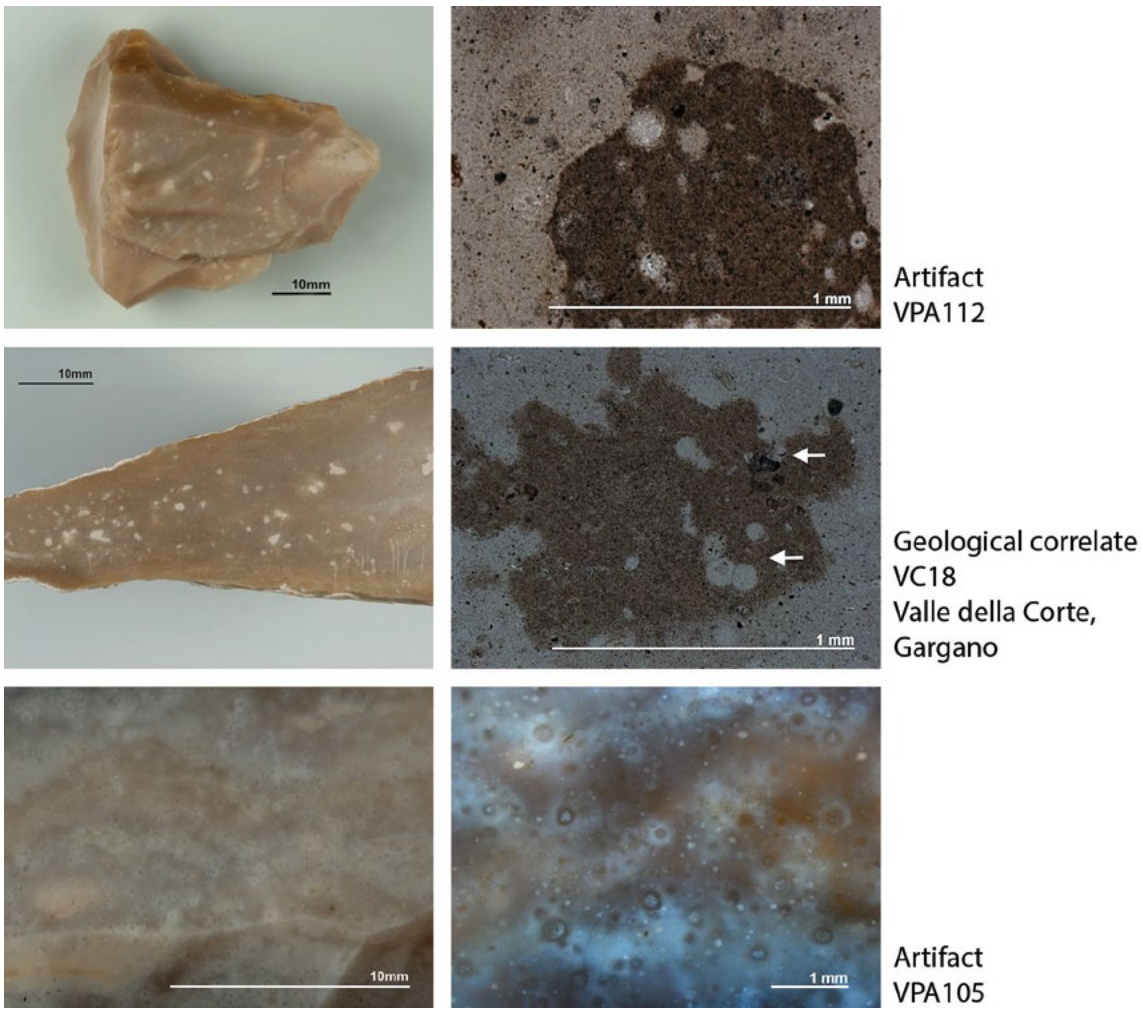


Figure 53. Brown Maiolica chert, top and middle rows: mt 30e, photographs (left) and microphotographs of thin sections in transmitted polarized light (right), arrows indicate planktonic foraminifers; bottom row: mt 30ep, photograph (left) and microphotograph in reflected light (right); bluish white: patina, brownish: non-patinated chert core, circular shapes: radiolarian fossils.

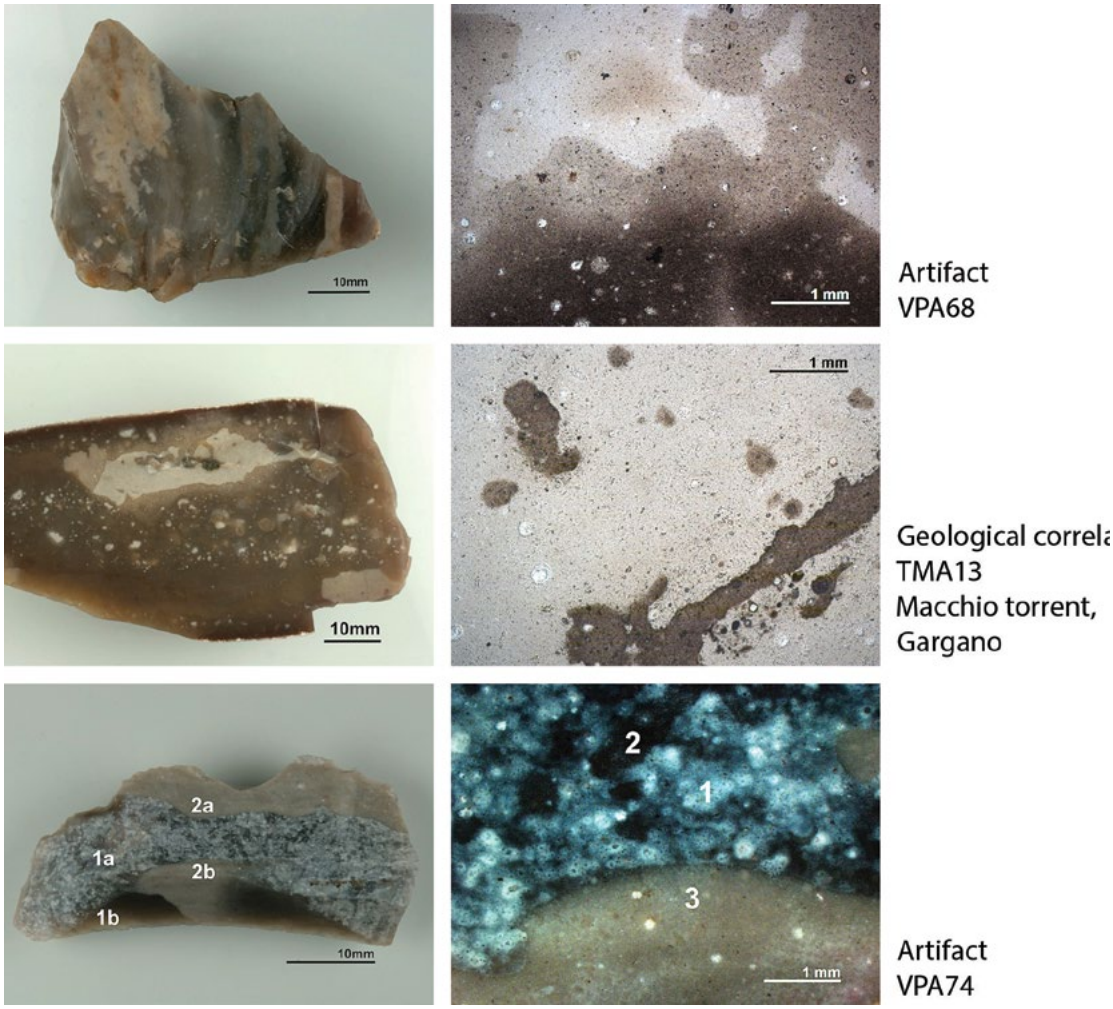
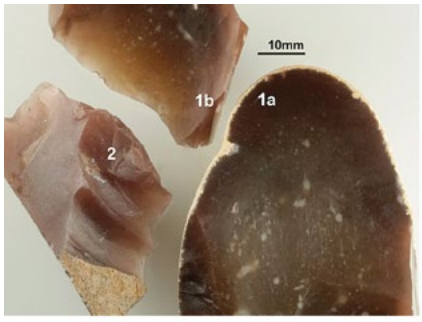


Figure 54. Brown Maiolica chert, top and middle rows: mt 30c, photographs (left) and microphotographs of thin sections in transmitted polarized light (right); bottom row: mt 30cp, photograph (left) and microphotograph of polished section in reflected light (right); left: white patina (1a) and patina removed by grinding (1b) on quartz phase, non-patinated quartz-calcite phase (2a) and ground quartz-calcite phase (2b); right: patinated (1) and non-patinated (2) quartz phase, non-patinated quartz-calcite phase (3).

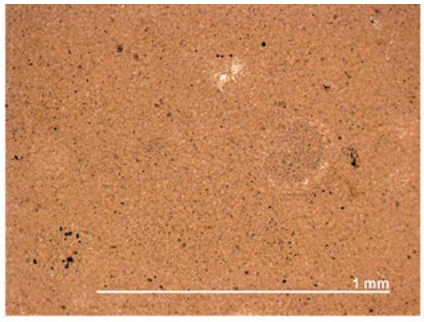
brown (5YR 6/4) cherts have a characteristic structure of opaque specks and stains. Cortex with sand grain inclusions was observed on some of the specimens. Many artifacts are heavily patinated (mt 30ep). The pale yellowish gray shade of patina is a visual effect produced by transmission of the basic yellowish brown color of chert through a thin layer of patina. Six to ten millimeter thick sections of some of the finds reveal developed patina across the entire profile. Microscopic determination: mudstone to wackestone with alternation of quartz and quartz-calcite phases. Tiny whitish specks ('ghosts' of silicified detritus) are made of aggregations that are denser than the surrounding matrix. Contains numerous fossils, mostly radiolarians, but also planktonic foraminifers (globigerinas).

mt 30c and **mt 30cp** (Figure 54) – Grayish brown cherts (5YR 2/2) with opaque grayish (5Y 8/1) specks and stains. Some of them (mp 30cp) have web-like patina with heavily patinated specks and small irregular stains (fossils and detritus), and lightly patinated matrix. In consequence, patina sometimes appears bluish and grayish. Large and opaque yellowish gray phases (5Y 8/1) of irregular, diffuse edges and free of patina, stand out clearly in the matrix. Nodular cortex on artifacts is worn smooth, sometimes exhibiting a fine cavernous structure. The artifacts from this group may be light or dark brown (for example, 5YR 5/2), translucent, and exhibit waxy gloss. The yellowish brown (5Y 8/1) stains and specks are less glossy and opaque. Microscopic determination: mudstone with alternation of quartz and quartz-calcite phases. Numerous radiolarians in cryptocrystalline matrix. By comparing the homogeneous type 30d with type 30c, which is heterogeneous and contains whitish specks and stains, we concluded that the macroscopically observable 'ghosts' are indicative of the quantity and preservation of microfossils.

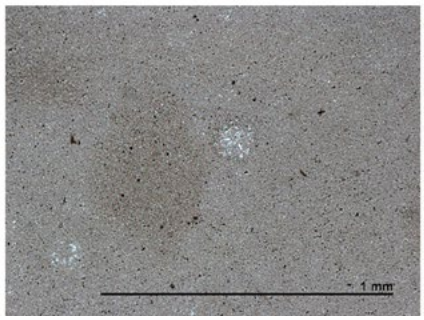


1 Geological sample MC4
1a nodule section
1b thin flake of the same nodule

2 Artifact VPA90



Artifact
VPA90



Geological correlate
MC4
Mattinata Carmine,
Gargano

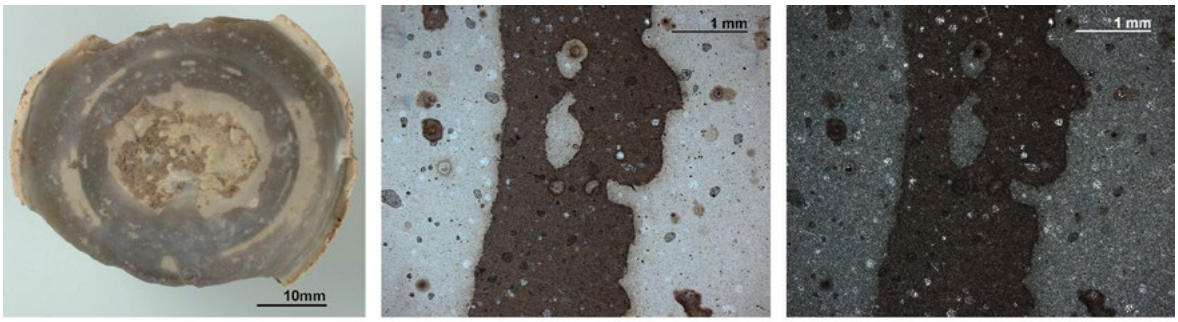
Figure 55. Brown Maiolica chert: mt 30a, photograph (left) and microphotograph of thin sections in transmitted polarized light (right).

mt 30a and **mt 30ap** (Figure 55) – Reddish brown variety of translucent chert. Radiolarians are visible in the homogenous matrix (mudstone). Type variety mt 30ap has a white patina, through which the primary reddish hue can be discerned.

mt 30h – Homogeneous and markedly translucent cherts, transparent where they are thin, with a smooth and glassy surface, prevailingly light brownish gray (5YR 6/1). Stains and specks characteristic of Gargano cherts are rare and barely discernible. We correlated these artifacts with a comparably thin flake of a geological sample that (in contrast to the core from which it was struck) exhibited the same color and translucency. Microscopic determination: mudstone. Rare radiolarians are visible only in polarized light, which is typical for homogenous and transparent cherts.

We recognized two variants of gray Maiolica cherts (Table 8):

mt 32b – Cherts of this group are homogeneous, light gray (N7, N8) and opaque. Rare irregular stains and circles are almost of the same color as the matrix, and are barely observable. This type differs from most other material types by its lack of translucency. Microscopic determination: mudstone. Fossils of radiolarians (some of them partially calcified) are numerous, but badly preserved in the matrix with fine alternation of calcite and quartz.



Artifact VPA70

Geological correlate
TR8
Romandato torrent,
Gargano

Figure 56. Gray Maiolica chert: mt 32a, photographs (left) and microphotographs of thin sections in transmitted polarized light (middle) and cross-polarized light (right).

mt 32a (Figure 56) – This group is defined by the following secondary characteristics: zonal nodule structure, cortex worn to subcortex or to core of the nodule, cavernous structure of cortex and subcortex, hollows in core part of the nodule, and lithoclasts. These traits are not specific for Gargano cherts only (we noted them in southern Albanian cherts), but in combination with other characteristics they support a western Adriatic origin. Like material type 32b, these cherts are opaque and light colored (from N7 to N4). Light gray specks and stains stand out clearly against the darker core matrix. Microscopic determination: mudstone to wackestone. Quartz-calcite concentric zones with prevailing calcite are visible in quartzite matrix. Radiolarians are equally common in both phases, while spicules of sponges are rare.

We recognized four varieties of black Maiolica cherts (Table 8):

mt 31a – This small group consists of artifacts made of black (N1) homogeneous and opaque cherts with a waxy gloss and a whitish, chalky cortex. Microscopic determination: mudstone. They have the same texture as the gray and the brown cherts, consisting of radiolarians and rare spicules of sponges in a cryptocrystalline matrix with alternating quartz and quartz-calcite phases.

mt 31c (Figure 57) – These cherts resemble type 31 by color, but they also include some dark gray finds (N2, N3). They are semitranslucent or translucent, waxy or glassy, with opaque gray stains and specks. In thin spots, their black or dark gray color acquires a brownish shade (5YR 2/1). Microscopic determination: mudstone to wackestone. Radiolarians are much better preserved in dark gray and black parts than in homogenous and translucent light gray parts.

mt 31dp – Two finds with detritic structure that is visible only under loupe differ from the basic characteristics of material type 31 and match the geological correlate.

mt 31p – Some of the finds of this group have a white patina through which chert color and structure are well visible. Other characteristics match the group mt 31.

2.1.3.1.3.2 Maiolica conglomerate cherts

mt 33ap (Figure 58) – This small group of artifacts (tables 7 and 8) contains brownish gray (5YR 4/1) translucent cherts with a conglomerate-breccia-like structure. The white patina highlights the conglomeratic structure. Microscopic determination: wackestone to packestone. Radiolarians are visible in matrix and in incorporated quartz sand grains, small pebbles and angular fragments. Secondary calcite accretions are visible only near the edges of artifacts.

2.1.3.1.3.3 Scaglia red cherts

mt 35a and **mt 35ap** (Figure 59) – Opaque cherts from this equally small group (tables 7 and 8) have been described as red, while actually being reddish brown (10R 5/4, 10R 4/6); a few are covered by a very thin white patina (mt 35ap). The illustrated archaeological

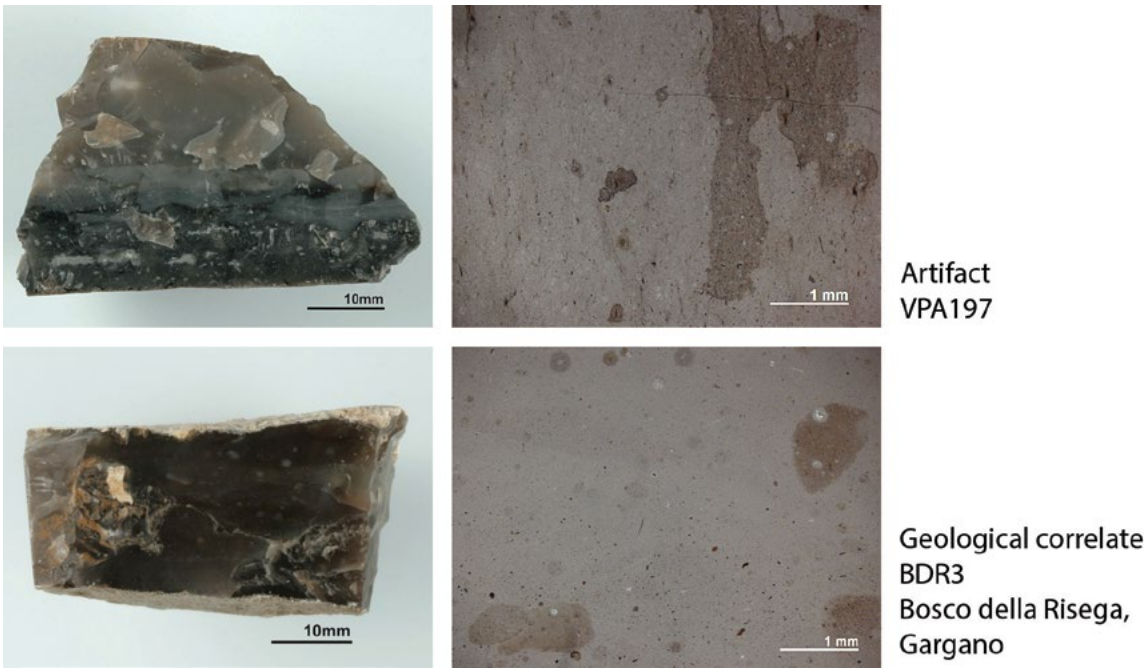


Figure 57. Black Maiolica chert: mt 31c, photographs (left) and microphotographs of thin sections in transmitted polarized light (right).

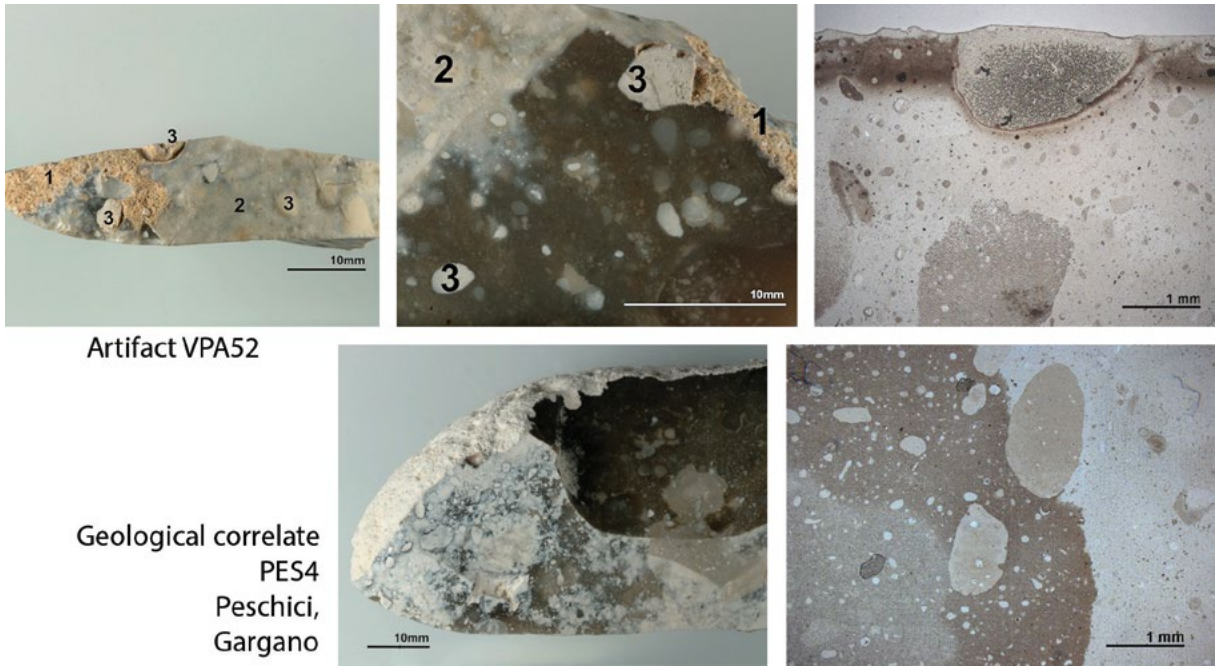


Figure 58. Maiolica conglomerate chert: mt 33ap, photographs (left and middle) and microphotographs of thin sections in transmitted polarized light (right); a flake with nodular cortex (1), patinated nodule core (2) and lithoclasts incorporated in cortex and core (3).

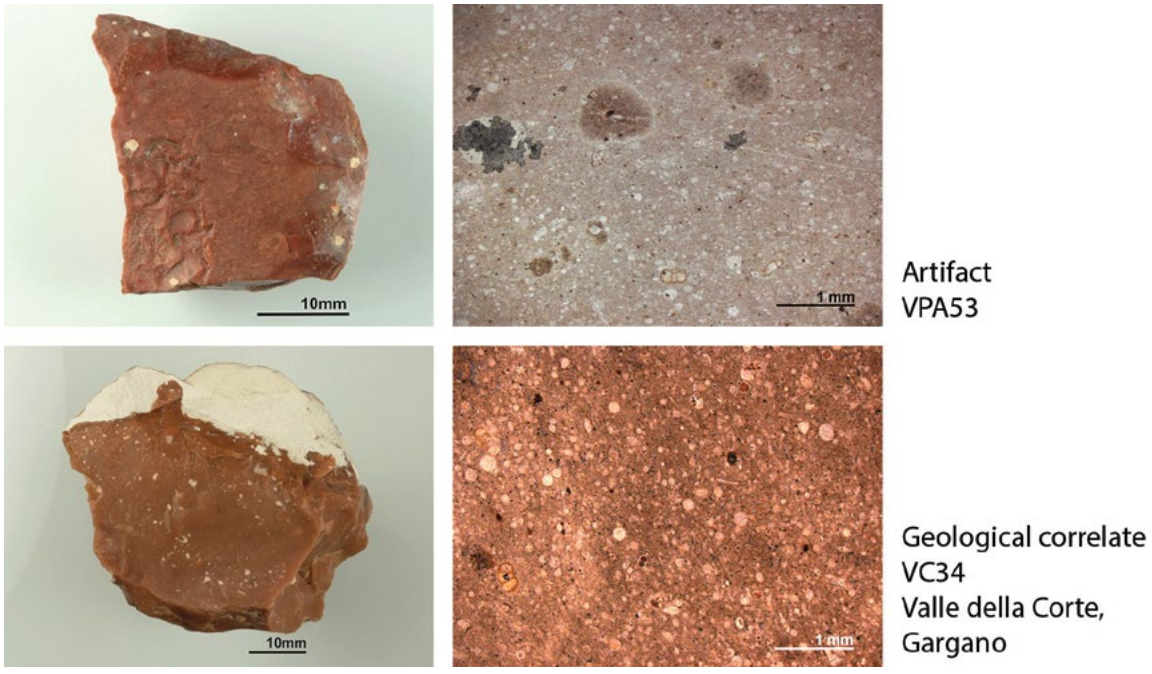


Figure 59. Scaglia red chert: mt 35a, photographs (left) and microphotographs of thin sections in transmitted polarized light (right).

sample is thermally altered, which is why its hue differs from its geological correlate. We recorded a very small outcrop of this chert in Gargano, in the area of Valle della Corte: an autochthonous outcrop in the cut of a field track, and allochthonous appearance in the soil of the surrounding olive groves (cf. Tarantini and Galiberti 2011: Figures 3 and 6). Microscopic determination: numerous well preserved planktonic foraminifers, radiolarians, and tiny lithoclasts. In some places, matrix and inclusions are calcitic.

2.1.3.1.3.4 Silicified calcarenites

mt 39dp (Figure 60) – Artifacts of this equally small group (tables 7 and 8) were made of grainy cherts with a coarse and porous surface and a weak porcelain gloss.

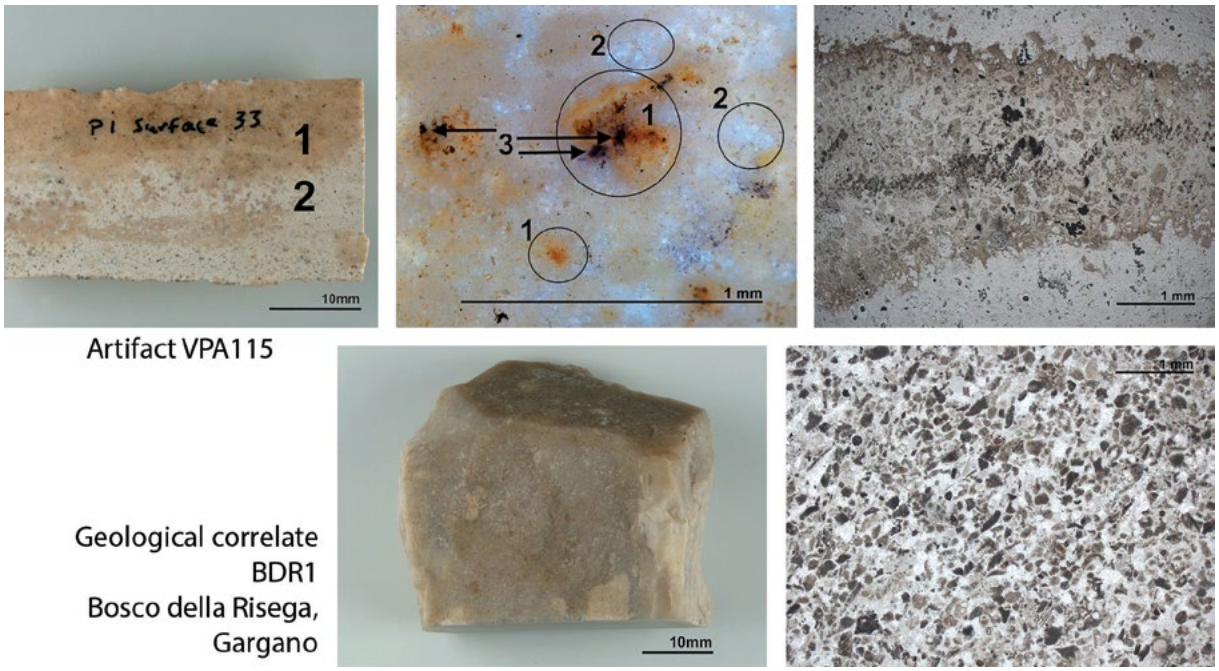


Figure 60. Silicified detritic calcarenite, top row: mt 39dp, photograph (left), microphotograph of polished section in reflected light (middle), and microphotograph of thin section in polarized light (right); left: ferrous patina and soil particles in hollows of the dehydrated surface of the chert (1), ferric patina layer removed by grinding (2); middle: ferrous patina (1), non-patinated phases (2), soil inclusions in hollows (3); bottom row: mt 39d, photograph (left) and microphotograph of thin section in transmitted polarized light (right).

They stand apart from all other chert types by their structure and texture. They are light gray colored, but appear dirty even after extensive washing due to the inclusions in porous rock surface. Tiny hollows, which become visible under loupe, are less reflective than the surrounding surface. Almost invariably, they are filled with tiny soil particles, and stained by oxidized iron that gives them a pale yellowish color (5Y 8/1). Microscopic determination: tiny angular and subangular lithoclasts, rare planktonic foraminifers, radiolarians, and various bioclasts. Lithoclasts have a grain-support (packestone). Matrix is porous, while grains are well silicified to fully silicified and fused with the matrix.

None of the artifacts had cortex, which makes the attribution of these atypical cherts *sensu lato* more difficult; they may belong either to nodular or layered detritic cherts, or to silicified calcarenites (Tišljar 2001: 249). While similar cherts are common in many torrent deposits of Gargano, in parent rock we observed them only as components of coarse breccia in a cut made by Romandato torrent. They probably originated from deposits of detritic limestones of calcarenite and calcirudite type in northeastern Gargano area. Silicified calcarenites appear in several formations, in Paleogene (Eocene) limestones with nummulites from Peschici to Vieste and at Monte S. Angelo, in Lower Cretaceous bioclastic limestones at Mattinata, in Upper Jurassic-Lower Cretaceous limestones at Monte Iacotenente, and in Upper Jurassic-Lower Cretaceous limestones of 'Rodi-Garganico Formation' (Martinis 1965; Martinis and Pavan 1967: 17, 20, 24; Selli 1970; Cremonini *et al.* 1971: 18; Di Lernia *et al.* 1995: 414).

2.1.3.1.4 Artifacts made of raw material from Palagruža

mt 17b and mt 17c (Figure 61) – Rare artifacts made of Palagruža cherts (tables 7 and 8) are gray, with a pale brownish tinge (N7, 5YR 6/1), totally opaque, and exhibit a weak porcelain gloss. Two varieties may be recognized based on structure: a homogenous one, and another that is stained, speckled, grainy, and possibly stromatolitic. We did not separate these varieties in our classification, however, since the geological samples collected at Palagruža contained both phases (homogeneous and heterogeneous) in a single piece of nodule or lens fragment. Microphotographs indicate that the artifacts were made of chert from a detritic rock. Tiny angular and subangular lithoclast grains, which are visible in the matrix, make these Triassic cherts similar to detritic Jurassic-Cretaceous types from Gargano, but their macroscopic characteristics are different. It is hard to say whether these inclusions have a grain-support (packestone) or mud-support (wackestone); when viewed under large magnification, it seems that the grains are somewhat spaced and have diffuse contours that exhibit some sort of optical continuity with the cryptocrystalline quartz matrix. Probably, this is a common consequence of the loss of

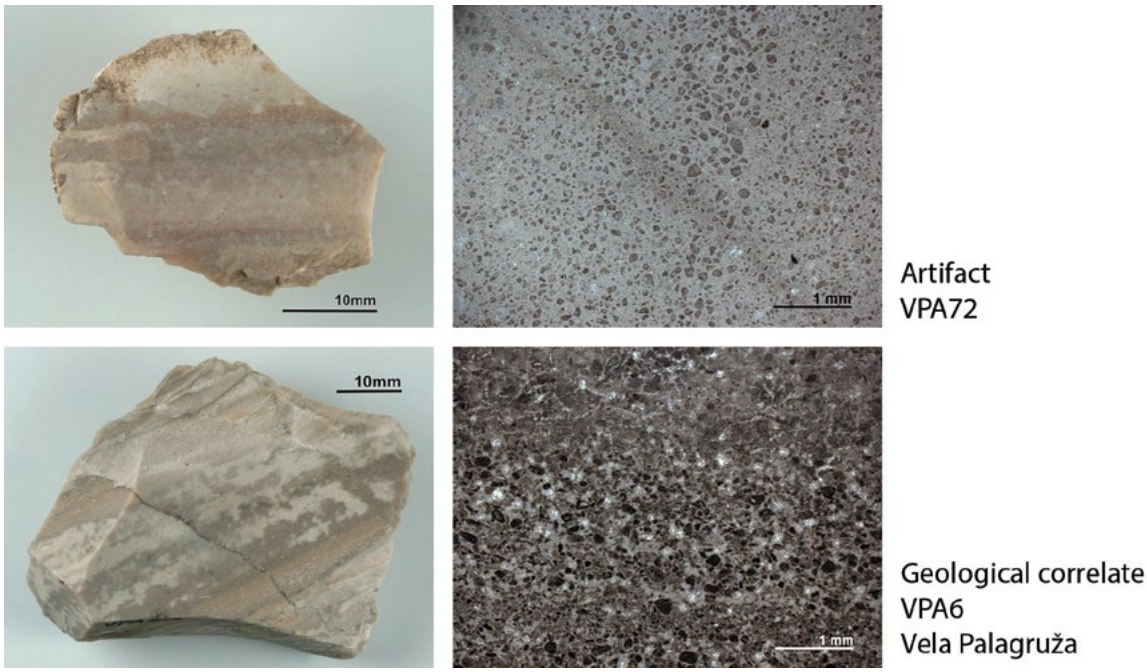


Figure 61. Palagruža chert: mt 17b, photographs (left) and microphotographs of thin sections in transmitted polarized light (right).

primary rock shapes during dolomitization, followed by rock silicification (Korbar *et al.* 2009). Rare spherulite chalcedony bird's nests averaging 0,2 mm in diameter (probably, recrystallized radiolarian fossils) and rare accretions of carbonate and hematite grains (<0,1 mm) are visible in thin section. According to that, the host rock in which these cherts developed probably had an arenite structure.

Beginning in year 2006, we surveyed Palagruža on several occasions with the aim of investigating its cherts. We documented autochthonous and parautochthonous outcrops on both Vela Palagruža and Mala Palagruža. According to our observations, Mala Palagruža is built mostly of layered dolomites with cherts, just like Lanterna A unit of Vela Palagruža (Korbar *et al.* 2009). Macroscopic and microfacial characteristics of cherts from Vela and Mala Palagruža are identical.

Having observed cherts in the rocks and beaches of Vela and Mala Palagruža, the first investigators of Palagruža lithics presumed that this raw material was used in situ (Forenbaher *et al.* 1993; Forenbaher and Kaiser 1997; 2011; Kaiser and Forenbaher 1999). Our recent research has shown, however, that the greatest majority of Palagruža lithics were not made of Palagruža chert. Since neither blades nor tools made of this material type have been recovered, but only flakes and debris, one may conclude that these represent evidence of testing of the local raw material, and nothing more than that. Artifacts attributable to an early phase of raw material preparation are absent from Mala Palagruža. The present debris was produced by tectonic disintegration and weathering of Palagruža rocks redeposited in loosely bound breccias, scree slopes and beaches (for example, the gully that descends into Medvidina cove, or the southern slope of Bardo ol Mondefusta, stratigraphic unit Laterna B) (Šplajt 2011). Dense series of chert lenses that almost constitute layers are more common and typical at Palagruža than spherical nodules, but those elongated and rigid bodies of chert are more liable to fracture than nodules, and do not represent an adequate raw material for blade production.

Hollow spaces aligned with chert lenses and nodules between the layers of Mala Palagruža dolomites were created by erosion of nodules from those rocks. Cherts are much more resistant to chemical and physical weathering than the carbonate rocks in which they form. Tectonic activity and corrosion of Palagruža dolomites weakened the bond between nodules and the bedrock, led to dissolution and leaching of interlayers and, finally, caused the chert to drop out of its socket. Loose nodule and lens fragments are exposed to further weathering, primarily to abrasion by waves, which attain high energy at Palagruža (Smirčić and Leder 1996; Korbar *et al.* 2009). Due to their hardness, angular fragments of chert are much less rounded than dolomite fragments. Proportion of chert in the beach of Mala Palagruža's Medvidina cove (up to 10%) is greater than at Vela Palagruža's Zolo, while in Stora vloka cove we noted only a few chert pebbles, which corresponds to the proportion of chert in the mass of the surrounding rocks.

2.1.3.1.5 Artifacts made of radiolarite

mt 04b, mt 04c and **mt 04f** – Only five artifacts, five well-preserved arrow points, were made of radiolarite (Figure 66: 2, 47, 50, 52, 53). Judging by its splintering fracture and porcelain gloss, one of the two reddish brown points is made of heavily weathered radiolarite or silicified claystone. Three other points are made of greenish and greenish gray radiolarite with reddish stains. The closest eastern Adriatic sources of radiolarite are gravel deposits of Neretva River (Perhoč and Altherr 2011). Many other autochthonous and allochthonous sources of green, gray, black, and reddish brown radiolarites are located in ophiolite zones of Banija, Bosnia-Herzegovina, Albania and Montenegro (Goričan 1994; Meço and Aliaj 2000; Pamić 2000: 70; Hrvatović 2006: 76; Perhoč and Altherr 2011).

2.1.3.1.6 Discussion and conclusion

Of the 4284 lithic artifacts from Palagruža, weighing in total 10475 grams, that were made of cherts *sensu lato,* 1279 artifacts weighing 2371 gram (29,9% by count, or 22,6% by weight) were excluded from material analysis (Table 7). Cherts of western Adriatic, Gargano origin were used for 2988 artifacts weighing 7941 gram, which is 99,4% by count or 98% by weight of all materially determined finds (Table 9).

Palagruža cherts were not among the reasons for landing and spending time on Palagruža. The island's isolation, dangers of Adriatic navigation, and the need for cherts in everyday activities may suggest that the people who spent some time on the island were forced to use local chert regardless of its quality. Even the author of this text did not resist the fascination of Palagruža cherts, as testified by his prejudiced emphasis of their quality (Perhoč 2009). Palagruža lithics, however, contain only a few pieces of debitage and debris made of the local raw material, a total of 12 finds weighing 157 grams. Average weight of those finds is five times greater than the average weight of artifacts made of Gargano chert (Table 9), which agrees with the expectations for finds made of a local raw material. Cherts are not ubiquitous on Palagruža, they are not universally present in rocks or easily accessible. Flint deposits in inaccessible cliffs, and chert fragments in dangerously steep slopes of loosely lithified breccias and screes, do not represent an archaeologically relevant source of raw material, since Palagruža chert is not suitable for flintknapping. Nodules, lenses, and layers of chert are tectonically fractured and weathered, grainy, uncommonly hard and difficult to break. Gargano cherts are incomparably better suited for production of long prismatic blades, which are well represented in Palagruža lithics.

Only five artifacts, weighing 5,5 grams in total, are made of an eastern Adriatic raw material (Table 9). Those radiolarite arrow points have not been made on the island, since not a single piece has been recovered of radiolarite debitage (a raw material most likely originating from Bosnia-Herzegovina). The average weight of those finds is two and a half times lower than the average weight of artifacts made of Gargano chert, which agrees with expectations for finds that had to be transported across large distances.

While we have recorded many lithic artifacts made of eastern Adriatic raw material in Paleolithic and Mesolithic levels of Dalmatian sites (Karavanić *et al.* 2008; Vukosavljević *et al.* 2011; Vukosavljević *et al.* 2014; Vukosavljević and Perhoč 2017; Vujević *et al.* 2017), such artifacts are rare on Neolithic sites that are relatively close to outcrops of Dalmatian cherts. A substantial part of the lithic finds from Sušac are made of Gargano cherts (Della Casa and Bass 2001), a smaller part is form a local chert from Sušac, but none are made of Dalmatian cherts (Perhoč and Altherr 2011). In Palagruža lithics, we did not record a single artifact made of cherts from Dalmatian islands, coast, or hinterland, despite the fact that Palagruža is better connected to the eastern Adriatic coast by a chain of islands, than to the western Adriatic coast. In Dalmatia and its hinterland, cherts have developed in carbonate rocks of Cretaceous and Eocene age. Good to high-quality Upper Cretaceous cherts that appear in small outcrops near Vela Luka on the island of Korčula, and on Vilaja mountain in the hinterland of Trogir, as well as the lower quality cherts from Dol on the island of Brač, differ macroscopically and microfacially from all cherts that are present in Palagruža artifacts (Perhoč 2009; Vukosavljević and Perhoč 2017). In the coastal Eocene belt of Dalmatia there are many outcrops of cherts with benthic foraminifers; we recorded the presence of these

	NUMBER		WEIGHT		AVERAGE WEIGHT
	n	%	grams	%	grams
Western Adriatic origin	2988	99,4	7941,0	98,0	2,7
Eastern Adriatic origin	5	0,2	5,5	0,1	1,1
Palagruža	12	0,4	157,0	1,9	13,1
TOTAL (determined material types)	3005	100,0	8103,5	100,0	2,7

Table 9. Assemblage break-down by raw material origin

cherts in lithic assemblages of several prehistoric sites in the region. Macroscopically and microfacially, these Dalmatian lower and upper Eocene cherts are easily distinguishable from Gargano Eocene cherts from nummulitic limestones (Vukosavljević *et al.* 2014; Šošić Klindžić *et al.* 2016). These types of Dalmatian cherts are not represented in Palagruža lithics.

The absence of artifacts made of eastern Adriatic raw materials (those of Croatian, Bosnian-Herzegovinian, Montenegrin and Albanian origin) indirectly supports the proposed western Adriatic origin of Palagruža artifacts' lithic raw material. According to our ongoing investigations, lithic artifacts from many Dalmatian Neolithic sites (Sušac, Grapčeva Cave, Markova Cave, Maslenica near Vrboska, Spila at Nakovana, Gudnja, Vilina Cave, Vela Cave on Korčula, Lokvice, Žukovica, Crno vrilo, Smilčić, Tinj-Podlivade, Pokrovnik, Vrbica, Ždrapanj-Rašinovac, Konjevrate, Bribir-Krivače, Čista Mala-Veliš tak, Danilo-Bitinj, Podgrađe-Solioce) are made of Gargano cherts. In all those sites, western Adriatic raw material is dominant. While the detailed information will be presented elsewhere, we can already claim with certainty that, for example, over 90% of lithic finds from Crno vrilo are made of Gargano cherts.

Gargano Peninsula is built of sedimentary rocks of the Apulian carbonate platform margin, which formed in the western part of Tethys from the Upper Jurassic until the Eocene Epoch. Rock formations of the platform interior were formed in a shallow sea and lagoonal environment. From Laguna Varano to Mattinata, they border on an organogenic ridge of sand and rocks of limestone-dolomite formations (Morsilli 2011). While comparing chert outcrops in different regions of the Adriatic basin, it is hard to avoid impression that Gargano overflows in those rocks. While that is not true for the entire peninsula, a wide band stretching across its northern and northeastern parts abounds in autochthonous and allochthonous chert outcrops. Rock formations with cherts were formed on the platform slope by redeposition and pelagic accumulation, and in forereef limestones in the peninsula's northeast. Cherts developed in chalky limestones of Rippe Rosse Formation (Kimmeridgian-Valangian), micritic limestones of bioclastic limestone Mattinata Formation (Vanginiano-Albino sup.), chalky limestones of Monte degli Angeli Formation (Albian sup.-Turonian inf.), micritic limestones of Peschici Formation (Lutetian-Bartonian), micritic limestones of Maiolica Formation (Tithonian-Aptian inf.), clayey limestones and marls of Marne a Fucoidi Formation (Aptian inf.-Albian sup.), and micritic limestones of Scaglia Formation (Cenomanian-Paleocene) (Bosellini *et al.* 1999; Morsilli 2011). Geological literature mentions a few other formations with cherts (Martinis 1965; Martinis and Pavan 1967; Selli 1970; Cremonini *et al.* 1971; Bosellini *et al.* 1999; Cita *et al.* 2005). Unsurprisingly, the greatest majority of Palagruža lithics were made of cherts from the largest one, the Maiolica Formation. It stretches from the line that connects Lago di Varano with Mattinata towards the northern and northeastern coasts of the peninsula, where it borders on the smaller zones of Marne a Fucoidi Formation, and on Peschici Formation zones around Vieste and Peschici at the very coast (Morsilli 2011: Figure 1).

While it would not be implausible to link the Palagruža lithics to the cherts procured from mines, the finds from Palagruža do not provide any support for that hypothesis. The earliest incidental information about the mines dates from 1930s and is related to the explorations of the 'Campignano phenomenon'. Since the systematic exploration of the mines began in year 1986, about twenty mines have been discovered in Maiolica, Scaglia and Peschici formations, but none in the Marne a Fucoidi Formation. Most of the mines are located to the north of the Varano – Mattinata line, around Vieste in Peschici Formation, and around Peschici in Maiolica and Scaglia formations. Several mines were recovered in the valley of Ulso torrent, while isolated mines are rare. They were in use from Early Neolithic until the Early Bronze Age (Di Lernia *et al.* 1991; 1995; Tarantini and Galiberti 2011; Tarantini *et al.* 2016).

The cortex (subcortex) of a part of Palagruža lithics exhibits signs of wear, indicating that the raw material originates from allochthonous outcrops that accompany the autochthonous ones, are easily accessible, and abound in very high quality cherts. Since the raw material for Palagruža lithics shows no signs of being excavated from outcrops *in situ,* specific material types cannot be linked directly to autochthonous chert outcrops of Gargano, or to chert mines in that region. The same is true for the finds from Spila at Nakovana (Forenbaher and Perhoč 2015). Depending on relief of the host rock and the weathering processes, we recorded parautochthonous chert deposits in the immediate vicinity of autochthonous outcrops in Gargano. Debris and clusters of complete nodules often appear at the foot of cliffs or in residues of dissolved and washed-out carbonate rocks in bare karst (Carmine near Mattinata), in Quaternary soils (Defensola olive groves, Foresta Umbra meadows and forests), in marine beaches with weak abrasion (Vieste) or strong abrasion that had rounded the angular debris to the shape of spherical pebbles without any trace of the primary shape of the nodule (Mattinata), and in paleoalluvium (Manfredonia and Siponto) (De Santis and Caldara 2015). Scree slopes consisting of limestone debris and abundant chert gravel are common in valleys, in the zone of Scaglia and Maiolica limestones (Martinis and Pavan 1967). Seasonal watercourse deposits abound in cherts that evidently are related to outcrops in rocks of the torrent gorges, or to the screes of the surrounding rocks. We documented all types and varieties of Gargano cherts

in the alluviums of Corretino, Chianara, Romandato and Machio torrents, which are located in the northern part of the peninsula. These short and intermittent watercourses contain a large proportion of angular or subangular fragments of chert, as well as entire nodules and lenses, from small shatter to block-size, intermixed with weakly rounded limestone debris. They represent an easily accessible and abundant source of cherts for prehistoric lithic production, their technical quality intact despite the long exposure to weathering.

Acknowledgements

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2.1.3.2 Major technological categories of artifacts

Preliminary classification proceeded by attributing each flaked stone artifact to one of the three general categories. Retouched pieces, regardless of their blank type, were classified as tools. Pieces of debitage that are at least twice as long as they are wide, as well as all recognizable prismatic blade segments (regardless of their length), were classified as blades. Flakes and flake fragments of all sizes, cores and core fragments, as well as chunks, were classified as waste (Table 10). More than two thirds of the assemblage is waste, but it should be noted that this category consists almost exclusively of flakes and debris, while cores are exceptionally rare. Blades constitute more than a quarter of the assemblage, while tools constitute less than 4% of the assemblage. Bifacial points dominate in the tool category. Together with microlithic crescents, they constitute 70% of all tools. Most of the remaining 30% of the tools are various kinds of retouched blades.

Detailed analysis included 1483 artifacts recovered in year 1993 from test trenches excavated across the north slope of Salamandrija, which is slightly over a third of the total assemblage.[3] Similar frequency and make-up of the three general artifact categories (Table 10) suggests that this sample is representative. Among the observable differences are somewhat more numerous tools and blades relative to waste, and a larger number of 'other tools' relative to bifacial points and crescent microliths. In both cases, different kinds of retouched blades clearly dominate the 'other tools' category. Other differences may be explained as consequences

CATEGORY	ALL FINDS		TEST EXCAVATION 1993	
Tools	169	3,9%	92	6,2%
bifacial points	72	1,7%	28	1,9%
microlithic crescents	46	0,8%	26	1,7%
other tools	51	1,2%	38	2,6%
Blades	1167	27,1%	538	36,3%
Waste (flakes, cores and debris)	2969	69,0%	853	57,5%
TOTAL	4305	100,0%	1483	100,0%

Table 10. Chert assemblage break-down (number and frequency)

of postdepositional processes. After disturbance and redeposition, many of the artifacts on the plateau were protected to some extent by relatively thick layers. As opposed to that, artifacts that were recovered in year 1993 were transported several dozen meters down the slope, where they rested near the surface in a thin layer of soil. Consequently, their edges are more damaged, and thermal alteration and patination are more common and more extensive.

Due to extensive edge damage of the entire lithic assemblage from Palagruža (and not just the sample recovered in 1993), it is sometimes difficult to differentiate between sloppy or irregular retouch and postdepositional damage. Expedient tools on flakes, which often have discontinuous or alternating retouch (or microretouch), as well as some of the 'sloppy' retouched blades, are particularly problematic. During preliminary classification, we followed conservative procedures and classified as debitage all pieces with discontinuous and alternating retouch, pieces with irregular marginal retouch, as well as single-blow notches. As a consequence, it is possible that the 'other tools' category (1,2%) has been underestimated at the level of the complete assemblage. Slightly less stringent procedures were adopted during the detailed analysis of the sample from 1993, which means that some of the pieces of debitage with damaged edges may have been classified as 'other tools' (2,5%), slightly inflating that category. The most likely frequency of 'other tools' is somewhere between those two values.

2.1.3.3 Cores and evidence of on-site core reduction

Salamandrija yielded only a few cores. The sample from year 1993 contained only four artifacts of this category (less than 0,3%): a couple of exhausted flake cores, the larger one weighing just under 90 grams (Figure 62: 1), and two amorphous core fragments. Cores are equally rare in the assemblage that was recovered from the plateau during its excavation. Rather conspicuous in that assemblage is a relatively small blade core preform (Figure 62: 2). It is too small for production of prismatic blades, which might explain why it was discarded.

[3] Primary data collection (determination of technological category, typological coding and measurement) was carried out by Timothy Kaiser, while data analysis was done by Stašo Forenbaher.

CATEGORY	FLAKES		BLADES		TOTAL	
Primary debitage	39	7,3%	2	0,4%	41	3,8%
Secondary debitage	124	23,2%	67	12,4%	191	17,8%
Non-cortical debitage	372	69,5%	469	87,2%	841	78,4%
TOTAL	535	100,0%	538	100,0%	1073	100,0%

Table 11. Number and frequency of primary and secondary debitage

Pieces of debitage that would clearly indicate reduction of blade cores are very rare. Among them are a few overshot blades that have removed a substantial part of the core (Figure 62: 4-6). These probably represent knapping errors, or attempts to remove hinge fracture scars and other previous errors from the core face. On their dorsal side, two examples retain large parts of the bottom end of prismatic blade cores. Such pieces of debitage did not have a practical purpose, but may be regarded as production waste. Core rejuvenation elements, such as crested blades, are even fewer. About 2% of the blades and flakes terminate in hinge fracture (Figure 62: 3), but most of these artifacts are quite serviceable for practical use and cannot be considered as waste, or as evidence of on-site lithic production.

Cortex is present on 22% of the debitage, but less than 4% is primary debitage (Table 11). In most cases, cortex covers only a small part of the dorsal surface, and is more common on flakes than on blades. Very small quantity of primary debitage, and a relatively small number of secondary pieces, indicate that the raw material was not decorticated at Salamandrija. Furthermore, with the exception of a single small specimen, core preforms of any kind (including prismatic blade cores) are absent. There are only rare indications of occasional on-site production of prismatic blades from already shaped cores. Other evidence of flintknapping is limited to numerous chips and chunks.

2.1.3.4 Blades

Almost all artifacts included in this category have subparallel edges and dorsal ridges (Figure 63). Their section is usually trapezoidal, less often triangular, or rarely polygonal. Their production requires specialized knowledge and skill, special tools and equipment, as well as fairly large chunks of high quality raw material (Crabtree 1968; Renault 2006). Amorphous chunks must be transformed by reduction into a core of a specific shape, from which regular prismatic blades can be detached. The first step can be accomplished by direct free-hand percussion, using hammers of different weight and hardness. Next, blades can be detached from the prepared core by pressure flaking, which requires application of great force with high precision. While the core is held firmly by a wooden vise, blades are detached from it with the aid of a tool resembling a pointed crutch. That implement allows the entire human body weight to be applied at a precise angle to a specific point near the edge of the core platform. In this way, an experienced flintknapper can produce many almost identical prismatic blades in a very short time. Such production would make sense economically only if it were aimed at exchange, since the prismatic blade technology requires substantial investment in the acquisition of the necessary skills and production tools (Clark 1987).

Quantitative analysis was carried out on a sample of 1483 artifacts recovered from test trenches that were excavated in the northern slope in year 1993. Blades and blade segments constituted 36,3% (n=538) of that sample, while together with tools on blades they constituted 39,4% (n=584). Blades to flakes ratio is almost exactly 1:1, but it should be noted that even the smallest debitage has been included among the flakes. Flakes that are smaller than some arbitrary cutoff value are commonly considered as production waste and classified as debris. If that criterion were applied, blades would outnumber flakes by a wide margin.

Blade size analysis was carried out on a sample of 523 blades. That sample contained all blades and blade segments of measurable width except crested blades, overshot blades, extremely irregular blades, and blade-like core rejuvenation elements (a total of 14 artifacts). Blade tools also were excluded in order to avoid the bias caused by the reduction of width due to retouch.

Great variability in blade width is evident (Figure 64). Most of the specimens are between 10 and 20 mm wide, median width is 14 mm, average width is 14,5 mm with a standard deviation of 4,95 mm, while coefficient of variation[4] is 35%. The narrowest segment is only 6 mm wide, blades wider than 25 mm are very rare, while the widest measured segment is 37 mm wide. Blade width has a continuous unimodal distribution, which indicates that there are no clearly delimited categories of wider (larger) blades and narrower (smaller) bladelets.

Blade length was directly measurable on only ten completely preserved specimens (less than 2%). Most of these were bladelets, shorter that 50 mm (Tixier 1963). This handful of complete blades definitely cannot be considered as a representative sample, since short blades will have a better chance to survive complete,

[4] As opposed to standard deviation, coefficient of variation is a relative measure of dispersion that monitors variability independently of the average value. It is suitable for comparison between populations whose relative homogeneity has to be assessed regardless of the absolute value of their respective means. It is calculated by dividing the standard deviation by the average value and multiplying the result by 100, and is expressed as percentage (Shennan 1988: 43-44).

Figure 62. Salamandrija, 1-2 cores, 3 blade segment terminating in hinge fracture, 4-6 overshot blades.

while long blades almost always will be fragmented. Therefore, we estimated the average blade length based on the number and length of the recovered proximal, distal, and medial segments; we have described this procedure elsewhere (Forenbaher and Perhoč 2015: 25-28). Aside from the ten complete blades, our sample contained 86 proximal, 64 distal, and 363 medial blade segments, with a total length of 10649 mm. An average blade length of 125 mm may be calculated from the above data. Relatively large discrepancy between the number of proximal and distal segments cautions of the possibility that some of the distal segments went unrecognized and were included among medial segments. If that were true, the proposed average blade

Figure 63. Salamandrija, 1-24 selected prismatic blades and blade segments.

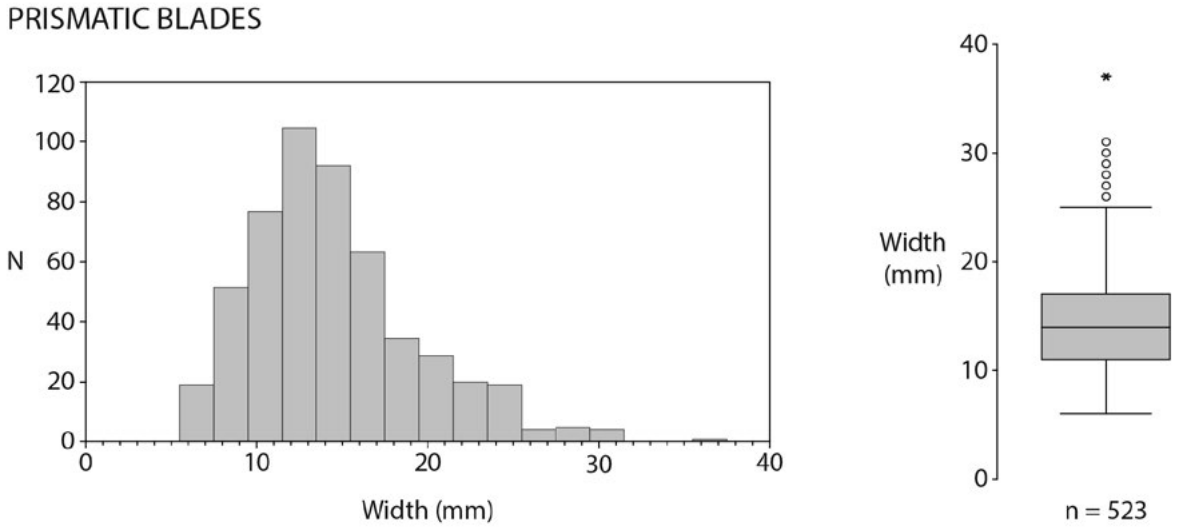

Figure 64. Prismatic blades width histogram and boxplot.

length would have been inflated by 10-15 mm. Notably, the longest complete blade[5] is 110 mm long (Figure 63: 19), which is very close to the estimated average blade length.

Prismatic blades are common at Dalmatian and other eastern Adriatic prehistoric sites dating from the period between years 6000 and 2000 BC (from Early Neolithic until the Early Bronze Age). According to the preliminary results of raw material analyses, most of them were made of Gargano cherts (Perhoč, pers. comm. 2016). Their general characteristics and specific formal details suggest that their production technology was very similar across the entire region. In rare cases where quantitative data are available, their dimensions also are similar (Forenbaher 2006a: 91-92; Forenbaher and Perhoč 2015: 24-28). Production of such prismatic blades has been extensively documented in Neolithic sites of the Tavoliere in southern Italy, in immediate neighborhood of the rich sources of high quality cherts in Gargano Peninsula (Guilbeau 2011; 2012).

2.1.3.5 Bifacial points

We collected 72 small bifacial points in the course of our explorations at Salamandrija. To those, one could probably add ten more points 'from Palagruža' without detailed provenience information, published a few years ago by Nikša Petrić (Petrić 2004: Figure 8).

Bifacial points also were made by pressure flaking, but in a much simpler way as compared to prismatic blades (Whittaker 1994; Musacchio 1995). A flake or a blade segment of appropriate size, which would have served as a blank, was thinned and shaped by retouch as needed. Thinning was accomplished by removing thin chips along all edges and both faces, until the shallow flake scars completely covered the entire surfaces. Thinning chips were removed from the hand-held preform by strongly pressing an antler tine to its edge at specific points and angles.

We recognized five types of bifacial points, defined according to the shape of their proximal part (base), which usually does not change with use (Figure 65, Table 12). As opposed to the base, distal part of the point exhibits less variability and is often modified while in use due to damage and repairs. Consequently, proximal part of the point is less appropriate for classification purposes.

TYPE	n	%
1	17	24
2	5	7
3	22	30
4	10	14
5	6	8
Indeterminate	12	17
TOTAL	72	100

Table 12. Frequency of points by type

2.1.3.5.1 TYPE 1: TANGED POINT

Almost a fourth of all recovered points belong to this type (Figure 66: 1-17). Fifteen of them were recovered from the northern slope of Salamandrija, while only two were recovered from the plateau itself. Tanged points are larger and heavier than other points. Unfortunately, weight and thickness data are available for only a part of the collected sample, for ten tanged points and nine points of all other types. Judging by the

[5] This blade was recovered during the area excavation of the plateau and was not included in the statistical analysis.

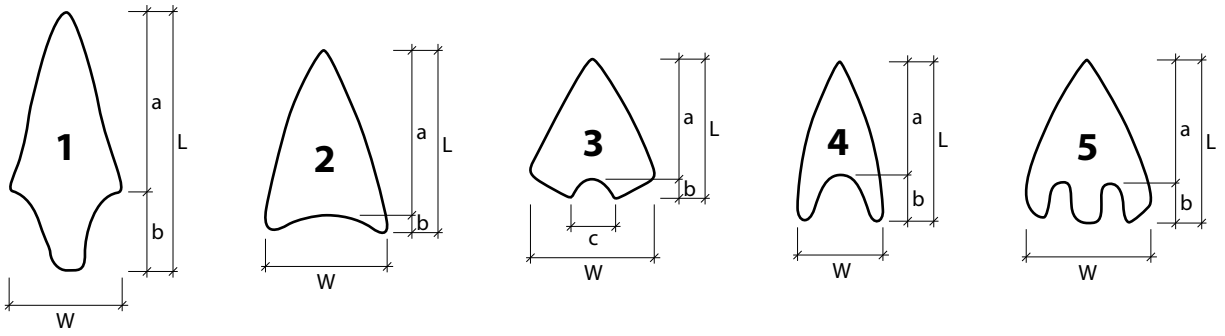

Figure 65. Point types and measurement.

measured examples, an average tanged point is almost three times as heavy as the combined average for all other types (Figure 67), it is relatively thick compared to them, and has greatest average length and width (Figure 68). It is also the most elongated, although there is great variation in length-to-width ratio (Figure 69). The most elongated examples probably were made on blades, but the diagnostic traits of their blanks were obliterated by the covering bifacial retouch.

The proximal, tang-shaped part of the point makes up between a quarter and a half of the point's total length. The length of the tang always measures less than the width of the point (Figure 70). Tang is always narrower than the shoulders (although, sometimes not much), while shoulders may be slight, prominent, or shaped as very short backward-pointing barbs. As for the distal part, half of the examples have straight lateral edges, less often those edges are convex, while in a few cases they are concave. One of the points is made of radiolarite (Figure 66: 2), a raw material that is extremely rare among flaked stone artifacts from Palagruža and probably comes from the western Balkan interior.

Bifacial points of this type are widely distributed and appear over a long period. From Neolithic to Bronze Age, they are present throughout southern Europe, from Greece (Perlès 2009: Figure 6: 1-4) and Romania (Roman 1992: Plate 77: 7) to Portugal (Forenbaher 1999: 77, Figure 29: 3). They are common in Italy, where elongated tanged points appear in Late Neolithic (Musacchio 1995: Figure 2: 1-4; Visentini 2005b: Plate 12: 15-17; Salzani 2006: Figure 1: 5, 8, 9) and Copper Age contexts (Barich 1971; Dolfini 2004; de Marinis 2014), while a shorter and wider variant is considered characteristic for the Bell Beaker period (Martini and Di Lernia 1990; Barfield 2001: 216, Figure 3: 12-14, Figure 5: 4).

In the eastern Adriatic, tanged points appear in mid-sixth millennium BC, or in the second half of the sixth millennium BC at the latest, in association with Danilo style pottery on Dalmatian Neolithic settlement sites (Korošec 1958: 28, Plate 54: 2; Batović 1963: 98, Plate 1; Brajković *et al.* 2013: 49) and stratified cave sites (Forenbaher and Vranjican 1985: Plate 1: 6, 7). The impression based on a small number of published finds is that the earliest tanged points were usually made on blades and only marginally retouched (bifacially or just normally). Points with covering bifacial retouch appear somewhat later in Late Neolithic settlements in Dalmatia (Batović 1987: Plate 33: 1) and Herzegovina (Benac 1958: 38, Plate 4: 8-11, 13, 14) and caves of the Karst (Turk *et al.* 1993: Figure 13: 5), in Copper Age contexts in Ljubljansko barje (Velušček 2009: 75, Plate 3.18: 4) and the Karst (Turk *et al.* 1993: Figure 13: 7), as well as in burial mounds, hillforts, and caves, in more-or-less convincing associations with Ljubljana style or Cetina style pottery (Batović 1987: Plate 19: 1, Plate 50: 9; Gilli and Montagnari Kokelj 1996: Figure 35: 52-55; Milošević 1998: 194, Figure 57, Figure 322; Šošić and Karavanić 2006: 378; Bilić *et al.* 2011: Plate 2: 17; Šuta 2013b: 99-100, Figure 6). Reliable information about context is not available for many other finds from the Karst (Leben 1967: Plate 2: 13, Plate 17: 1, Plate 23: 21, 23, 24; Gilli and Montagnari Kokelj 1993: Figure 73: 728-730; Borgna and Càssola Guida 2009: Figure 7; Betic 3013: Figure 3: 4), Istria (Petrić 1978: 449, Figure 2: 2; Forenbaher 2006b: Plate 6.2: 11), islands of the Kvarner Bay (Malez 1974: Plate 6: 17), Dalmatia (Milošević 1998: 273, Figure 443) and Herzegovina (Oreč 1978: Plate 1: 11, 12, Plate 5: 6, Plate 6: 2).

2.1.4.5.2. Type 2: concave base point

Of the five points classified as Type 2 (Figure 66: 18-22), four have been recovered from the northern slope and only one from the plateau. Most of them are shorter and less elongated than the points of the previous type, but one unusually elongated example (Figure 66: 20) skews the average values considerably (Figures 68 and 69). Their proximal ends are shaped like shallow notches that extend across the full width of the base, but do not intrude more than 10% into the length of the point. Depth of the notch is always less than one fifth of the point's width (Figure 70). Straight and convex lateral edges are equally common. One of these points has a prominent, needle-like tip (Figure 66: 22).

Figure 66. Salamandrija, bifacial points, 1-17 Type 1, 18-22 Type 2, 23-44 Type 3, 45-54 Type 4, 55-60 Type 5, 61 indeterminate, 62 preform.

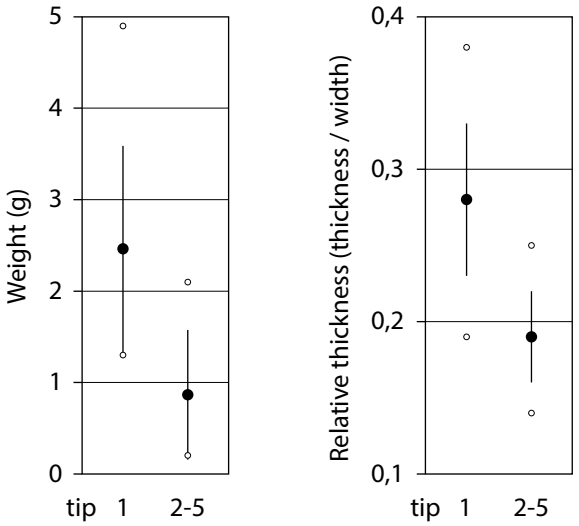

Figure 67. Weight and relative thickness of Type 1 points compared to points of all other types (average, 1SD range, minimum and maximum).

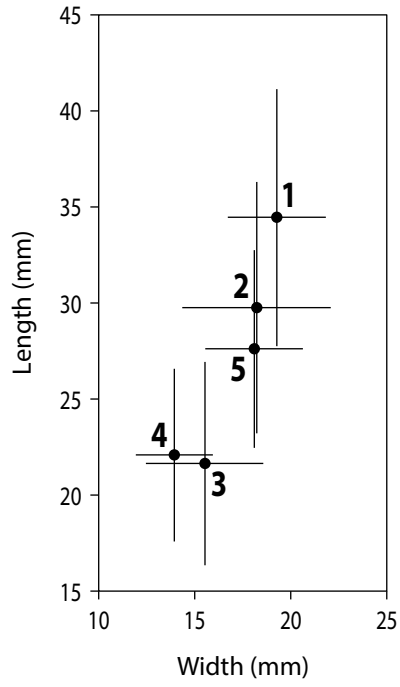

Figure 68. Point size by type (average length and width with their respective 1SD ranges).

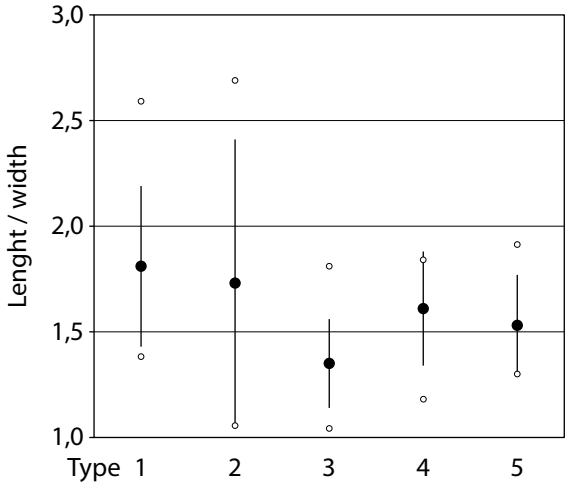

Figure 69. Point elongation by type (average, 1SD range, minimum and maximum).

Concave base points are present almost throughout Europe, from Romania (Roman 1992: Plate 77: 2-4) and Greece (Dörpfeld 1927: Attachment 70: 5) through Italy (Barich 1971: Figure 13: 2, 6, 11, 18, Figure 14: 2) to Portugal (Forenbaher 1999: 77, Figure 29: 6-9, 11) and across Central Europe to Netherlands (Harrison 1980: Figure 12, Figure 26: 9, Figure 39; Turek and Černý 2001). Most of them appear in association with Bell Beakers or Copper Age finds that immediately precede Beakers. In northern Italy, short and wide concave base points are considered to be an innovation related to the appearance of Bell Beakers (Barfield 2001: 515).

In eastern Adriatic, concave base points are present in caves of the Karst (Leben 1967: Plate 17: 4-6; Gilli and Montagnari Kokelj 1996: Figure 35: 56-58; Montagnari Kokelj and Crismani 1997: Figure 25: 4; Flego and Župančič 2012: Figure 16: 10), on Istrian hillforts (Petrić 1978: 449, Figure 2: 4), on islands of Kvarner Bay (Malez 1974: Plate 6: 18), in Dalmatia (Batović 1987: Plate 21: 10, 11, Plate 52: 8, 9; Batović and Kukoč 1988b: Plate 25: 12, Plate 43: 8; Milošević 1998: 193, 248, Figure 318, Figure 409), as well as in Ljubljansko barje (Velušček 2004: Figure 3.1.23, Figure 3.1.33: 3; Velušček 2009: 75, Plate 3.3: 8). Information about their context is often unreliable or absent. In cases where it is available, it points towards possible association with earlier Copper Age finds, as well as Ljubljana style and Cetina style pottery.

2.1.3.5.3 Type 3: notched point with wide barbs

This is the best represented type, to which 22 points (just under a third of all recovered) have been attributed (Figure 66: 23-44). More than half were recovered from the plateau, while the rest are from the northern slope of Salamandrija. Most of them are small (Figure 68), and they are the least elongated on the average, compared to other point types (Figure 69). Their proximal part is shaped as a notch that usually extends across less than a half of the width of the base (Figure 70). The notch penetrates from 10% to 30% into the length of the point, while its shape and size may vary considerably. The wide barbs tend to be angular, although sometimes their ends may be rounded (for example, Figure 60: 40, 41). Lateral edges of the distal part of the point are usually straight, and only sometimes convex.

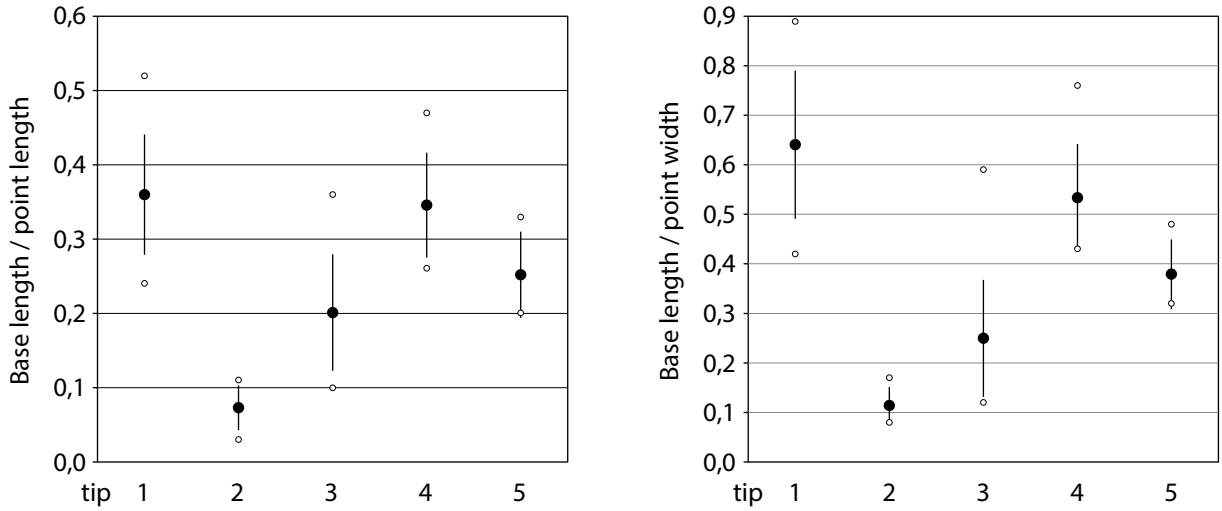

Figure 70. Base length relative to length and width of the point, by type (average, 1SD range, minimum and maximum).

Three very deeply notched examples (Figure 66: 42-44) are similar to Type 4 points, but they were classified as Type 3 due to their wide barbs. One of the points has an asymmetric proximal end with only one wide barb (Figure 66: 23) and therefore comes close to the previous Type 2. Finally, one of the points stands out by its size and elaborate shape (Figure 66: 24). It is marked by a very deep notch, wide and angular barbs that are clearly set apart from the body, and a slightly enhanced tip. One of the barbs is missing, but assuming that the point was symmetrical, its dimensions would have been 35x35 mm.

Notched points with wide barbs also are present throughout Europe, from Romania (Roman 1992: Plate 76: 4, 5, Plate 77: 5) and across Italy (Barich 1971: Figure 13: 13, 17, Figure 14: 16; Salzani 1998: Figure 2: 5, 8, 9; Ugas 1998: Figure 12: 4) to Portugal (Forenbaher 1999: 77, Figure 29: 10), and across Central Europe to Netherlands (Harrison 1980: Figure 12; Turek and Černý 2001: Figures 2 and 3). Throughout this area they tend to appear in association with Bell Beakers or their contemporary finds. In northern Italy, this type of point is also considered to be an innovation related to the appearance of Bell Beakers (Barfield 2001: 511, 515, Figure 3: 20, Figure 5: 2, 3).

In eastern Adriatic, all examples from known contexts were found in association with Ljubljana style, Cetina style or Early Bronze Age pottery. The sole exception would be a point that was recovered from a late Hvar context of Vela Cave (Čečuk and Radić 2005: 159-160, Figure 32), unless it is an intrusive find.

2.1.3.5.4 Type 4: notched point with long barbs

Half of the ten notched points with long barbs (Figure 66: 45-54) were recovered from the plateau, and the other half from the northern slope of Salamandrija. Like Type 3 points, most of them are rather small (Figure 68), but they are more elongated (Figure 69). Their proximal part is shaped as a deep notch, which penetrates from 25% to 50% into the length of the point and usually is deeper than half of the point's width (Figure 70). Barbs are long, narrow, and have pointed ends. Lateral edges of the distal part are almost always convex. A few examples with relatively shallow notch and somewhat wider barbs (Figure 66: 46, 47) come close to the previous Type 3 points.

Four examples (40% of all Type 4 points) are made of radiolarite (Figure 66: 47, 50, 52, 53). This is remarkable, since only one other artifact (a Type 1 point) was made of that raw material, which otherwise is absent from Palagruža. Since the closest sources of radiolarite are Neretva River gravels and the ophiolite zones of the deep eastern Adriatic hinterland, this point type might be connected to the western Balkan interior.

Notched points with long barbs are relatively rare. None have been published so far from the eastern Adriatic region. They appear in western Greece, in burials S8 and S4 of the 'family tomb S' at Skaros (Dörpfeld 1927: Supplements No. 69: 5 and 70: 5), dated around the middle of the Middle Helladic period, or the transition from the third to the second millennium BC (Souyoudzoglou-Haywood 1999: 31). Similar points are known from Iberia, where they are attributed to the Copper Age (Martín Socas *et al.* 1995: Figure 4: d; Forenbaher 1999: 79, Figure 29: 4, 5).

2.1.3.5.5 Type 5: tanged and barbed point

All of the six tanged and barbed points (Figure 66: 55-60) were collected from the plateau of Salamandrija. They are somewhat larger than points of the last two types

(Figure 68), but like them, they are relatively short and wide (Figure 69). Their proximal end is provided with a narrow tang that often has parallel lateral edges, and barbs that may be as long as the tang (or shorter), and have angular, rounded or pointed terminations. Tang and barbs usually take up about a quarter of the total length of the point (Figure 70). Lateral edges of the distal part are often convex and only rarely straight. Two of the points have prominent needle-like tips (Figure 66: 57, 58). One example with short wings and triangular tang (Figure 66: 60) is close to Type 1 (its variant with short, slightly backwards pointing barbs). Interestingly, all Type 5 points are made of very similar-looking grayish brown Gargano chert.

Points of this type are widely distributed in association with Bell Beakers, from Italy (Barich 1971: Figure 12: 4, 5, 6, 8-10, 15, Figure 13: 15, 19; Atzeni 1998b: Figure 8: 14; Barfield 2001: Figure 3: 11), France (Furestier 2014: Plate 3: 1-6) and Spain (Harrison 1977: Figure 72, Figure 74; Martín Socas *et al.* 1995: Figure 4: c) to Netherlands (Harrison 1980: Figure 12), England (Fitzpatrick 2002: Figure 3) and Scotland (Harrison 1980: Figure 93).

In eastern Adriatic, tanged and barbed points may be related to either Ljubljana or Cetina style pottery in one of the caves in the Karst (Gilli and Montagnari Kokelj 1996: Figure 35: 50, 51) and on two Dalmatian hillforts (Milošević 1998: 194, Figure 57; Šuta 2013b: 99-100, Figure 6), while on Brijuni they have been attributed rather generally to the Copper Age (Petrić 1978: 449, Figure 2: 9, 10). On the other hand, at four other sites they have been recovered from Neolithic contexts. At Pupićina peć, a Type 5 point has been recovered from Horizon H, marked by Danilo-Vlaška style pottery and dated by radiocarbon to the second half of the sixth millennium BC (Forenbaher 2006b: Plate 6.1: 10). Points from Layer 7 of Grotta dei Ciclami (Gilli and Montagnari Kokelj 1993: Figure 30: 30), from Phase 4b of Spila at Nakovana (Forenbaher and Perhoč 2015: Plate 3: 10) and from the settlement of Lisičići (Benac 1958: 38, Plate 4: 12) were recovered from Late Neolithic contexts. Information about context is missing for the other finds from the Karst (Gilli and Montagnari Kokelj 1993: Figure 73: 731-733; Gilli and Montagnari Kokelj 1994: Figure 42: 419), Istria (Petrić 1978: 449, Figure 2: 3), islands of the Kvarner Bay (Malez 1974: Plate 7: 14), Dalmatia (Batović 1987: Plate 30: 1) and Herzegovina (Oreč 1978: Plate 5: 5).

2.1.3.5.6 Indicators of point production and use

A fairly roughly retouched half product (Figure 66: 62) is a bifacial point preform of indeterminate type, discarded possibly due to unsuccessful thinning. It represents the only indication that points were made occasionally at Salamandrija.

More than half of the bifacial points have been damaged, including the eleven typologically indeterminate fragments (*e. g.,* Figure 66: 61). In most cases, barbs have been broken off, followed by broken tips, while only rarely the tang is missing. Most of this damage may be postdepositional, but four of the pieces (about 7% of all points) display an impact fracture near the tip (Figure 66: 18, 33, 52, and 60) that suggests use-related damage.

There can be little doubt that these artifacts served as arrow points (Figure 71: 1-6). Their shape, size and weight

Figure 71. Proposed reconstructions of arrows tipped by bifacial points (1-5) and composite points made of microlithic crescents (7, 8) in combination with a bifacial point (6) and a transversal point (9) (illustration: Iva Pataračec).

correspond to that function. There is an interesting dichotomy between Type 1 points and points of all other types. Type 1 points are much heavier and thicker, and somewhat larger and more elongated on the average than other points, most of which are light and thin, and sometimes having needle-like tips. These differences in shape and dimensions may point to differential use. Larger points inflict more extensive tissue damage and disable the victim by causing extensive bleeding. As opposed to that, small and thin points that penetrate deep into the tissue are particularly effective for bringing down the victim with the aid of poison.

Great majority of Type 1 points and all Type 5 points were recovered from the northern slope of Salamandrija, while points of other types were more-or-less equally common on the slope and on the plateau. Unfortunately, due to total disturbance of the prehistoric deposits, it remains unclear what these differential spatial distributions might reflect.

2.1.3.6 Transversal point

A single transversal point (Figure 71: 9, Figure 72: 46) was recovered from the north slope of Salamandrija. Its base is covered by bifacial retouch and shaped like a short and wide tang, while its sharp transversal distal edge has not been retouched.

Similar transversal points appear from the Late Neolithic (Salzani 2006: Figure 1: 6), through Copper Age (Barfield 2001: Figure 6: 5, 6), until the Bell Beaker period and the Early Bronze Age (Barich 1971: Figure 5: 10, Figure14: 7; Martini and Di Lernia 1990: Figure 9: 3, 4, 8), while their presence is limited to northern and central Italy (Barfield 2001: 514-515). According to Barfield's typochronological scheme, our example would belong to the Copper Age. Transversal points of this type remain unreported in the eastern Adriatic.

2.1.3.7 Microlithic crescents

A third of the 46 microlithic crescents collected from Salamandrija (Figure 72) were recovered from the plateau, while two thirds came from the northern slope. Judging by the removal scar patterns on their dorsal surface, at least half of them were made on blade segments. For the rest, blank type could not be determined reliably, but it is possible that all were made on blades. Some are shaped as regular circular segments, other as more or less irregular elliptical segments. The blunted, curved edge is backed (sometimes, crossed) or steeply retouched, while the opposite, sharp working edge is not retouched. Proximal and distal ends terminate in points that may be more or less acute.

Figure 72. Salamandrija, 1-45 microlithic crescents, 46 transversal point.

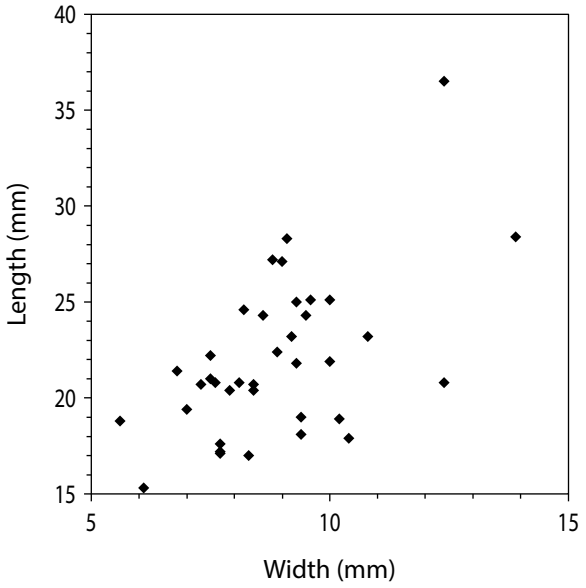

Figure 73. Size of microlithic crescents.

There is no indication that microburin technique (Tixier *et al.* 1980: 62-64) was applied for their production.

Barring a few very small and very large specimens, most of the microlithic crescents are between 17 and 28 mm long, between 7 and 11 mm wide and weigh between 0,4 and 0,9 grams (Figure 73). Their length-to-width ratio is usually around 2,5: 1, but it may vary from 1,7:1 to 3,4: 1.

In central and western Mediterranean, microlithic crescents appear in Late Upper Paleolithic and are regarded as characteristic for that period, as well as for the Early Mesolithic (Kozlowski and Kozlowski 1979; Perlès 1987; Mihailović 1999; Whallon 1999; Pluciennik 2008). After a lengthy pause, very similar tools appear again during the Copper Age. They are particularly common during the late third millennium BC, when they appear in association with Bell Beakers in southern France (Lemercier 2009: Figure 4; Sauzade 2012: Figure 6: 5-7; Furestier 2014: Plate 1: 11), southern Switzerland (Barfield 2001: 515), as well as throughout Italy (Biancofiore 1967: Figure 13: 2, Figure 14: 6, Figure 16: 1, Figure 25: 2, 13, 15, 22; Martini and Di Lernia 1990: Figure 4: 1-12; Atzeni 1998b: Figure 8: 15; Ugas 1998: Figure 7: 22-24, Figure 12: 5-7; Visentini 2006: Figure 3: 11, 12, 22, 23; Sarti 2014: Figure 10: 23-25, Figure 11: 4, 5). In the eastern Adriatic, only a few examples have been published from the islands of Kvarner Bay, Dalmatia and Herzegovina. Specimens from Nakovana (Spila Cave and Grad hillfort) were recovered from Copper Age and Early Bronze Age contexts (Forenbaher and Perhoč 2015: 38, 55, Plate 4: 8, 14, Plate 5: 15), those from the hillforts around Posušje probably also belong to those periods (Oreč 1978: Plate 6: 9, Plate 7: 4, 5), while there is no information about context of the piece from Lopar (Malez 1974: Plate 1: 1).

Microlithic crescents most likely served as transversal points and additional armatures attached along the arrow shaft (Figure 71: 6-9). One may compare them with the well-preserved and roughly contemporary arrows from Egypt, dating from the last third of the third millennium BC (Clark *et al.* 1974: 326, 334, Plates 5 and 18, Figure 9; Barfield 2001: 515, Figure 7). In Egyptian arrows, one microlithic crescent was attached transversally at the tip of the arrow, while several other were attached along the arrow shaft at an angle, with one of their pointed ends protruding backwards. They were fixed rather loosely by drops of resin, possibly with an intention to detach and remain embedded in the wound after the arrow shaft had been pulled out, which also may suggest use of poisoned arrows (Clark *et al.* 1974: 341-342).

2.1.3.8 Other tools made of chert

Over 80% of all other tools were made on blades. Dominant among them are different variants of retouched blades (Figure 74), one or both of their lateral edges retouched partially or along their entire length. Retouch is usually direct, less often inverse, alternating or bifacial. Steep and semisteep retouch is common, while scalar or denticulate retouch is rare. A few specimens with a particularly steep retouch might be classified as backed blades.

Prominent among the retouched blades are a number of tools with converging lateral edges that terminate in a robust point (Figure 75: 8, 10). Similar 'pointed blades' appear at Danilo in association with Danilo style pottery (Korošec 1958: Plates 53 and 54), at Lisičići and Grapčeva Cave in association with Hvar style pottery (Benac 1958: Plate 3: 13-15; Forenbaher 2006a: 106, Figure 11: 3, 4; Forenbaher and Kaiser 2008: 78, 80, Plate 23: 3, 4), and in Hvar and Nakovana contexts of Spila at Nakovana (Forenbaher and Perhoč 2015: 30, Plate 2: 23, Plate 3: 6, Plate 4: 7). Several oblique truncations on blades (Figure 75: 1-3) also terminate in a robust point. Two blade segments are bifacially retouched along both lateral edges and one transversal edge (Figure 75: 5, 6). Their retouch is flat or semi-steep, and covers the entire dorsal surface of one of the specimens.

End scraper on blade, transverse burin on blade, and transverse burin on retouched blade are each represented by a single specimen. The distal end of a retouched blade segment (Figure 75: 4) is shaped in a way that resembles one of the transversal point types associated with Bell Beakers in northern Italy (Barfield 2001: Figure 3: 18), except for the fact that its proximal end is not retouched.

Tools on flakes are very rare. Among them is a single end scraper on an irregularly shaped retouched flake (Figure 75: 7) and a few poorly defined expedient tools

Figure 74. Salamandrija, 1-14 retouched blades.

(retouched flakes). Aside from those, there are a few more indeterminate retouched fragments.

A carefully shaped elongated rectangular artifact of plano-convex section belongs to a category by itself (Figure 75: 9). Continuous direct flat retouch extends along all of its edges and covers much of its dorsal side. Most likely, this is a gunflint (Evans 1887; Jamnik 1993), possibly made from a recycled prehistoric artifact.

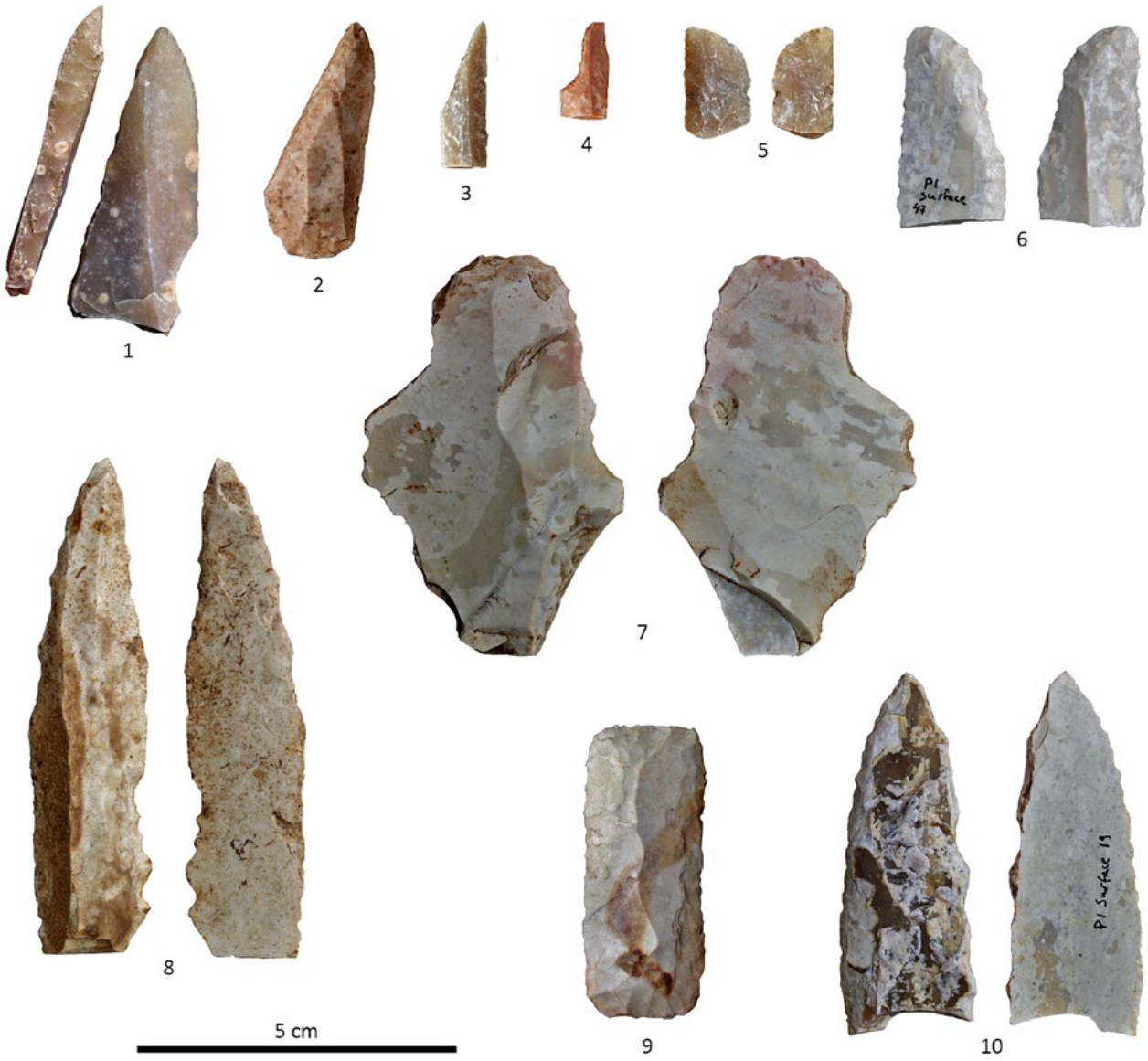

Figure 75. Salamandrija, 1-3 oblique truncations on blades, 4 retouched blade segment, 5-6 bifacially retouched blade segments, 7 end scraper on retouched flake, 8 and 10 'pointed blades', 9 gunflint.

2.1.3.9 Obsidian artifacts

2.1.3.9.1 Origin of the raw material
by Robert H. Tykot

2.1.3.9.1.1 Obsidian in Europe and the Mediterranean

Obsidian is a glassy rock that only forms under certain volcanic circumstances. The sharp, yet brittle, nature of obsidian led to its wide use in prehistoric times, while the chemical homogeneity of each source allows us to distinguish them using a variety of analytical methods. In Europe, the only geological sources that were utilized for producing stone tools are on the Italian islands of Lipari (Tykot *et al.* 2006), Palmarola (Tykot *et al.* 2005), Pantelleria (Francaviglia 1988), and Sardinia (Monte Arci) (Tykot 1997; 2002); the Greek islands of Antiparos (Carter and Contreras 2012), Giali (Carter *et al.* 2016), and Melos (Torrence 1986; Frahm *et al.* 2014; Milić 2014); and in the Carpathian Mountains of Hungary, Slovakia, and the Ukraine (Biró 2006; Rosania *et al.* 2008) (Figure 76).

Early analyses of obsidian artifacts from sites in the central Mediterranean region showed that obsidian traveled great distances from the island sources at the beginning of the Neolithic period, when the agricultural way of life involving domesticated plants and animals and the use of ceramics were spreading westward (Hallam *et al.* 1976; Williams-Thorpe *et al.* 1979; 1984). Over the past 25 years, the development of non- or minimally-destructive analytical methods have led to thousands of obsidian artifacts being tested, and statistical comparisons between sites and time periods (De Francesco *et al.* 2012; Tykot 2011; 2014; Tykot *et al.* 2013).

Figure 76. Map showing obsidian sources in Europe and the Mediterranean.

Obsidian from a number of archaeological sites along the Adriatic Sea has now been tested (Figure 77). On the central Italian side, due west from Palagruža and other Dalmatian islands, analyses by Barca *et al.* (2008) and De Francesco *et al.* (2012) have already shown the long distance that obsidian had traveled from Lipari, as well as from Palmarola. In southeastern Italy, even one example from far-away Sardinia was identified at the site of Pulo di Molfetta (Acquafredda *et al.* 2008). In between is the Gargano peninsula and the Tavoliere region of northern Apulia, a major agricultural zone, and the area closest to Palagruža. Analyses at Masseria Candelaro (Acquafredda *et al.* 1998), Passo di Corvo (Mello 1983), and many other sites in the Tavoliere (Brown and Tykot, nd) reinforce the regular presence of Lipari obsidian, while Palmarola obsidian averages about 15% and is only present at about one-third of the sites.

2.1.3.9.1.2 Analytical methods

Over 90% of all obsidian finds from Palagruža were included in the analysis. Most of the 49 obsidian artifacts were first tested in 2009, with the last 9 in 2010, using the same instrument, a Bruker III-V+ portable X-ray fluorescence spectrometer (Tykot 2016) (Figure 78). In 2015, the Bruker III-SD model was used to re-test 12 of the artifacts, to confirm the consistency in analytical results and the identification of four

Figure 77. Map showing sites near the Adriatic Sea with ten or more obsidian artifacts tested.

Figure 78. Conducting pXRF analyses on obsidian in Croatia.

'outliers'. Portable, or hand-held, XRF instruments have the same principles as regular energy-dispersive XRF spectrometers, except that the sample remains outside the instrument. The secondary X-rays produced for iron (Fe), and trace elements thorium (Th), rubidium (Rb), strontium (Sr), yttrium (Y), zirconium (Zr), and niobium (Nb) are not absorbed in the air. The analysis is entirely non-destructive, with only basic cleaning of the area to be analyzed (5x7 mm) necessary. Analyses were conducted using settings of 40 kV and 10 μA, and run for 180 seconds while using a filter of 12 mil Al, 1 mil Ti, and 6 mil Cu to enhance the precision of the results. The raw data were calibrated against a series of international standards assembled by the Missouri University Research Reactor, and are directly compared with European and Mediterranean geological obsidian samples analyzed with the same instrument.

2.1.3.9.1.3. Results

For obsidian sourcing in Europe and the Mediterranean, trace element ratios are more than sufficient for assigning artifacts to the different source groups (Figure 79), and even to the subsources for Lipari (Gabellotto, Canneto Dentro) (Figure 80), Melos (Sta Nychia, Demenegaki) (Figure 80), and in the Carpathians. Forty-five of the obsidian artifacts found on Palagruža came from Lipari-Gabellotto, and four from Melos-Sta Nychia. In addition to the few elements used in the graphs to distinguish the obsidian sources, the complete set of data is also consistent with these specific source assignments (Table 13).

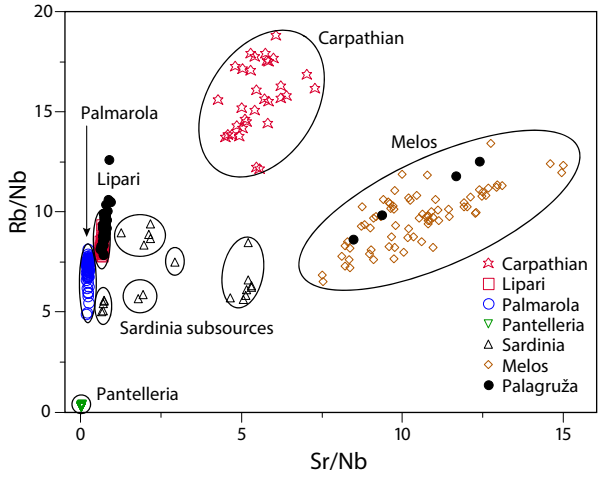

Figure 79. Graph showing the elemental groups for the different sources (Carpathian, Lipari, Palmarola, Pantelleria, Sardinia, Melos) and the Palagruža artifacts.

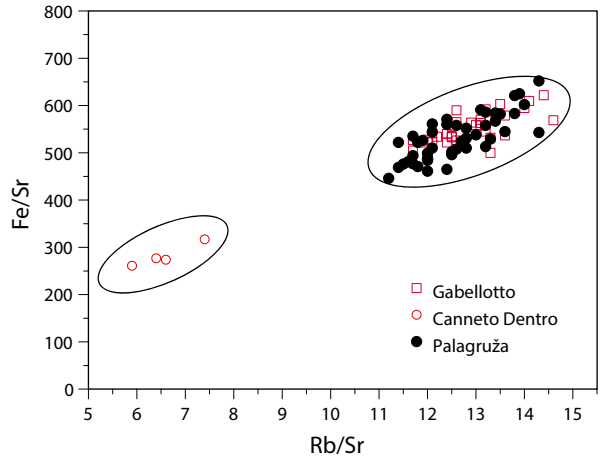

Figure 80. Graph showing the subsources for Lipari, along with 45 of the artifacts tested.

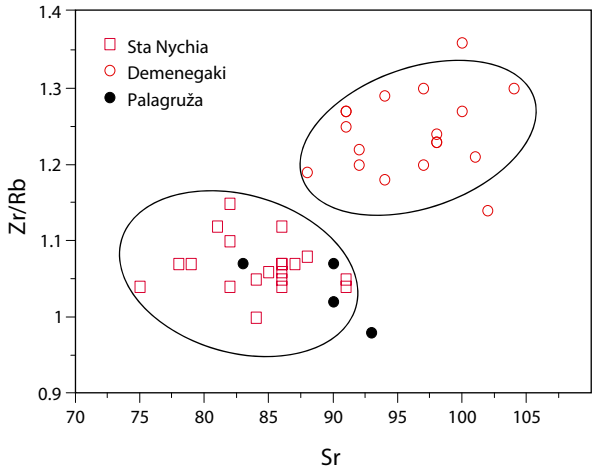

Figure 81. Graph showing the two Melos subgroups, along with four artifacts tested.

Fig. #	USF #	Source	Location	Fe	Th	Rb	Sr	Y	Zr	Nb
1	13419	Lipari	Gabellotto	9009	27	214	18	34	146	23
2	13420	Lipari	Gabellotto	9703	34	216	16	31	133	26
4	13399	Lipari	Gabellotto	10132	30	225	18	28	122	24
5	13432	Melos	Sta Nychia	6444	8	92	90	16	98	11
6	13946	Lipari	Gabellotto	9931	40	247	20	35	142	25
7	13412	Lipari	Gabellotto	9656	27	233	18	27	144	25
8	13413	Lipari	Gabellotto	9809	34	258	18	38	150	26
9	13951	Lipari	Gabellotto	10120	34	236	17	36	142	25
10	13411	Lipari	Gabellotto	10063	33	242	21	33	142	26
11	13400	Lipari	Gabellotto	10048	39	253	20	32	147	30
12	13414	Lipari	Gabellotto	9639	35	257	21	30	147	27
13	13415	Lipari	Gabellotto	9851	31	236	20	35	146	25
14	13408	Lipari	Gabellotto	10133	33	234	18	39	138	24
15	13402	Lipari	Gabellotto	10069	26	228	18	26	130	24
16	13403	Lipari	Gabellotto	10188	35	247	19	30	144	28
17	13421	Lipari	Gabellotto	11057	32	243	17	32	134	19
18	13404	Lipari	Gabellotto	10597	32	246	18	33	142	26
19	13398	Lipari	Gabellotto	10408	31	247	19	34	142	30
21	13409	Lipari	Gabellotto	10800	34	235	19	30	131	22
22	13952	Lipari	Gabellotto	10473	30	240	18	32	143	24
23	13428	Lipari	Gabellotto	9830	39	244	20	36	161	29
24	13406	Lipari	Gabellotto	10249	35	252	21	36	151	28
25	13424	Lipari	Gabellotto	9628	35	241	18	32	143	25
26	13947	Lipari	Gabellotto	11382	40	245	20	30	139	24
27	13410	Lipari	Gabellotto	9941	32	241	19	34	143	30
28	13407	Lipari	Gabellotto	11237	42	245	22	33	141	23
29	13401	Lipari	Gabellotto	10682	32	238	20	33	140	26
30	13945	Lipari	Gabellotto	10888	28	246	19	27	133	25
31	13953	Lipari	Gabellotto	10310	41	243	18	37	143	25
32	13422	Lipari	Gabellotto	10017	32	242	21	32	142	28
33	13418	Lipari	Gabellotto	9856	38	242	20	35	152	28
34	13433	Lipari	Gabellotto	10173	32	241	20	31	148	29
35	13950	Lipari	Gabellotto	10602	41	236	17	35	138	24
36	13416	Lipari	Gabellotto	9236	22	228	18	32	145	28
37	13954	Lipari	Gabellotto	9625	29	227	17	35	138	25
38	13417	Lipari	Gabellotto	10500	39	239	20	33	132	25
40	13423	Lipari	Gabellotto	9534	33	246	19	40	156	28
41	13397	Lipari	Gabellotto	9736	27	213	18	32	123	20
42	13405	Melos	Sta Nychia	6139	8	95	90	15	97	10
43	13434	Lipari	Gabellotto	9773	36	244	21	28	140	28
44	13429	Lipari	Gabellotto	9417	30	230	20	34	152	29
45	13426	Melos	Sta Nychia	6849	8	94	93	13	91	7
46	13435	Lipari	Gabellotto	9513	32	240	18	30	134	25
47	13436	Lipari	Gabellotto	9788	27	245	19	31	142	25
48	13425	Lipari	Gabellotto	11467	33	253	19	32	153	24
49	13430	Melos	Sta Nychia	6670	9	84	83	15	90	7
50	13427	Lipari	Gabellotto	9290	34	234	21	35	154	30
51	13431	Lipari	Gabellotto	10577	33	239	20	32	142	26
52	13944	Lipari	Gabellotto	9115	37	238	20	32	146	25

Table 13. Elemental data (in ppm) and source assignments for the artifacts tested

2.1.3.9.2 Technology and typology of the artifacts

The obsidian assemblage contains 53 artifacts, which weigh 25 grams in total. Most of them are tiny, their maximum length usually does not surpass 20 mm and their weight is less than 1 gram. The largest among them are lighter than 4 grams and shorter than 30 mm (Figure 82).

Bladelets and tools on bladelets together constitute more than three quarters of the assemblage, while flakes and flake tools constitute less than 20% (Table 14). In addition, only two other artifacts were recovered: a small core fragment, probably of a bladelet core (Figure 82: 52) and a small chunk weighing 2,5 grams (Figure 82: 53).

Forty of the 41 bladelets, including tools on bladelets (Figure 82: 1-41), have subparallel lateral edges and dorsal ridges. Cross section of these prismatic bladelets usually is trapezoidal, less often triangular or polygonal. Not a single complete specimen has been recovered, but only bladelet segments, the longest of them 25 mm long. If we apply the same procedure for bladelet length estimate based on the number of proximal, distal and medial segments and their total length (Forenbaher and Perhoč 2015: 25-28), the average obsidian bladelet would have been around 75 mm long.

Analysis of bladelet width was carried out on a sample of 39 measurable segments (Figure 83). Following Tixier's classic criterion, all of them fall into the bladelet category since none are wider than 12 mm (Tixier 1963). Most of them are between 5 and 10 mm wide, while their average width is 7,4 mm, with a standard deviation of 1,65 mm. Coefficient of variation is 22%, indicating greater standardization of obsidian bladelets, compared to prismatic blades made of chert (coefficient of variation 34%).

Relatively numerous tools constitute 19% of the total assemblage, but many of them are poorly defined. This is exacerbated by postdepositional edge damage, which also was the case with flaked chert artifacts. Consequently, it is sometimes hard to distinguish postdepositional damage from intentional retouch. We followed the same conservative procedures and did not regard microretouch, discontinuous and alternating retouch, irregular marginal retouch, as well as single-blow notches as intentional modifications of the blank. It should be noted that such edge damage is present on more than three quarters of all obsidian artifacts.

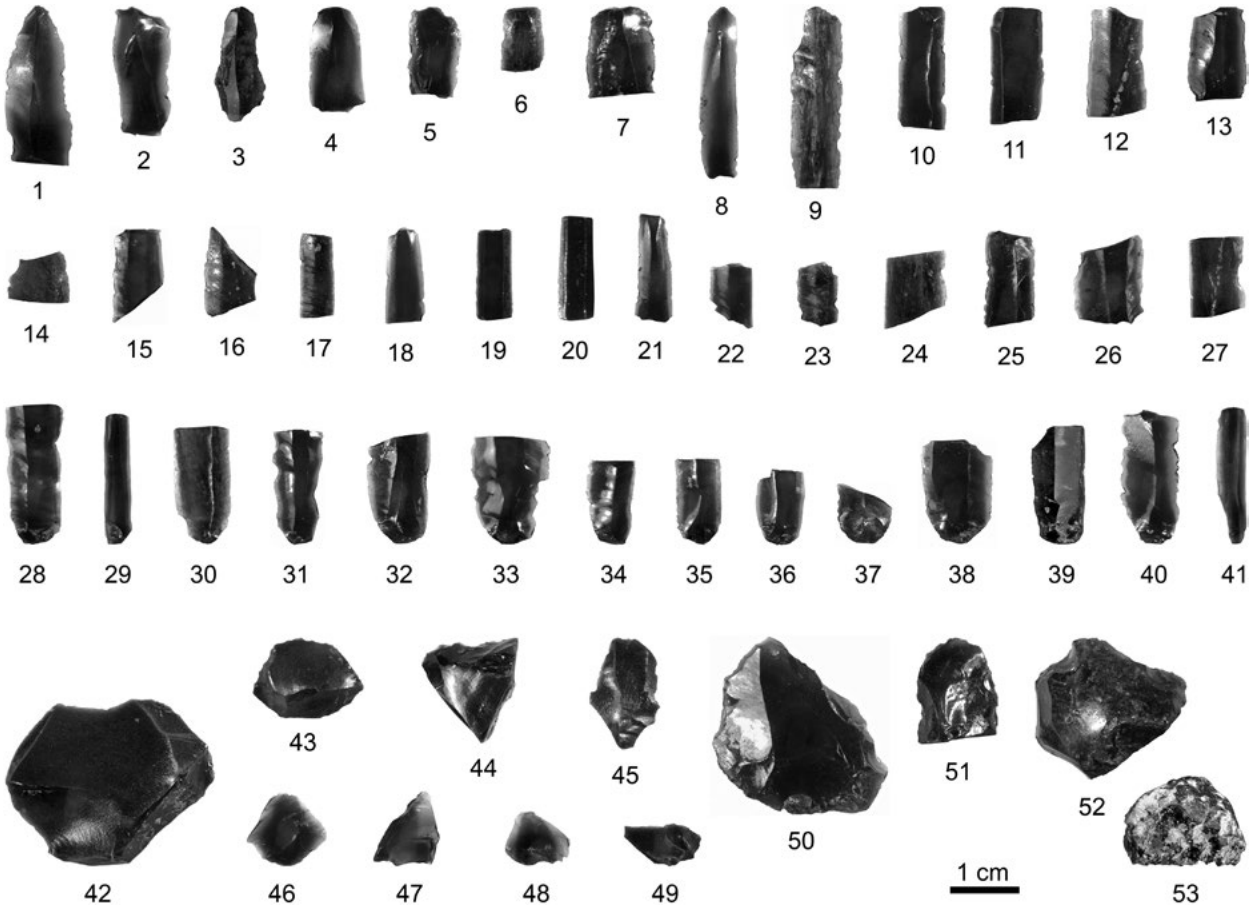

Figure 82. Salamandrija, obsidian artifacts.

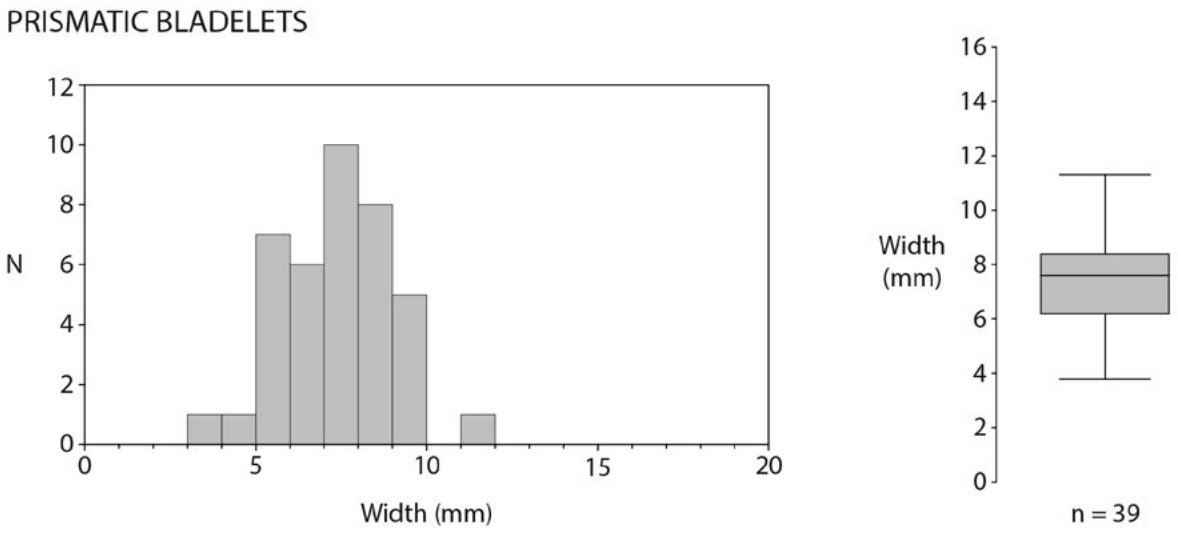

Figure 83. Obsidian prismatic bladelets width histogram and boxplot.

Of the ten artifacts classified as tools, eight are made on bladelets. Among them are three retouched bladelet segments: two with short stretches of marginal retouch near the distal or proximal end of the left lateral edge (Figure 82: 8, 37), and a third one with steeply retouched proximal part of the left lateral edge (Figure 82: 41). One bladelet segment, classified as end scraper, has a steeply retouched distal end (Figure 82: 7), while another has a steeply retouched notch on its right lateral edge (Figure 82: 27). Three bladelet segments were classified as microburins (Figure 82: 38-40). Aside from bladelet tools, there are two rather ill-defined side scrapers on retouched flakes (Figure 82: 50, 51).

The four artifacts made of Melian obsidian do not stand out from the rest of the assemblage by their size or technological and typological characteristics. They include a bladelet segment (Figure 82: 5), a fairly large flake (Figure 82: 42), and a couple of small flakes (Figure 82: 45, 49).

CATEGORY	n	%
Tools	10	19
retouched bladelets	3	
notch on bladelet	1	
end scraper on bladelet	1	
microburin	3	
side scraper on retouched bladelet	2	
Bladelets	33	62
Waste (flakes, cores and debris)	10	19
flakes	8	
core fragment	1	
chunk	1	
TOTAL	53	100

Table 14. Obsidian assemblage break-down (number and frequency)

2.1.3.9.3 Temporal attribution of the finds

Artifacts made of obsidian are present in small quantities on many prehistoric sites in the eastern Adriatic. The raw material of which they were made usually is Liparian, but there are also rare finds of Carpathian obsidian and obsidian from Palmarola (Tykot 2011: Figure 4: 4). The four artifacts from Palagruža currently represent the only find of Melian obsidian not just in the Adriatic, but also anywhere to the west of Greece (Tykot 2011: 40). A few objects from Grotta del Leone near Pisa, which initially were claimed to be made of Melian obsidian (Bigazzi *et al.* 1986), are no longer mentioned in more recent publications (Bigazzi and Radi 1996; Bigazzi *et al.* 2005).

In the eastern Adriatic, most of the obsidian finds that are accompanied by reliable provenience information were recovered from the second half of the sixth millennium BC (Middle Neolithic) contexts, from caves such as Vela spila on the island of Korčula (Čečuk and Radić 2005: 110), Spila at Nakovana (Forenbaher and Perhoč 2015: 35, 36), or Vaganačka pećina (Forenbaher and Vranjican 1985: 9), and from settlements like Danilo (Korošec 1958: 28, Plate 66: 6-10; Moore *et al.* 2007a: 19), Pokrovnik (Moore *et al.* 2007b: 29), or Sušac (Radić *et al.* 2000: 61). Bladelets of closely similar shape and size as those from Palagruža are quite common. So far, there are no obsidian finds from reliable Early Neolithic contexts, while finds from later contexts are exceptional. Among them is a backed bladelet made of Liparian obsidian from Pupićina peć (Forenbaher 2006b: 243), collected from Horizon G and ascribed to the Late Neolithic based on characteristic pottery, and dated by radiocarbon to the third quarter of the fifth millennium BC. Another example is a flake from burial mound #1 at Mali Mosor, collected from a context marked by Cetina style pottery

(Periša 2006a: 367). In the latter case, it would be very useful to know whether the obsidian was Liparian or Melian (or other!), but the provenience analysis of the raw material has not been carried out yet.

In the Apennine Peninsula, exploitation and exchange of Liparian obsidian decline towards the end of the Copper Age, having reached their zenith in the late fifth and early fourth millennium BC (Robb 2007: 193). As opposed to that, Melian obsidian continues to be mined and exchanged across the Aegean and western Greece, where bladelets and other artifacts made of obsidian continue to appear in settlements (Dörpfeld 1935: 101, Plate 22), burials (Dörpfeld 1927: Attachment 63c: 2, 3, 6) and sanctuaries (Renfrew 2007: 433) until the end of the Early Helladic period around year 2000 BC.

2.1.4 Ground stone artifacts

This small assemblage contains twelve ground stone items. Prominent among them are two complete wrist-guards and four broken ones (Figure 84: 1-6), although the fragments with only a single hole near one end might be pendants, since we do not know whether their other end was also pierced. Aside from them, a few other elongated and flat medial pieces without holes also may be wrist-guard fragments. Other similarly shaped objects are not pierced near the preserved end (Figure 84: 9, 11, 12) and therefore cannot be wrist-guards. One of them is too thick (20 mm) and too heavy to serve as a wrist-guard (Figure 84: 12). As opposed to wrist-guards, these objects are temporally insensitive and may be prehistoric, but also later.

An archer's wristguard is a protective device that prevents injuries to the lower arm, caused by the bow string after its release while shooting arrows. A widely held assumption is that the prehistoric finds, recognized as wrist-guards by archaeologists, were functional objects, attached by string directly to the inside of the lower arm, or to a leather support that is pulled on like a glove or attached to the arm in some other way (Figure 85). Recent work has indicated that many of those objects could not have served that practical purpose due to their size or shape, while finds from undisturbed burials suggest that often they have been attached to the outside of the lower arm (Woodward *et al.* 2006; Fokkens *et al.* 2008). It seems more likely that these were primarily symbolically charged decorative objects, related to the martial status of the archer.

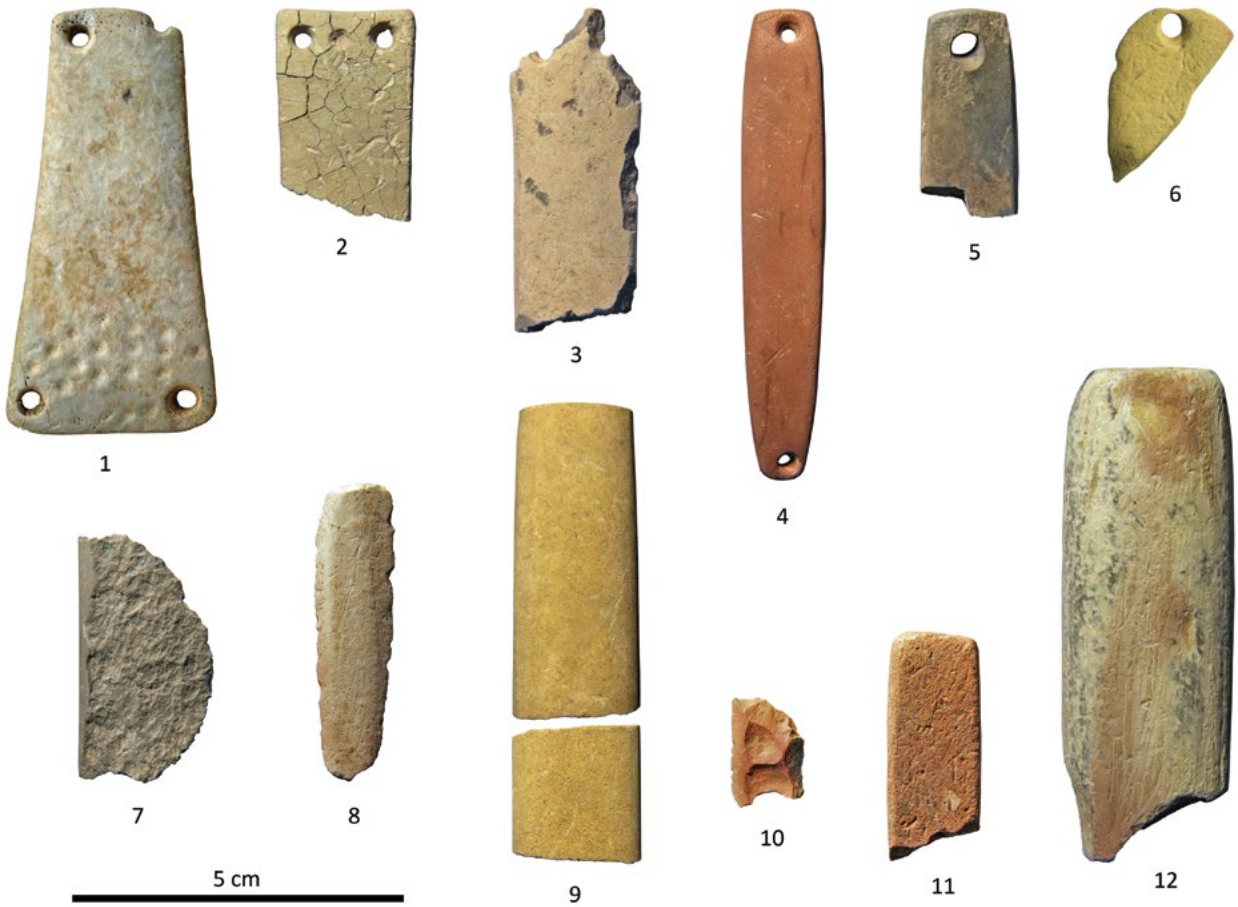

Figure 84. Salamandrija, ground stone objects.

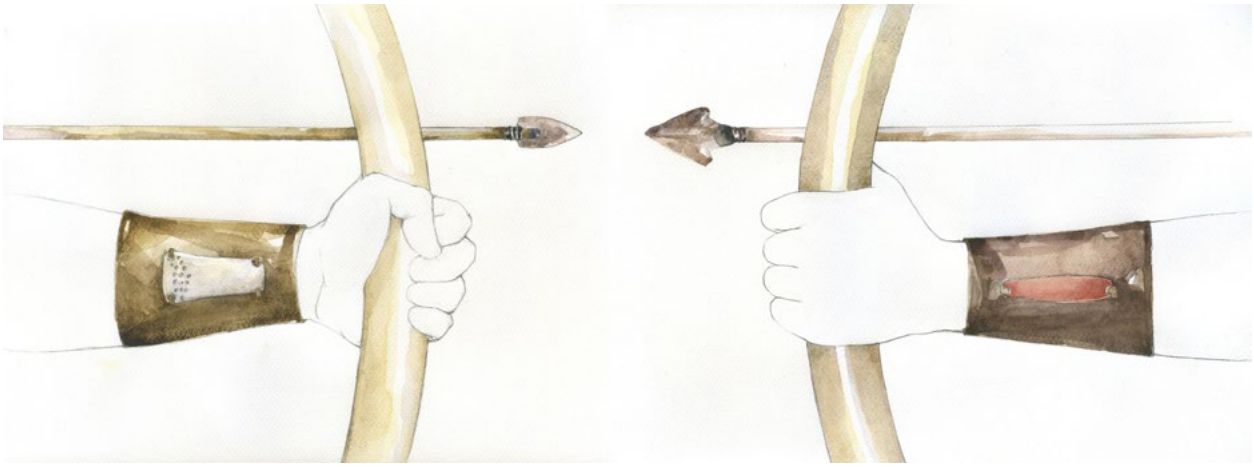

Figure 85. Proposed reconstructions of wristguards attached to the inside or the outside of the lower arm (illustration: Iva Pataračec).

Three types of wrist-guards are present in the Salamandrija assemblage. Two wrist-guards are flat plaques of rectangular or slightly trapezoidal outline, about 6 mm thick, with a pair of holes at each of the opposing ends (Figure 84: 1, 2). The badly damaged fragment with two holes (Figure 84: 3) may belong to the same type. The only complete specimen of this type is 64 mm long, while their width varies between 20 and 32 mm. Two of them are decorated, one with seventeen shallow oval pits, scattered near one of the ends (Figure 84: 1), another with a single oval pit placed between the holes near the preserved end (Figure 84: 2).

Two other wrist-guards are of similar thickness like the first two, but they are narrower and more elongated. They are slightly wider at the middle and have only a single hole at each end (Figure 84: 4, 5). The only complete specimen of this type is 71 mm long, while their widths are 13 and 15 mm, respectively. The last fragment (Figure 84: 6) is a thin, rounded end of an object with a single hole, possibly a part of an elongated-elliptical wrist-guard.

Production of these carefully shaped, ground and polished objects required considerable skill and command of stone working. All wrist-guards from Salamandrija have a glossy, polished surface, except for a single fragment (Figure 84: 2) that was damaged by fire. Each one was made from a different kind of stone, presumably of exotic raw materials from different sources. Petrographic analyses of the rock have not been carried out.

Currently, only a dozen ground stone wrist-guards from the eastern Adriatic have been published (Figure 86: 1-12), plus one specimen made of copper or bronze (Figure 86: 13). They are distributed from Trieste Karst to eastern Herzegovina, but most of them come from the hinterland of the middle Adriatic. Their shapes and sizes vary widely. Their outline may be elongated-elliptical, elongated-rectangular, wide rectangular, slightly trapezoidal, waisted, or with mushroom-shaped endings. At the thickest point, which is usually near the middle, they may be from 4 to 10 mm thick. The narrow specimens have a single hole at each end, the wider ones may have one or two holes, while a slightly trapezoidal specimen from Mala glavica has a single hole at one end and two holes at the other end (Figure 86: 7). Two of the wrist-guards are decorated in a similar way as those from Salamandrija: the specimen from Begovići (Figure 86: 11) with a series of tiny, shallow pits along one of the ends (Beg 2009: 75, Figure 7), and the specimen from Ljubomir (Figure 86: 10) with two oval pits placed on both sides of the hole near the preserved end (Čović 1983a: 165, Plate 20: 2).

Eight of the wrist-guards were recovered from burial mounds, four were recovered from caves, while one lacks provenience information. One narrow wrist-guard and an object looking like an unfinished short and narrow wrist-guard were recovered from Ravlića Cave (Marijanović 1981: Plate 5: 4, 5; 2012: Plate 17: 3, Plate 59: 6), the first one from Phase 3a marked by Ljubljana and Cetina style pottery, the second one from Phase 2c marked by Nakovana style pottery. The waisted wrist-guard from Mound 8 in Ljubomir (Čović 1983a: 165, Plate 20: 2) was found under the mound, at the level of soil, together with a ground stone shaft-hole ax. The slightly trapezoidal wrist-guard from Mala glavica (Batović and Kukoč 1988b: 23, Plate 26: 1, Plate 44: 1), as well as the waisted wrist-guards from burial mounds at Begovići (Beg Jerončić 2011: Plate 1: 1) and Gomile više lada (Marović 1991: Figure 75: 16; 1994: 71-72, Figure 6), were collected from the mound fill, where they were associated with fragments of Cetina style pottery. The wrist-guard with mushroom-shaped

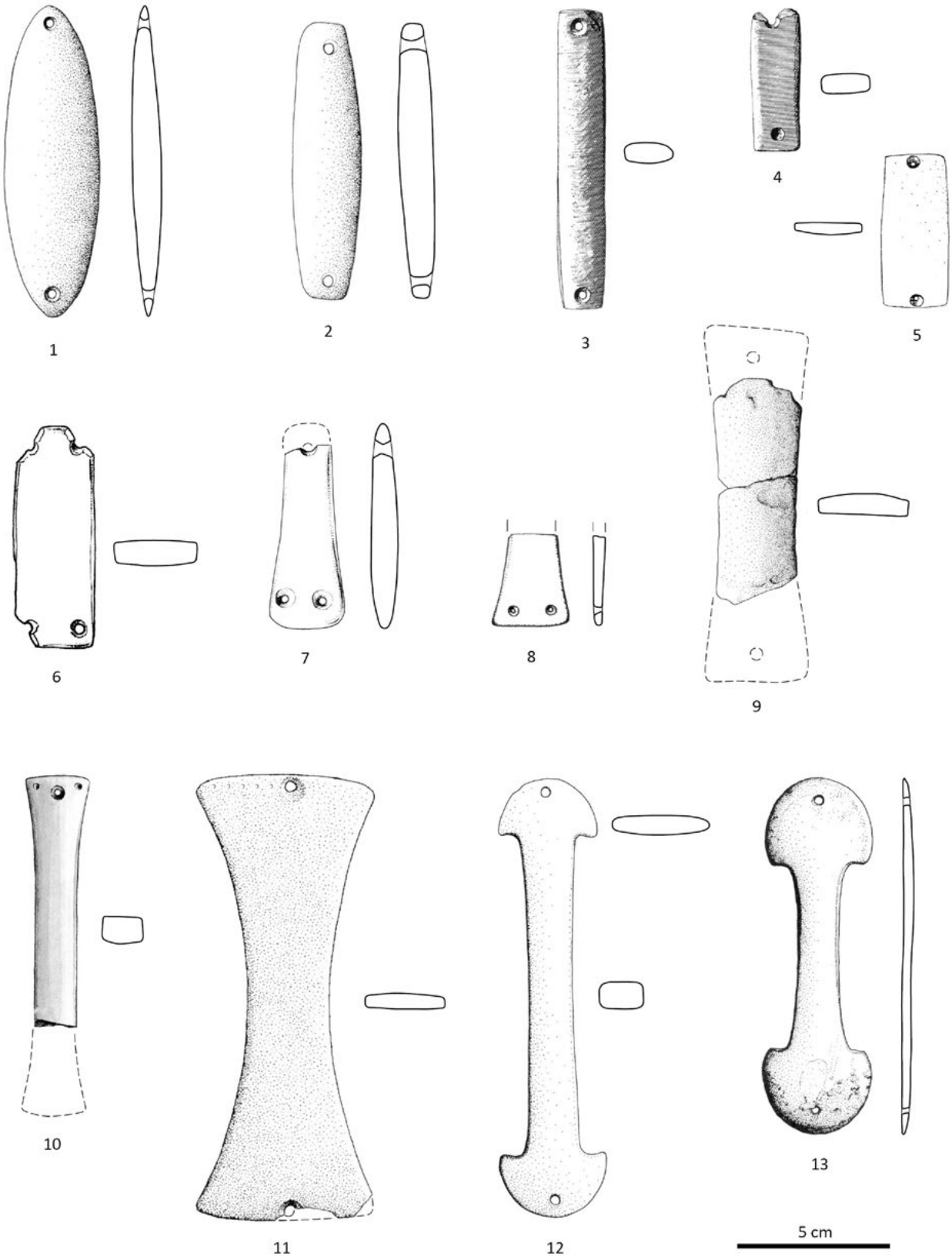

Figure 86. Wristguards from eastern Adriatic sites, 1 Bitelić (Marović 1994: Figure 5: 2; Milošević 1998: Figure 216), 2 Kekezova gomila (Marović 1994: Figure 5: 1), 3 and 4 Ravlića pećina (Marijanović 1981: Plate 5: 4, 5), 5 Grotta dei Ciclami (Gilli and Montagnari Kokelj 1993: Figure 73: 737), 6 Poljanice (Milošević 1986: Figure2; 1998: 276), 7 Mala glavica (Batović and Kukoč 1987: Figure 2), 8 Grotta delle Gallerie (Gilli and Montagnari Kokelj 1994: Figure 9: 38), 9 Gomile više lada (Marović 1994: Figure 6), 10 Ljubomir (Čović 1983: Plate 20: 2), 11 Begovići (Beg Jerončić 2011: Plate 1: 1), 12 Živalji (Marović 1994: Figure 3: 3), 13 Ravča (Marović 1994: Figure 4: 1); 1-12 stone, 13 bronze or copper.

endings from Živalji was found in a mound, in a stone cist that was used for burial at least twice, together with a short bronze sword with metal hilt, a small flat dagger and a piece of golden wire (Marović 1994: Figure 3: 3). Specific information about context is missing for the remaining wrist-guards.

Wrist-guards very similar to those from Salamandrija represent a characteristic component of the Bell Beaker burial assemblage across a large swath of western and central Europe, including the western Mediterranean (Sangmeister 1964; Harrison 1980; Woodward *et al.* 2006; Fokkens *et al.* 2008). In the wider neighborhood of the eastern Adriatic, such wrist-guards appear in Bell Beaker contexts in northern Italy, Toscana and Lazio, as well as Sicily and Sardinia (Nicolis and Mottes 1998; Nicolis 2001a). Several narrow wrist-guards with a single hole at each end were found on Crete (Mesara) and Peloponnesus (Lerna IV) in EH II and EH III contexts (Maran 2007: 13-14, Plate 4: 1-3), which makes them roughly contemporary to the Bell Beaker period (middle and second half of the third millennium BC).

2.1.5 Artifacts made of mollusk shells

Two artifacts from Salamandrija made of marine mollusk shell are attributable to prehistory. One is a pierced discoid bead, 7 mm thick and 19 mm in diameter (Figure 87: 1). Judging by the structure of the raw material and the clearly visible growth rings, it was made of a large bivalve shell, most probably of spondylus *(Spondylus gaederopus)*, which is common on the rocky sea bottom of the eastern Adriatic littoral. Dead spondylus shells that are deposited on beaches by the waves represent an excellent and easily accessible raw material for production of personal adornments. After the mollusk has died, certain kinds of marine predators bore holes through its shell. The bead from Salamandrija is full of such holes, which indicate that it was made from a dead bivalve shell that was picked up from a beach, and not from a live mollusk pulled out from the sea.

Artifacts made of spondylus are distributed widely across the eastern Adriatic, but they never appear in large numbers. Most of them were recovered from Middle Neolithic and Late Neolithic contexts. Among them are only a few discoid beads comparable to the one from Salamandrija from Danilo-Barice (Kukoč 2012: Figure 8b) and Benkovac-Barice (Kukoč 2012: Figure 18e). Several irregular discoid beads from Obre II settlement in central Bosnia also come from a Middle Neolithic context (Benac 1971). Many beads of a similar size were found in two burials in Vukovar; at least one of those burials belongs to the third millennium BC (Brunšmid 1902: 60-64, Figure 19: 8-10, Figure 20). Jewelry made of spondylus is not a frequent find in Italian sites either, although it appears already in the Early Neolithic and is present throughout the Neolithic, and probably continues until the Bronze Age. Discoid beads are sometimes mentioned among other spondylus finds (Borrello and Micheli 2011).

The other artifact is a 46 mm long and 8 mm wide pendant (Figure 87: 2). It was made of a small cowry shell – probably, *Luria lurida* – from a narrow splinter near the denticulate aperture on its bottom side. *Luria lurida* is a very attractive Adriatic mollusk, brown and glossy like glazed porcelain, with a pair of dark spots at both ends (Figure 88). It lives on rocky sea bottom,

Figure 87. Artifacts made of mollusk shell, 1 discoid bead made probably of Spondylus gaederopus, 2 pendant made of Luria lurida.

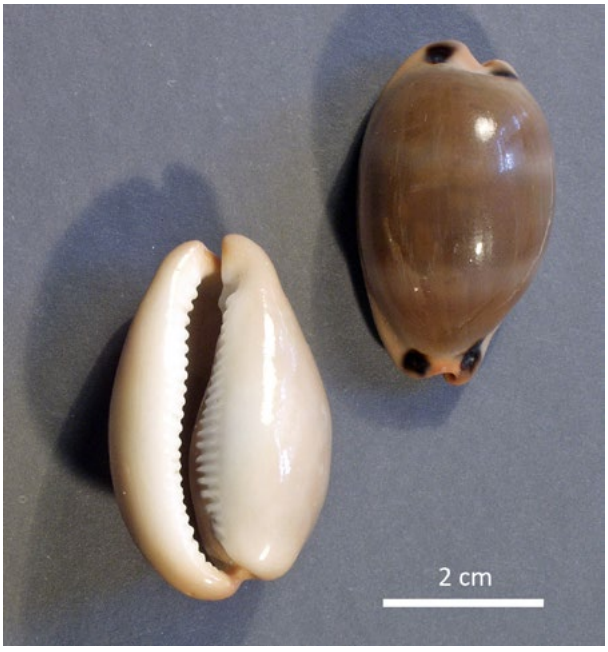

Figure 88. A couple of Luria lurida shells collected from a beach in Pelješac Peninsula.

usually at depths between 20 and 30 meters. It is active at night, while in daylight it hides in holes and under rocks. It is fairly rare, and is included in the list of strictly protected species.

Several small cowry shells with a hole bored near one of their ends were recovered from Mesolithic contexts of Vela Cave on Korčula (Čečuk and Radić 2005: 57, Drawing 5: 1). A complete cowry shell, slightly modified by grinding, comes from the Middle Neolithic settlement of Danilo-Bitinj (Korošec 1958: 39, Plate 50: 7; Kukoč 2013: Figure 5a). Another complete cowry shell was recovered from Grave 2 of Glava maslinova burial mound, located near Bogomolje on the island of Hvar (Marović 1985: 16-18, Figure 9: b). The burial cist did not contain any time-sensitive finds, while the scarce finds from the mound's mantle are attributable to the Copper Age or the Bronze Age.

2.1.6 Diachronic change in intensity of activities

Many human activities leave slight material evidence detectible through archaeological investigation, or virtually no evidence at all. The quantity of finds therefore is a rather unreliable proxy measure of site use intensity, but the material evidence related to human action remains the only source of information for a prehistorian. In our case, the disturbance of all prehistoric contexts and the impossibility of their chronometric dating represent an additional problem. As a consequence, the following discussion can be based only on the presence and frequency of temporally sensitive finds. Some of those finds are very characteristic for a specific period, while others cover relatively long time spans (Figure 89). While keeping in mind the aforementioned methodological limitations, what can be said about the timing and intensity of Salamandrija's use during prehistory?

The earliest trace of human presence is a single Impressed Ware potsherd that undoubtedly belongs to the first half of the sixth millennium BC. A handful of plain potsherds of generic 'Neolithic shape' vessels, as well as the numerous prismatic blades made of chert, might belong to the same early time, although all of those finds (aside from the Impressed Ware fragment) easily may be much younger. So, while we can be sure that people were visiting Salamandrija already in the first half of the sixth millennium BC, it seems that those visits were rare, and activities were of a limited scope.

Many of the finds may belong to the two and the half millennia long period that follows (roughly, from year 5500 until year 3000 BC), but there is not a single characteristic and temporally specific find that could not be younger or older. Most abundant among them are the numerous prismatic blades made of chert, but the tanged bifacial points and the rare plain potsherds of 'generic Neolithic shape' vessels also belong to that category. Perhaps the relatively rare artifacts made of Liparian obsidian should be attributed more readily than any other find to this period (more precisely, to the second half of the sixth millennium BC). However, Salamandrija also yielded obsidian originating from Melos in the Aegean, where it remained in circulation until the end of the third millennium BC. Due to all of the above, the period from year 5500 until year 3000 BC (Middle Neolithic, Late Neolithic, and Early Copper Age) remains unresolved.

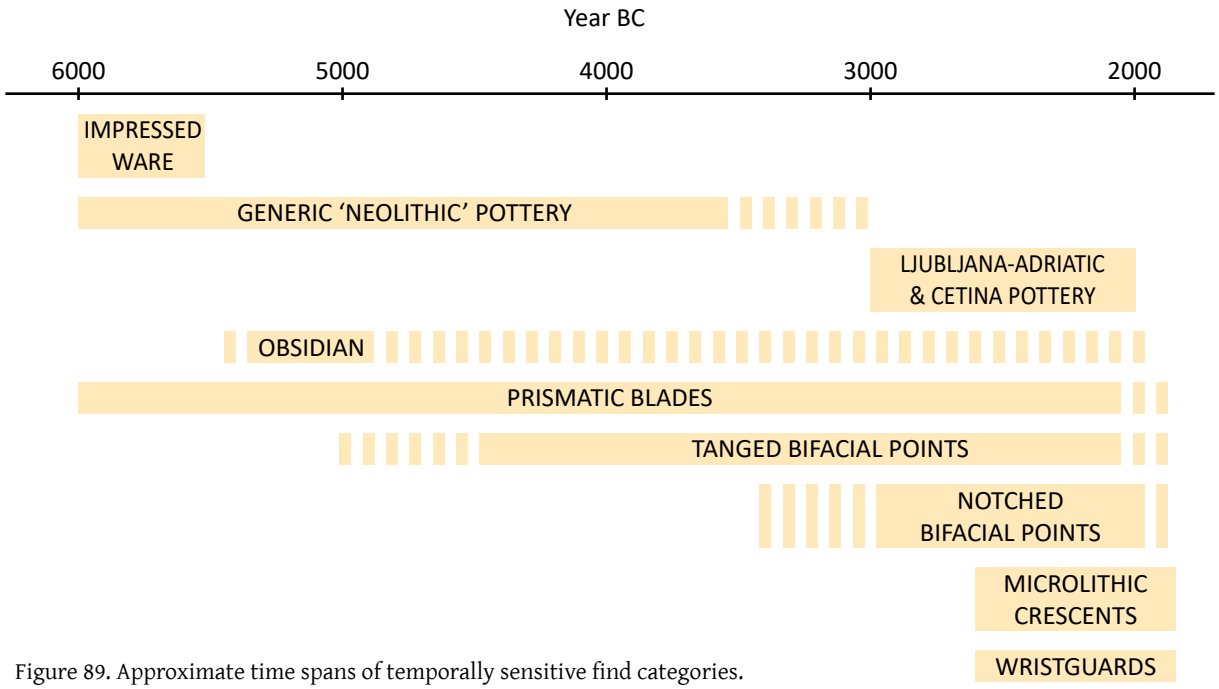

Figure 89. Approximate time spans of temporally sensitive find categories.

Maybe nothing much was happening at Salamandrija throughout those times, but it is equally possible that a substantial part of the flaked stone assemblage was deposited at the site during that period.

The greatest number by far of temporally sensitive finds belongs to the third millennium BC. They include hundreds of characteristic potsherds decorated by incised-and-impressed designs, dozens of microlithic crescents and notched bifacial points, and several ground stone wristguards. Almost all other temporally less sensitive finds, like prismatic blades, tanged bifacial points, and possibly also obsidian artifacts, may belong to the same period. There can be little doubt that intensive activities were taking place at Salamandrija during the third millennium BC.

Only a very small number of characteristic finds may be attributed with confidence to later prehistoric times (the second millennium and the first half of the first millennium BC). A few of the nondiagnostic potsherds shaped by free hand probably also belong to those times. Evidence of intensive human activities is conspicuously absent during the Bronze Age and Iron Age, until around year 500 BC and the establishment by the ancient Greeks of a sanctuary devoted to Diomedes (Kirigin 2012: 60).

2.2 Other sites

Aside from Salamandrija, prehistoric artifacts have been recovered from four other locations at Vela Palagruža, and from a single location at Mala Palagruža. Only one of those locations is a genuine archaeological site. The rest may be considered as sites only conditionally due to uncertain provenience, low density, and minute number of finds.

2.2.1 Jankotova njiva

Originally recorded as 'Site Palagruža 2', Jankotova njiva is the second largest plateau on Palagruža, only slightly smaller than Salamandrija (Forenbaher *et al.* 1994: 37-39, Figure 16; Gaffney and Kirigin 2006: 75). It is located at the eastern end of the island (Figure 2), and its surface is just under 2000 m^2. It slopes gently eastwards and is partially enclosed by low drystone walls of unknown age, which probably are related to agricultural activities of the last few centuries (Figures 90 and 91). It lies 55 meters above the sea level and terminates on three sides in precipitous cliffs that drop directly into the sea. Towards the west, it is linked to the remaining parts of the island by a very narrow and barely passable saddle called 'Priko tankega'[6] (Božanić 1996a: 105), while the sea is eroding its eastern side. It

Figure 90. Jankotova njiva, view towards east with Mala Palagruža in the background (1993).

[6] Literally, 'by the slim'.

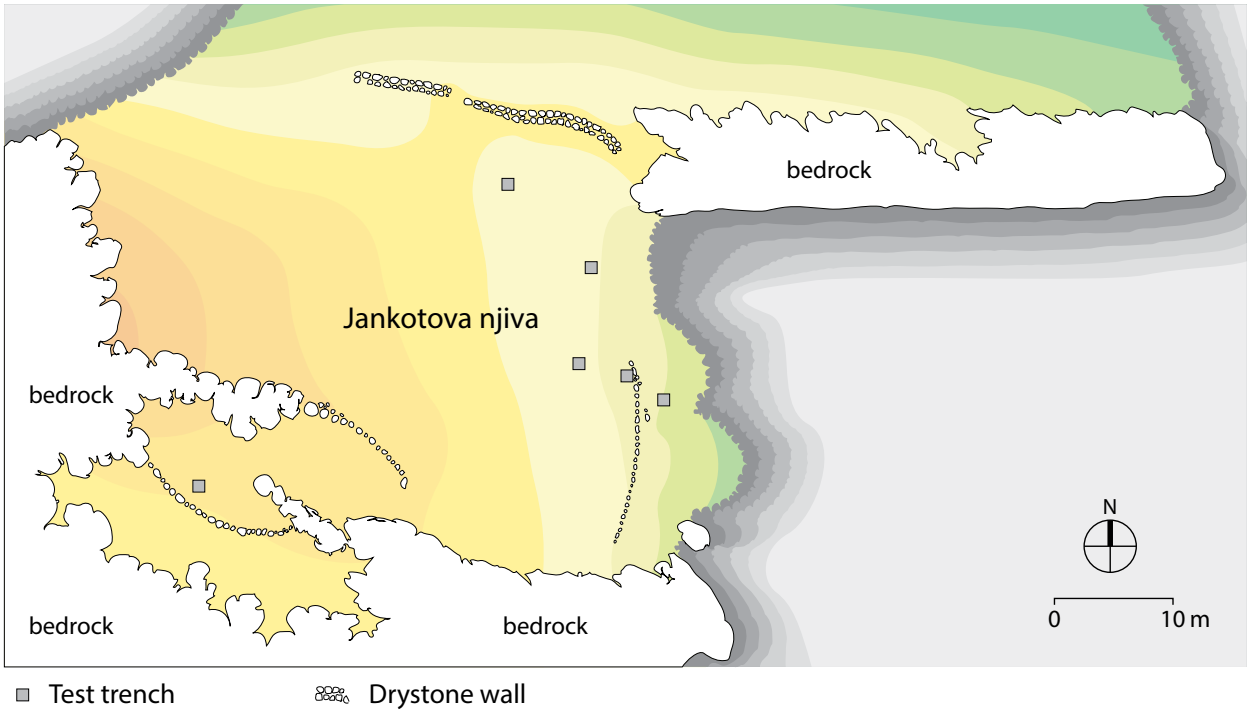

Figure 91. Plan of Jankotova njiva.

Figure 92. Jankotova njiva, eastern edge of the site (2004).

Figure 93. Jankotova njiva, test excavation (1993).

Figure 94. Jankotova njiva, a flaked stone artifact photographed in situ on the surface of the site (2004).

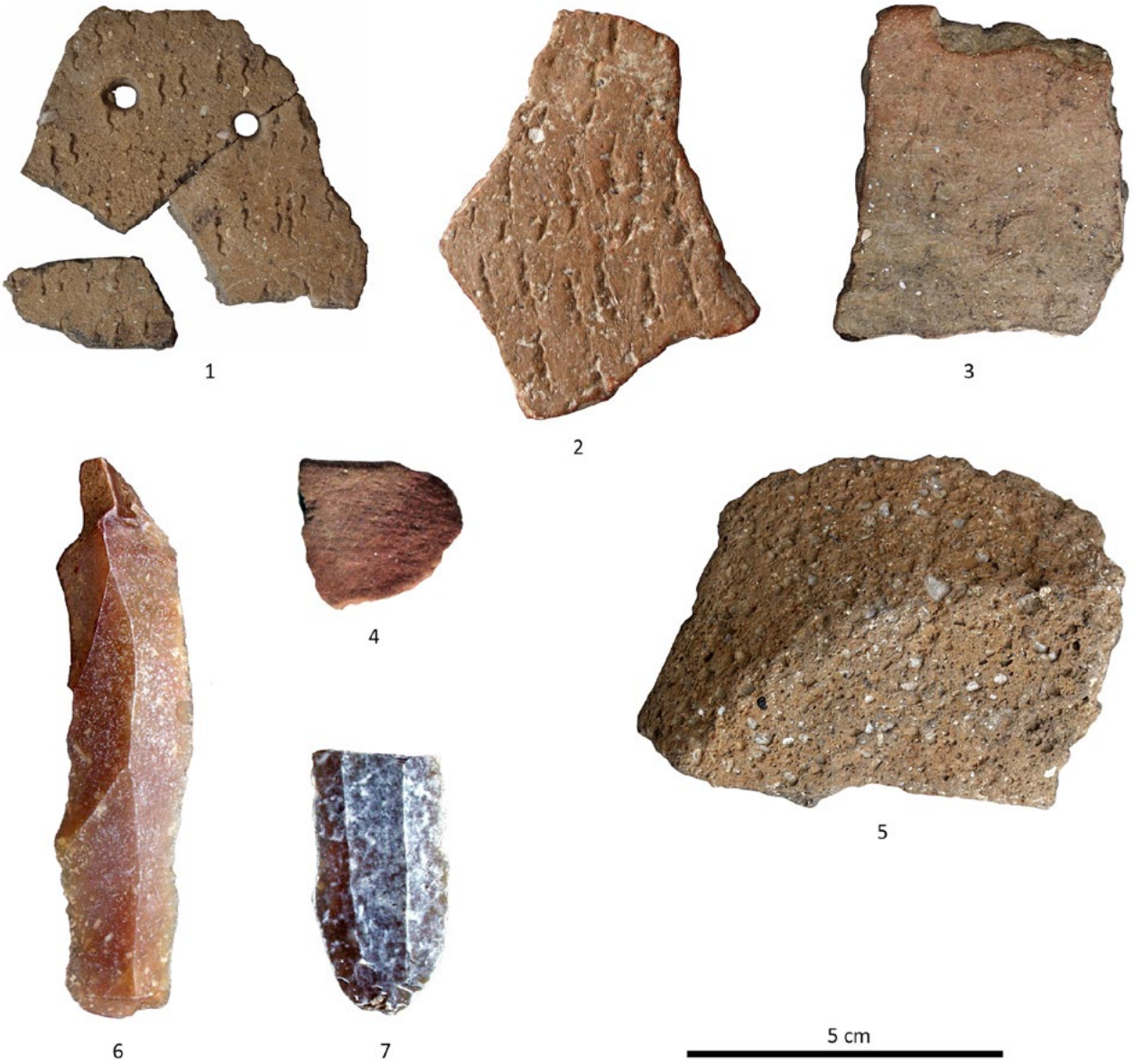

Figure 95. Jankotova njiva, a selection of finds, 1-5 pottery, 6-7 chert.

used to extend farther eastward, but that part of the plateau was obliterated by rock collapse and landslides. At the time of transition to farming, Jankotova njiva probably was the largest plateau on the island, although it could not have been very large.

Two blade segments and a characteristic Impressed Ware potsherd were recovered from the surface during the first, informal visit to the site. Those finds induced us to carry out an intensive surface survey based on 10-meter squares. Despite excellent visibility, concentration of surface finds proved to be very low: only three more potsherds and another flaked stone artifact were recovered. Next, six randomly located 1x1 m trenches were excavated near the eastern edge of the plateau (Figures 92 and 93) with the aim to test whether any subsurface archaeological layers or features existed at the site. Unfortunately, that excavation yielded virtually no results. In all trenches we encountered bedrock below a 0,4-0,6 m thick layer of archaeologically sterile soil. Sixteen other potsherds and sixteen flaked stone artifacts were recovered during later informal visits in year 2002, 2003 and 2004, pointing to an active erosional environment (Figure 94).

The pottery assemblage contains only twenty sherds, weighing in total 305 grams, and includes seven diagnostic sherds. Among them are four characteristically decorated Impressed Ware potsherds (Figure 95: 1, 2). They come from two different vessels, and are decorated across their entire surfaces by series of parallel *cardium* shell impressions, in a manner that is considered characteristic of the older 'Impressed Ware A' phase of that pottery style (Batović 1979;

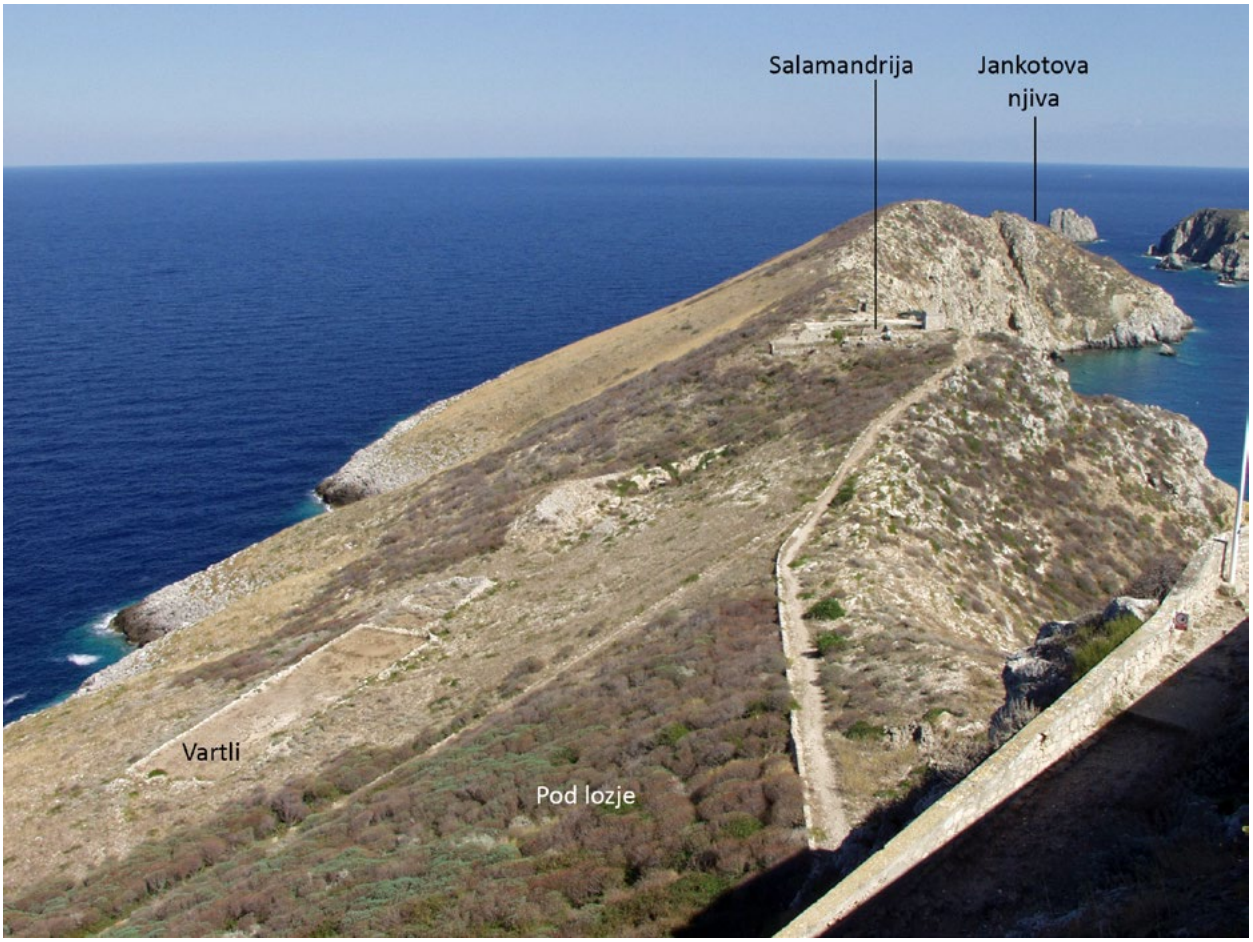

Figure 96. View of the central part of the island from Lanterna, with marked positions of archaeological sites (2004).

Müller 1994; Čečuk and Radić 2005). Two secondarily bored holes testify that one of those vessels had been mended. As already mentioned, Impressed Ware appears in the Adriatic around year 6000 BC; it goes out of use in the eastern Adriatic around the middle of the sixth millennium BC (Forenbaher *et al.* 2013: 597), while in the western Adriatic it continues until the end of the sixth millennium BC (Skeates 2003: 170). According to their shape and general technological characteristics, the plain rim sherd of a slightly restricted vessel with a barely marked neck (Figure 95: 3), as well as the flat base fragment of a fairly large vessel, with coarse inclusions of ground limestone clearly visible below its heavily weathered surface (Figure 95: 5), probably belong to the same period. Finally, a small rim sherd of a vessel shaped by free hand (Figure 95: 4) is prehistoric, but cannot be determined more closely.

The flaked stone assemblage contains nineteen artifacts, weighing slightly more than 100 grams in total. While waste predominates (flakes and chunks), three blade segments also have been recovered, including a proximal part of a relatively wide prismatic blade (Figure 95: 7), and a large (distal) part of an elongated core rejuvenation element resembling a crested blade (Figure 95: 6). None of these artifacts are narrowly time-sensitive. All of them may be contemporaneous with the Impressed Ware potsherds, but they may just as easily be as late as the end of the third millennium BC (Guilbeau 2011; 2012; Forenbaher and Perhoč 2015).

Archaeological evidence from Jankotova njiva testifies unequivocally of human presence at that location during the first half of the sixth millennium BC. Later diagnostic finds are absent, in contrast to Salamandrija, where finds from the third millennium BC dominate. The scarcity of evidence suggests low levels of activity, such as occasional short visits. Possibility should be left open, however, that this is just a peripheral remnant of a site, most of which has been destroyed by the sea (Figure 10).

2.2.2 Pod lozje

Pod lozje is located in the western part of the northern slope of the island (Figures 2 and 96). It occupies an area

Figure 97. Pod lozje, an Impressed Ware sherd.

delimited from below by the trail that leads to Stora vloka and from above by the trail that leads to Lanterna and the vertical rock crowned by the lighthouse. 'Palagruzonka' grapevine used to be cultivated in that area[7] (Božanić 1996a: 104, Figure 1). Cultivation has been abandoned long ago, and the area today is partially overgrown in feral grapevine, tree spurge, and other small vegetation. Prehistoric finds were recovered from the surface of the slope above the Stora vloka trail, as well as along the trail itself. Scarce finds were scattered widely across an area some 200 meters long and about 40 meters wide.

Only one of the three pottery fragments shaped by free hand is diagnostic (Figure 97). It is decorated by a series of impressions made by a thin, flat object (maybe, broken end of a blade segment). Like the similar finds from Salamandrija and Jankotova njiva, it may be attributed to Impressed Ware and the first half of the sixth millennium BC.

The flaked stone assemblage contains sixteen artifacts, weighing in total 40 grams. While more than half of it is waste (flakes and chunks), five blade segments, a fragment of a bifacial point, and an expedient tool on flake also have been recovered. By their shape and dimensions, the blade segments and the bifacial point fragment correspond fully to similar finds from Salamandrija.

Since the locality 'Pod lozje' was terraced for vineyards, it is quite possible that prehistoric artifacts were brought there from elsewhere together with the soil. One should keep in mind that Salamandrija is only about 200 m away from this locality, that is, only a few minutes of easy downhill stroll.

2.2.3 Vartli

Vartli is a small flat area on Palagruža's northern slope (Figures 2 and 96), the only plot of arable land on the island worth mentioning. Wheat used to be grown in this small field fenced off by drystone walls (Božanić 1996a: 105, Figure 1). Today, this area serves as a helipad.

Eight small and weathered potsherds were recovered from the surface of the field and its immediate surroundings. All of them are shaped by free hand, nondiagnostic, and attributable only generally to prehistory. They may have arrived to Vartli together with the soil brought from Salamandrija, or by redeposition from Pod Lozje, which is located only a few dozen meters uphill.

2.2.4 Stradun

This includes surface finds from two adjacent localities: Stradun (Božanić 1996a: 104), the trail that connects Zolo to Salamandrija, were finds were picked up casually by archaeologists in their daily commute, and the steep and broken rocky south slope of the island immediately to the west of that trail, originally recorded as 'Site Palagruža 4' (Forenbaher *et al.* 1994: 40, Figure 16), where finds were collected during the field survey in year 1992 (Figure 2).

Among the total of 51 potsherds shaped by free hand are fifteen diagnostic fragments. Some of them are decorated by incision and impression in a characteristic third millennium BC manner (Figure 98: 1, 2). A fragment of a distinctively shaped vertical handle (Figure 98: 4) and a body fragment with a horizontal appliqué rib (Figure 98: 3) probably belong to the second millennium or the first millennium BC (Barbarić 2011). In addition to about fifteen potsherds from Salamandrija, those are the only finds from Palagruža that are younger than the third millennium BC, but older than the Greek sanctuary. Two tunnel-shaped handles (Figure 98: 5, 6) are less time-sensitive and may belong either to the third millennium BC or to later prehistoric times.

The flaked stone assemblage contains 33 artifacts, weighing slightly less than 100 grams in total. Waste predominates (flakes and debris), but five blade segments also were collected, as well as a bifacial point fragment and a couple of expedient tools. These artifacts correspond fully to similar artifacts from Salamandrija.

All prehistoric finds were found in secondary position, transported and redeposited downhill by natural processes or by recent human activities. Since most of them were collected from just below the plateau, presumably they all originated from Salamandrija.

2.2.5 Mala Palagruža

The rocky islet of Mala Palagruža consists of two parallel, steep and narrow carbonate rock ridges, and a small

[7] 'Pod lozje' literally means 'below the grapevine'.

Figure 98. Stradun, a selection of diagnostic potsherds.

marly plateau between them, known as 'Popina njiva' (Božanić 1996a: 107). We have mentioned repeatedly in our earlier writings a probable prehistoric chert mine on Mala Palagruža (Forenbaher and Kaiser 1997: 20, 22; 2011: 103-104; Kaiser and Forenbaher 1999: 316; Forenbaher 2009b: 80; Gaffney and Kirigin 2006: 74-75), and we have proposed that the primary reduction of nodules pried out of the surrounding rocks took place at Popina njiva (originally recorded as 'Site Palagruža 6'). This was suggested by numerous chert lenses and nodules incorporated in carbonate bedrock of Mala Palagruža's main ridge, and even more numerous empty sockets in the rock where chert was taken out, or fell out, from its host rock (Figure 99), as well as by the

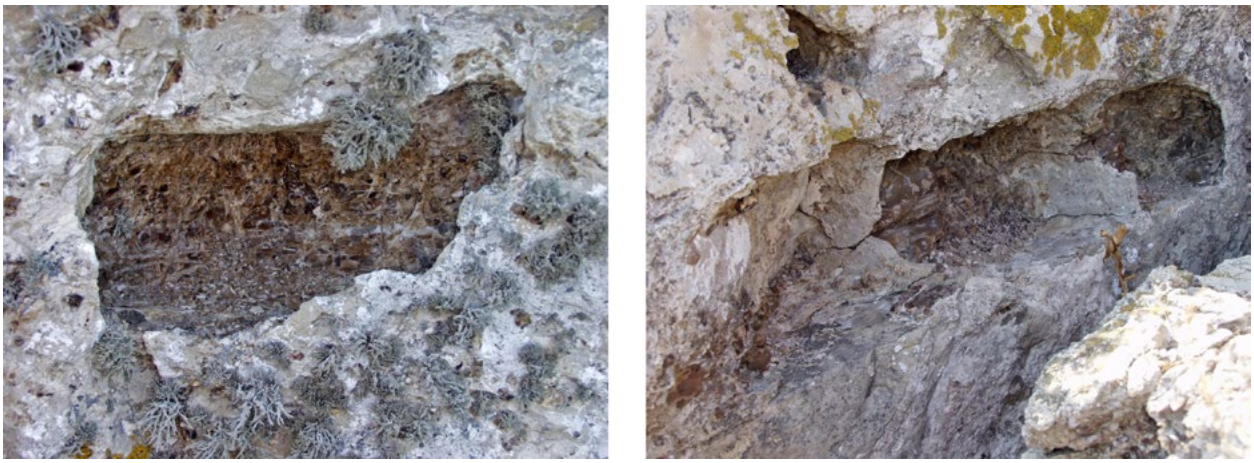

Figure 99. Mala Palagruža, left: part of a chert nodule contained in carbonate host rock; right: a rock hollow with traces of chert (2004).

abundant chert debris on the surface of Popina njiva and the rounded chert fragments among the beach pebbles below. Unexpectedly large number of chert artifacts at Salamandrija, as well as their raw material that superficially resembles Mala Palagruža chert, led us to presume that flaked stone artifacts were produced at Palagruža from a locally available raw material (Forenbaher *et al.* 1994: 40-41; Forenbaher and Kaiser 1997: 22-24; Kaiser and Forenbaher 1999: 316-319).

Results of extensive analyses that have been completed in the meantime lead to a very different conclusion. New and thorough analyses of chert raw materials have demonstrated unequivocally that the artifacts from Salamandrija were not made of the local Palagruža chert. While collecting chert samples from primary outcrops on Mala Palagruža (Perhoč 2009: 33) it became clear that it would have been very hard to extract from the host rock large and undamaged chunks of chert, which are a prerequisite for the sophisticated prismatic blade reduction technology. Furthermore, there is not a single unquestionable artifact among the chert debris from Popina njiva, which probably consists of geofacts. Finally, the rare evidence of core reduction from Salamandrija is not indicative of large-scale local production.

It follows from the above that our preliminary interpretation of Mala Palagruža as a prehistoric chert mine was unwarranted and wrong. Unequivocal evidence of prehistoric chert extraction and reduction is absent from that islet. In fact, there is no evidence of any prehistoric visits, unless a single nondiagnostic fragment of a coarse vessel shaped by free hand, recovered during survey from the rocky ridge near the eastern end of Mala Palagruža, represents a prehistoric find.

3

Palagruža and Adriatic prehistory

3.1 Small islands and great journeys

Palagruža's archaeological evidence, which has been presented in previous chapters, testifies of prolonged temporal gaps during which the island was rarely visited. After many years of extensive archaeological investigations, those gaps cannot be considered as fortuitous consequences of insufficient research or uneven preservation. Why did people visit Palagruža often during some periods, but almost never in other times? Was this situation specific for this small island? How did it compare with other small, isolated islands in the Adriatic? Is there a general pattern and, if there is one, how might one explain it in general terms?

This chapter focuses on the archaeological record of small and remote Adriatic islands, and their changing role in promoting contact and interaction among distant prehistoric communities. In times before telecommunications, such interaction would have subsumed travel, whether by individuals or groups, messengers or migrants, traders or raiders.

Long-distance interaction does not necessarily imply particular individuals crossing great distances. Objects and information could have travelled far by moving down-the-line, as a cumulative result of multiple short trips made by many different individuals (Renfrew 1975). In some geographic circumstances, however, long-distance travel could not have been avoided if there was to be any interaction at all. The case of trans-Adriatic contact, with the two Adriatic coasts standing some 150km apart, provides a good example. The few remote islands that are scattered around central Adriatic are among the most obvious places to looking for evidence of ancient travelers.

Trans-Adriatic contacts are well attested archaeologically at least since the time of transition to farming. The evident stylistic unity of certain classes of pottery, such as Impressed Ware (Müller 1994; Fugazzola Delpino *et al.* 2002) or polychrome painted *figulina* finewares (Spataro 2002; Teoh *et al.* 2014), testifies of regular and continuing contacts during much the Neolithic. Obsidian from Lipari and chert from Gargano had to cross the Adriatic on their way to Dalmatian Neolithic villages (Tykot 2011; Forenbaher and Perhoč 2015). Contacts continued in later prehistoric periods. Numerous close similarities have been observed in Bronze Age and Iron Age material culture from opposite sides of the Adriatic (Batović 1976; Marović 1975; Petrić 1999). There is no reason to assume, however, that trans-Adriatic interaction was equally intensive during all those periods, or that it was gradually growing more and more intensive. The changing character of that interaction, its changing social and economic context, as well as the changing technological means by which it was accomplished, are some of the topics to be considered when discussing the prehistory of the region.

This interaction would have involved navigation across considerable stretches of open water. The coast-to-coast distance across the Adriatic is too great to be covered in a single day by a small boat propelled by wind or human muscles. It seems reasonable to assume that the ancient mariners would have avoided overnighting on the open sea. Preferably, the passage would have been broken into several stages, by putting ashore at intervening islands, where boats could be pulled out of the sea to the safety of a beach, and the night spent on land. This would have made the isolated and remote islands particularly interesting to travelers, especially those that could be used as stepping-stones between more distant destinations.

3.1.1 Why set off for a small, remote island?

Apart from the sheer curiosity, exploration and colonization of islands can be related to social or political motives, exploitation of insular resources, and competent maritime technologies and seacraft (Patton 1996: 24). Several models predict the probability of insular discovery and colonization (Bass 1998: 175-177). Reaching an island is considered as 'discovery', while 'colonization' implies permanent settlement.

The likelihood that an island will be discovered is directly proportional to its apparent size on the horizon, and inversely proportional to its distance. This 'target/distance ratio' (Held 1989: 13) has been defined as the ratio between the target width (the angle that the island subtends on the horizon as observed from the voyage starting point) and the linear distance to it from the staging point. For example, target/distance ratio calculated from the closest landfall is 26°/km for the island of Brač, 3°/km for the Vis, 0,4°/km for Sušac, and 0,07°/km for Palagruža.

An island may be permanently settled if it contains ample terrestrial resources that can support a viable population. Islands with a greater amount of biological

and territorial diversity will have a higher carrying capacity, which is of key importance for the incoming colonists. According to MacArthur and Wilson, an island's biodiversity is directly proportional to its size and inversely proportional to its distance from the mainland (MacArthur and Wilson 1967). Their simple area to mainland distance ratio was expanded by Held (1989) to account for stepping-stone islands. Held defined the distance between target island and mainland as the width of the largest water barrier in a chain of intervening islands. That distance was later labeled 'the longest single voyage' (Patton 1996: 40). Accordingly, an island's biogeographic diversity index (a proxy measure of the likelihood that an island will be colonized) is defined as the ratio between the island's size (area) and the longest single voyage (Bass 1998: 177). For example, this index is 75 km for the island of Brač, 7 km for Vis, 0,2 km for Sušac, and 0,007 km for Palagruža.

A large island, even when remote, sooner or later will be discovered and settled. In contrast, small, distant islands with little biodiversity and severely limited resources will rarely, if ever, support permanent settlers. Their archaeological records will testify of temporary visits by travelers and fishermen.

The sea around isolated offshore islands often abounds with fish, but systematic harvesting of deep-sea fish stocks is a relatively recent development. It requires organizational capabilities and capital investment in fairly large, specialized and expensive boats and equipment that would have been beyond the reach of small early farming communities (Gilman 1981: 7; Harding 2000: 181-185). In the Adriatic region, the first signs of social elites and hierarchically organized societies that may have been able to engage in this kind of capital-intensive pursuits date from the mid-third millennium BC (Chapman *et al.* 1996: 283-286; Forenbaher 2009: 84; Forenbaher and Kaiser 2011: 106), but there is no evidence for the actual practice of deep-water harvesting. The earliest unquestionable historical evidence of exploitation of rich fishing grounds around the Adriatic remote islands dates from the sixteenth century AD (Kovačić 1997: 40).

This leaves us with travelers, suggesting that the prehistoric record of small remote islands, particularly those located along possible navigation routes, will reflect intensity of maritime travel and long-distance interaction. Abundant archaeological evidence on such islands should indicate times of intensive travel. In the following sections the archaeological record of the most remote Adriatic islands is investigated in search of patterns that may indicate the changing intensity of long-distance maritime interaction.

3.1.2 Adriatic islands

Over a thousand islands break the surface of the Adriatic (Figure 100). Virtually all of them, including all of the large ones, are situated along the eastern Adriatic coast and today belong to Croatia. According to Duplančić Leder *et al.* (2004), there are 1246 islands, islets, and rocks in the Croatian part of the Adriatic, where an island is a piece of land completely surrounded by the sea with an area larger than 1 km^2, an islet has an area between 0.01 and 1 km^2, and a rock is smaller than 0.01 km^2. Almost all of these islands are arranged in several parallel chains that run roughly along the coast. They are distributed across an area that extends some 400 km from Dubrovnik in the southeast to Pula in the northwest and varies in width between 20 and 50 km.

The Adriatic archipelago was formed relatively recently by Holocene transgression. About 20.000 years ago, during the Last Glacial Maximum, virtually all today's islands were part of the mainland, the only exceptions being Palagruža, Jabuka, and probably also Sušac (Forenbaher 2002: Figures 1 and 2). By the end of Pleistocene, the rising seawaters began flooding the valleys between the coastal ranges (Fairbanks 1989: Figure 2; Lambeck *et al.* 2014: Figure 4a), and by 6000 BC, most of the islands obtained roughly their current outline (Forenbaher 2002; van Andel 1989; 1990).

Terrestrial resources of the islands vary, but are never abundant, the main limiting factors for human presence being the scarcity of soil and water. In the rough and mountainous karstic landscape, agriculture requires intensive labor investment in field clearance and terracing, for which there is some evidence beginning with the second millennium BC (Chapman *et al.* 1996: 283-284). Large tracts of stony land, and sometimes entire islands, are more productively exploited by keeping herds of sheep and goats. Only a very few islands, for example Hvar (Kirigin 1993), boast relatively large expanses of arable land. Given the limits of traditional subsistence economies and technologies, a number of large islands could have supported permanent human populations subsisting on a mixture of agriculture, herding, and fishing (Bass 1998: 181).

Fourteen Adriatic islands are larger than 50km^2, the largest being Cres and Krk at 405.7 km^2 and 405,2 km^2, respectively (Duplančić Leder *et al.* 2004). Although the archaeological evidence is patchy and uneven, it suggests that all of these islands were settled early. Finds from Lošinj (Komšo *et al.* 2005), Dugi Otok (Vujević and Bodružić 2013; Vukosavljević *et al.* 2014), Brač (Vukosavljević *et al.* 2011), Hvar (Forenbaher 2002: 364) and Korčula (Čečuk and Radić 2005) indicate that they were inhabited before the Holocene transgression separated them from the mainland. Most of the large islands seem to have been occupied continuously from

the time of transition to farming up to the present (Benac 1979-1987). This is not surprising, given their proximity to the mainland or to the neighboring islands. In late prehistoric times, each one of the largest islands may have supported up to a few thousand inhabitants (Forenbaher 2002: 372; Stančić and Gaffney 1996).

Many of the small islands and islets also have yielded archaeological evidence of prehistoric occupation. Although often too small to support a self-sustaining population, most of them were only a short distance away from a larger island or mainland, allowing the islanders to commute to additional resources. While the island communities may have been essentially self-sufficient, they were not isolated. Interaction networks linking the islands, the islets, and the mainland were easily maintained across short stretches of water, and the Adriatic archipelago provided a convenient natural setting for experimenting with navigation.

A few small and distant islands differ sharply from the described majority. Although most of these relatively remote specks of land have very limited resources, some of them possess quite an impressive archaeological record that extends deep into prehistory. Why would they have been visited at all? In recent historical times, some of them have been inhabited, for a while, by small 'permanent' monastic communities, lighthouse crews, military garrisons, or penal colonies. Others supported periodic, seasonal settlement by fishermen, agriculturalists, or shepherds, who would stay for a limited period during the fishing, cultivation, or harvest season, or in search of seasonal pasture. Even where permanent settlements existed, the majority of their population actually spent much of the year on the mainland. These various modes of semi-permanent occupation were fully dependent on external support provided by communities and polities centered on the distant mainland. None of them is compatible with small-scale prehistoric societies of the Adriatic. In those earlier times, small and remote islands would have served, more than anything, as important landmarks, easily identifiable locations that provided fundamental spatial information used for wayfinding purposes (Golledge 2003: 36-37). Also, they would have offered potential places of shelter in the course of long sea voyages.

3.1.3 Remote islands

Remoteness is a relative concept: it means very different things in the Pacific Ocean and in a relatively small, landlocked sea such as the Adriatic. Most Adriatic islands cannot be considered as remote. They are separated from the mainland, or from each other, by relatively narrow channels, and accessible across straits that are rarely more than 5 km wide. Most of them can be reached by a small boat propelled by a sail or by oars

Figure 100. Location of remote islands in the Adriatic Sea.

in less than a couple of hours. Only Vis, Lastovo, and a number of small islands in their neighborhood require a considerably longer passage of about 13 km.

There are just a few islands that are more than 20 km distant from the nearest landfall, either the mainland or another island. Passage to those relatively remote places is a much more serious undertaking. It takes many hours of navigation while exposed to the open sea, which should be attempted only in stable weather conditions and good visibility, that is, during an appropriate season of the year, and even then it involves serious risks. Only five islands or small archipelagos satisfy this simple condition of remoteness: Jabuka, Pianosa, Sušac, Tremiti and Palagruža (Figure 100). Svetac also should be included, although it is just 19 km away from the nearest neighboring island, since it is located at the end of a long island chain. All six of them are small islands or islets, the area of the largest being barely over 4 km^2. Their natural resources are severely limited or insignificant from the point of view of a traditional farming population, with the exception of Tremiti archipelago, which boasts sizable patches of cultivable land.

The earliest archaeological evidence recovered so far from any of these islands dates to around 6000 BC, which coincides with the time of transition to farming. At that time, the sea level in central Adriatic was about fifteen meters lower than today (Lambeck *et al.* 2004: 1595, Figure 12), but locally it may have been much closer to its modern relative level due to tectonic uplift

Island	Area (km^2)	Highest elevation (m)	Closest land (km)	Apparent target size (°)	Target/ distance ratio (°/km)	Biogeographic diversity index (km^2/km)	Number of inhabitants (year)
Jabuka	0,02	96	22 (Svetac)	0,5	0,02	0,001	0
Pianosa	0,11	13	21 (Tremiti)	1	0,05	0,005	0
Palagruža	0,32	103	44 (Sušac)	3	0,07	0,007	0
Tremiti	3,06	116	22 (Italy)	11	0,50	0,139	401 (1951)
Sušac	4,03	239	20 (Korčula)	8	0,40	0,202	24 (1953)
Svetac	4,19	316	19 (Biševo)	6	0,32	0,221	64 (1953)

Table 15. Descriptive statistics for the remote Adriatic islands

(Korbar *et al.* 2009: 88). Since the islands rise steeply from relatively deep sea, they would have been only slightly larger and similarly shaped.

All remote Adriatic islands are waterless and sun-scorched. Water is available only from ponds, made or improved by people, and from cisterns, the earliest of which were constructed during the Hellenistic period. Another common characteristic is that the sea surrounding these islands abounds in marine resources. These rich fishing-grounds were heavily exploited and often contested by competing fishing communities in recent historical times (Županović 1993: 225-228).

Descriptive statistics of the Adriatic remote islands are listed in Table 15. The areas of each island and island group are from Duplančić Leder *et al.* (2004), while maximum elevations, distances to the closest landfall, and apparent target widths were taken from 1:25.000 general survey maps. Target/distance ratio (a proxy measure of likelihood of island discovery) and biogeographic index (a proxy measure of likelihood of island colonization) were calculated from those data for each island. Distance to the nearest landfall coincides with the longest single voyage in all cases except for Pianosa, which is one kilometer closer to Tremiti than the distance from Tremiti to the Italian mainland. The maximum permanent population figures are based on historical census data that cover roughly the last couple of centuries (Korenčić 1979). They do not include temporary residents such as lighthouse crews or military personnel.

Data in Table 15 indicate that there are two categories of remote Adriatic islands: those that are more difficult to discover and cannot be permanently settled, and those that are easier to discover and provide marginal conditions for colonization. Their target/ distance ratios differ for an order of magnitude, while their biogeographic indexes differ for two orders of magnitude. The islets of Jabuka, Pianosa and Palagruža fall into the first category, while the small islands of Tremiti, Sušac and Svetac belong to the second. This corresponds to the distinction between the islands that can only sustain short-term cultural commitments, and those that can support medium-term and possibly multi-seasonal cultural commitments (Bass 1998: 181). According to Bass, islands of the first group have extremely limited terrestrial resources that prohibit visits of longer duration, regardless of nearby marine biodiversity. Islands of the second group also have limited (but not negligible) terrestrial diversity, which includes useful wild flora, soils that may support agricultural pursuits, and a landscape that allows limited ovicaprid herding.

The following sections of this chapter provide a brief account of each of the remote islands, in terms of its location, morphology, resources, archaeological record, and history.

3.1.3.1 Jabuka

This tiny islet lies some 60 km off the eastern Adriatic mainland, 22 km to the west-northwest from the small island of Svetac (Figures 100 and 101). Jabuka is a towering crag of gabbro, an intrusive igneous rock. Its pointed summit rises almost 100 meters above the current sea level. Its steep cliffs, almost completely devoid of vegetation, continue to drop off steeply deep underwater (Juračić 2005). Jabuka lies away from the main shipping lanes and is rarely visited. In clear weather, its tall, dark shape is visible from afar, and can serve as an off-route landmark (Golledge 2003: 36) in trans-Adriatic navigation. Its shores are inaccessible and do not offer protected coves or reliable anchorages (Anon. 1976). There are no traces of human activity from any historic or prehistoric period.

3.1.3.2 Pianosa

This is another tiny islet, located some 35 km from mainland Italy, 21 km to the northeast of the Tremiti archipelago (Figures 100 and 101). Composed of Eocene

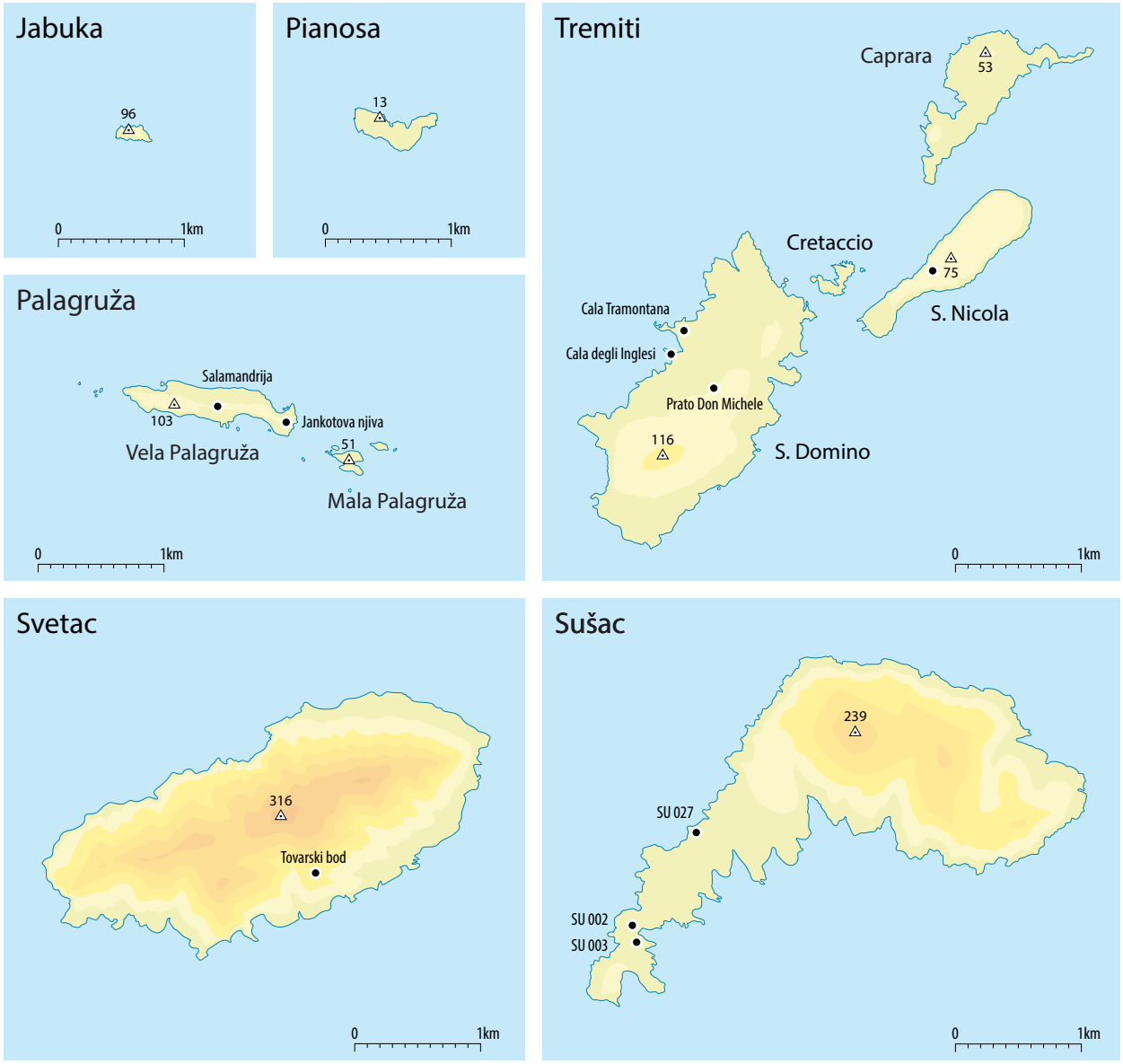

Figure 101. Remote islands of the Adriatic drawn to the same scale.

and more recent limestones, Pianosa is a polar opposite of Jabuka: it is low and flat, and is almost completely washed over by surf during major storms (Anon. 1983). The immediately surrounding waters are shallow, particularly off its southern and western shores. Due to its low profile, Pianosa is of little value as a landmark. It is best avoided, since shoals and currents make it dangerous for navigation, as attested by several Roman and later shipwrecks in its vicinity. A lighthouse and an abandoned building next to it are the only evidence of recent human presence.

3.1.3.3 Palagruža

Only the most important information will be summarized here about the small archipelago that is the topic of this book (Figures 100 and 101). Closest neighbors of Palagruža are Sušac, 44 km towards the north, and Pianosa, 45 km towards the west-southwest. The closest point in mainland Italy is Torre di Calalunga on Gargano Peninsula, 52 km to the south, while the eastern Adriatic mainland lies over 100 km away to the northeast. This makes Palagruža the most isolated speck of land in the Adriatic. Three small coves do not offer adequate shelter for large vessels, but their pebble beaches provide good possibilities for pulling small boats ashore.

The earliest evidence of human presence on Palagruža dates from the time of transition to farming. A few Impressed Ware potsherds testify unequivocally of visits to the island during the first half of the sixth millennium BC, but those visits seem to have been rare and involved only modest low-level activities.

This was followed by a period from around year 5500 until year 3000 BC (Middle Neolithic, Late Neolithic, and Early Copper Age) during which we do not know if anyone was visiting Palagruža. A substantial part of flaked stone artifacts that are not narrowly time-sensitive may have been deposited during that period, as well as the plain vessels of generic 'Neolithic' shapes, but it is equally possible that almost nothing was happening on Palagruža throughout those times. Most of the temporally sensitive artifacts by far (diagnostic potsherds and temporally sensitive flaked stone and ground stone artifacts) belong to the third millennium BC and testify of intensive activities. Only a very small number of diagnostic finds may be attributed with confidence to later prehistoric times, the second millennium and the first half of the first millennium BC.

Palagruža was again frequently visited during the classical antiquity. Abundant fragments of top-quality ceramics (including black-figure and red-figure painted vases), potsherds inscribed with votive graffiti, coins, jewelry, and other probable votive offerings and ritual paraphernalia, testify that a sanctuary devoted to Diomedes existed at Salamandrija from the fifth until the first century BC (Kirigin and Čače 1998; Kirigin 2012: 58-73). Three ancient shipwrecks (two Hellenistic and one Roman) have been recorded in its vicinity, while a roman anchor was recovered from Stora vloka cove (Gaffney and Kirigin 2006: 82-83). The sanctuary was replaced in late Roman times by a massive defensive structure (Kirigin 2012: 89-94).

Despite an often-assumed presence of Benedictine monks (*e.g.,* Mardešić 1993), Palagruža seems to have been largely abandoned during the Middle Ages (Kovačić 1997: 40; Kirigin 2012: 98-99). The only enigmatic evidence of medieval activities are three burials without burial goods, two of them dated by radiocarbon around 9th century AD, the third around 12th century AD (Forenbaher *et al.* 2015: 102-103). Palagruža became important again in the early sixteenth century, with the development of deep-sea fishing. That is when a small defensive tower was built, but it was soon demolished by Venetian authorities and there are no traces of it left today (Kirigin 2012: 108-109). A lighthouse was built on the island's summit in year 1876. Late 19th century photographs show a small church standing on Salamandrija, surrounded by a few fishermen's huts; these were destroyed during World War I (Kirigin 2012: 104). According to the existing census data, Palagruža never supported permanent inhabitants.

3.1.3.4 Tremiti

The small archipelago of Tremiti lies 23 km off mainland Italy, the nearest landfall being Torre Mileto, just west of Gargano peninsula (Figures 100 and 101). The archipelago consists of a small island, San Domino, and three islets, Caprara, San Nicola, and Cretaccio. All are composed of Eocene and more recent limestones, and have high, mostly inaccessible shores. Above the cliffs of San Domino and San Nicola are relatively large plateaus, covered by deposits of Upper Pleistocene loess.

The indented shores of Tremiti offer shelter from westerly, northerly, and northeasterly winds. A small port has existed there since classical antiquity. The archipelago lies off the direct trans-Adriatic route that connects Vis and Korčula via Sušac and Palagruža to Gargano, but is conveniently located for navigation towards Italian destinations situated to the west of Gargano Peninsula (Kozličić and Faričić 2004: 45). The islands today are mostly covered in maquis and pine groves, but relatively large tracts of land were cultivated in recent historical times, when fishing and agriculture provided a living for a substantial population. San Domino was the most productive island, yielding harvests of wheat, grapes, olives and figs, and parts of Caprara and San Nicola also used to be cultivated (Anon. 1950). Another resource of potential interest for prehistoric visitors is a chert source at Cala Sorrentino on Caprara (Fumo 1980: 39).

The archaeological record of the Tremiti archipelago is relatively well known. The best represented prehistoric period is the Neolithic. Flaked stone artifacts, most of them probably dating from between year 6000 and 4000 BC, have been collected from the surface of all of the constituent islands (Fumo 1980), while pottery from that period was recovered from three sites on San Domino. Prato Don Michele, near the center of the island plateau, was excavated half a century ago by Zorzi. The site yielded numerous fragments of Impressed Ware attributable to the first half of the sixth millennium BC, associated with lithic artifacts and other occupational debris, but no structural remains (Fusco 1965; Cornaggia Castiglioni 1968).

Zorzi also located the later Neolithic sites at Cala degli Inglesi and Cala Tramontana, and extensively explored the latter (Palma di Cesnola 1965; 1967). Polychrome painted *figulina* potsherds from that site are comparable to those from Scaloria, Vela Cave (Korčula), Danilo, Ripoli, and Serra d'Alto, while the *impasto* potsherds with geometric incised designs and figural appliqué decoration closely resemble Dalmatian Danilo style pottery (Batović 1979). Both are attributable to the second half of the sixth millennium or the beginning of the fifth millennium BC (Forenbaher *et al.* 2013: 599-601). These finds were associated with abundant flaked stone artifacts made of chert, as well as a few made of obsidian. Palma di Cesnola reports sickle gloss on some of the lithic blades (Palma di Cesnola 1967: 387). The deposit also contained a small ground stone ax, a few ornaments made of *Spondylus* shell, some sheep and goat bones, and marine mollusks. Again, structural remains were not encountered. Cut into this layer with

occupational debris were several pits containing human remains of about a dozen individuals. The few complete skeletons were in flexed position, with Late Neolithic Diana-style vessels deposited close to their heads.

The next (scarce) traces of human visitors belong to the first millennium BC (Iron Age) and were recovered from the islet of San Nicola. They consist of potsherds excavated from beneath the Benedictine abbey, and cylindrical holes in exposed limestone bedrock that have been interpreted as post-holes. Substantial amounts of Hellenistic ceramics, dated from the third to first century BC, as well as a second-century BC bronze coin, hint at more frequent and, possibly, prolonged visits. They are followed by the remains of several Roman structures. The fortified Benedictine abbey, founded in the eleventh century, and heavily modified on several later occasions, was abolished in the late eighteenth century. A penal colony, established in 1792, lasted until 1926. In recent historic times, the population of Tremiti has been stable at around 350 people, although many of the inhabitants do not reside on the islands year-round.

3.1.3.5 Sušac

This small island lies almost 70 km off the eastern Adriatic mainland, 20 km to the south of the island of Korčula (Figures 100 and 101). Composed mostly of Cretaceous limestones, it consists of a hilly northeastern part and a smaller knoll in the southwest, connected to each other by a long, flat isthmus. Sušac rises steeply from the sea, except along a part of its southern coast that is indented by a number of small coves and relatively easily accessible.

Sušac has no natural harbors, but several small coves offer shelter from northerly and westerly winds, and provide the possibility for small boats to be pulled ashore. A few Hellenistic or Roman shipwrecks have been reported in the vicinity (Rismondo 1990). Sušac is often mentioned in medieval written sources, but only as an off-route landmark in navigation along the Adriatic (Kozličić 1997). The island today is covered in brush, maquis, and some forest in its upper reaches. The scarce cultivable soil is mainly restricted to abandoned agricultural terraces that cover an area of just a few hectares. A few hundred sheep and goats, periodically tended by shepherds based on other islands, have been grazing on Sušac from times immemorial. Water for them is provided by about a dozen water holes lined with clay or cement (Bass *et al.* 1997; Radić *et al.* 1998).

A substantial amount of archaeological work has been carried out on Sušac over the last two decades. Extensive surface survey was followed by excavation of several small test trenches at promising locations (Bass *et al.* 1997; 1998; Radić *et al.* 1998; 2000; Tolja and Radić 2010). The only well-represented prehistoric period is the Neolithic. Three open-air sites, all of them located on the isthmus, yielded Impressed Ware pottery attributable to the first half of the sixth millennium BC (Bass 1998: 168-171). One of them, SU003, is a surface scatter of Impressed Ware pottery and lithic artifacts, recorded by the surface survey. Test excavation at a different site, SU002, yielded many typologically early 'Impressed Ware A' (Müller 1994) potsherds and a radiocarbon date of around 5800 BC (Bass 2004: 53). Also reported were numerous flaked stone artifacts, a few fragments of ground stone axes, and marine and land mollusks (Radić *et al.* 2000). There were no traces of architectural remains.

The third site, SU027, also yielded some Impressed Ware sherds, but almost all of the finds recovered by excavation from secure contexts are attributable to the second half of the sixth millennium or the beginning of the fifth millennium BC (Della Casa and Bass 2001). Among them are numerous polychrome painted *figulina* sherds similar to those from Vela Cave (Korčula), Gudnja, Scaloria, and, to a lesser extent, Serra d'Alto. The context containing polychrome *figulina* sherds was dated by radiocarbon to around 4800 BC. Associated with them were numerous flaked stone artifacts, including several blades with sickle gloss. Most of those artifacts were made of cherts that must have been imported, since raw material of adequate quality is not to be found on Sušac (Perhoč and Altherr 2011), whilst a small number of obsidian artifacts were made of Liparian obsidian. The deposit contained marine and terrestrial mollusks, as well as bones of sheep and goats, sea mammals, birds, and fish. Some of the exposed drystone structures – remains of a free-standing wall or a retaining wall – belong to the same context. About a dozen fragments of ground stone axes were recovered from the surface of the site.

After a long break, the next traces of human visits are fragments of a characteristic Ljubljana-Adriatic open bowl with wide rim, richly decorated by incision, excision, and incrustation (Figure 102). Those fragments, recovered from Site SU002 (Uvala Duga), currently represent the only find from Sušac that is clearly attributable to the first half of the third millennium BC. A few other potsherds shaped by free hand from the surface of the same site probably belong to later prehistoric periods, although they are not narrowly time-sensitive (Della Casa and Bass 2001). Another fragment of a plain open bowl with wide rim was collected during surface survey from the vicinity of watering holes in the hilly southeastern part of the island (Radić 2009: 22, Figure 8).

Following another break, second century BC Hellenistic pottery, remains of Roman rural architecture, a late Roman fortification, and a small Early Christian church that was later adapted by Benedictine monks (Bass *et*

Figure 102. Uvala Duga, site SU002, fragments of an open bowl with wide rim, decorated on the exterior, interior, and top of the rim by incision, excision and incrustation.

al. 1997; Radić *et al.* 1998; 2000) testify of increasingly frequent and permanent human presence. Written sources from 15th century mention two small seasonal settlements with a little church and sardine-salting huts, used by fishermen from the neighboring islands of Vis and Lastovo. A major lighthouse was built at the southeastern end of the island in year 1878. A tiny, semi-permanent settlement existed on Sušac until a few decades ago. It is still seasonally occupied by a single shepherd.

3.1.3.6 Svetac

Also known as Sveti Andrija, Svetac is the largest of all remote Adriatic islands (Figures 100 and 101). It lies some 55 km off the eastern Adriatic mainland, 19 km to the west of the small island of Biševo. Composed of Cretaceous limestones, the entire island consists of steep hills with several summits higher than 250 meters above sea level. Most of the Svetac's shores are inaccessible, and steep gradients continue deep underwater. There are no beaches or other natural landing spots, and a few small coves offer only poor shelter. These were used in antiquity as overnight anchorages during navigation between Italy and the north-eastern Adriatic (Kozličić and Faričić 2004: 37), as attested by numerous Hellenistic anchors recovered from Kolac and Slatina coves, as well as a few shipwrecks dating from that period, or slightly later (Gaffney and Kirigin 2006: 81-82).

The island today is covered in maquis, holm oak, and pine forest. Its timber and pitch were highly valued by local shipwrights. Cultivable soil is scarce, concentrated on a small plateau near the island's summit, and in relatively recently built agricultural terraces. Although agriculture was never of major importance in recent historic times, vineyards used to be relatively productive, yielding up to 100,000 liters of wine annually (Gaffney and Kirigin 2006: 9). Aside from that, carob trees, olives, figs and walnuts were planted, and a limited number of sheep were raised.

Little archaeological work has been carried out on Svetac (Kirigin and Milošević 1981; Kirigin 1999). A cave site, Tovarski bod, was excavated in 1886 by a schoolteacher from Komiža, a village on the island of Vis. It yielded pottery shaped by free hand, including a sherd attributable to the Bronze Age. Remains of Roman buildings, a small medieval church and a Benedictine monastery have been located by surface survey near the island's summit, next to the only sizable patch of cultivable soil. Ruins of a late Roman fort overlook the eastern end of the island (Gaffney and Kirigin 2006: 10, 12, 74). A settlement consisting of a few houses and a small church was founded near the southern shore in late 19th century; today, no permanent residents remain.

3.1.4 Patterns of diachronic change

The tiny islets of Jabuka and Pianosa are devoid of all resources and evidently uninhabitable. Neither of them lies directly on the main trans-Adriatic shipping route, and only Jabuka can serve as an off-route landmark. It is not surprising that they did not yield any terrestrial archaeological evidence. In contrast, one would expect that the relatively large island of Svetac would have possessed a more abundant prehistoric record. In its case, the apparent scarcity of archaeological evidence is probably due to the absence of systematic field research.

The archaeological record of the other three remote islands – Sušac, Tremiti and Palagruža – is reasonably well known, and exhibits an interesting temporal

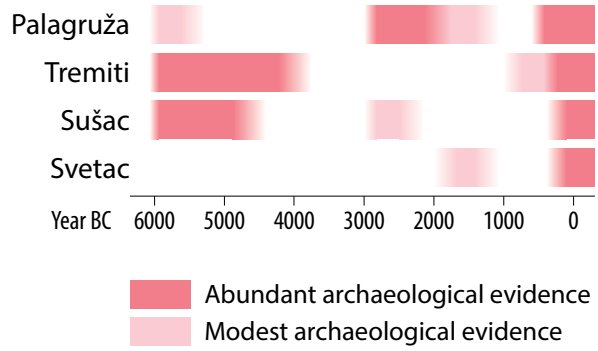

Figure 103. Diachronic changes in the abundance of archaeological evidence for remote Adriatic islands

pattern (Figure 103). There is ample evidence of Neolithic visitors, but after that the evidence becomes scarce until the end of prehistory, with the exception of Palagruža. Clearly, these islands were visited more regularly during certain periods, and much less often in other times. Finds from the first half of the sixth millennium are present on all of them, and are quite abundant on Sušac and Tremiti. The second half of the sixth millennium and the early fifth millennium BC are well attested on the last two islands, while finds from the later fifth millennium are present only on Tremiti. Apparently, during the course of the Neolithic, the remote islands were abandoned one after another.

The only well-represented later prehistoric period is the third millennium BC. Remains from that period are abundant only on Palagruža, the most remote and, at the same time, the most strategically positioned Adriatic remote island, while the island of Sušac yielded a single contemporary find. Both of those islands lie directly on the main trans-Adriatic route, and the first one is too small, remote and devoid of resources to be permanently settled. After that, all that we have is a single Bronze Age potsherd from Svetac, a few Bronze Age sherds from Palagruža, possibly a few more from Sušac, and a few Iron Age potsherds from Tremiti. Only during the Hellenistic period do we find evidence again of an almost universal human presence.

Two things emerge from the described pattern. One is that the universally well-represented periods are those during which one may well argue for colonization: the time of transition to farming, and the time of foundation of Greek colonies (by default, colonization implies exploration and travel). The other is that the most prominently represented prehistoric periods correspond to the times when broadly uniform pottery styles extended over vast parts of Europe: the Impressed Wares and the Bell Beakers.

3.1.4.1 Transition to farming

Little doubt remains that the earliest domesticated plants and animals arrived to Europe from Western Asia (Zohary 1996; Jones 2001; Rowley-Conwy 2003), although there is no consensus yet about the mechanisms and processes involved (Price 2000; Bellwood and Renfrew 2002; Ammerman and Biagi 2003; Isaakidou 2011). Actual movement of people probably played an important role. Molecular genetics supports a certain degree of immigration (Jones 2001; Richards *et al.* 2002), although who moved, from where, in what numbers, and over which distances, remains open to discussion. There would have been room for both autochthonous and immigrant travelers, and the process was marked by much regional variation (Zvelebil and Lillie 2000; Forenbaher and Miracle 2005; 2014a; 2014b). Regardless of the details, it would be hard to imagine the spread of domesticates, and the accompanying new technologies, knowledge and skills, without intensive interaction. The common presence of finds from the time of transition to farming on remote Adriatic islands testifies of their importance in that process.

A few of these previously uninhabited islands seem to have been colonized soon after the first exploratory ventures. The evidence is abundant and covers longer periods on Tremiti and Sušac, islands that, aside from being stepping stones for trans-Adriatic travel, provide a limited possibility of settlement. It is much scarcer and covers a shorter period on Palagruža, a strategically located islet with severely limited resources. This corresponds well with the situation where travel is undertaken primarily in search of places to settle.

Later Neolithic finds from Sušac and Tremiti include evidence of herding (sheep and goat bones), agriculture (blades with sickle gloss, broken ground stone axes), exploitation of marine resources (mollusk shells, bones of fishes and marine mammals), lithic production activities, building of drystone structures (Sušac), and burial of the deceased (Tremiti), suggesting permanent or semi-permanent settlement. One may notice that the *duration* of Neolithic 'settlement' of the Adriatic remote islands correlates with their terrestrial resources. On the tiny Palagruža, these would have been depleted almost immediately, on the much larger Sušac they would have lasted somewhat longer, while the loess-covered Tremiti offered relatively good opportunities for continuous agricultural production.

3.1.4.2 The rise of elites

Of all the remote Adriatic islands, only Palagruža yielded abundant evidence from the third millennium BC. This does not conform to expectations for island colonization outlined above, Palagruža being the most remote, tiny, and with scarcely any terrestrial resources; it does, however, occupy the crucial spot in the main trans-Adriatic route. Sušac, the somewhat larger island that yielded only a single find from this period, also sits on that route. This suggests that the

motives for visiting remote islands have changed since the Neolithic times. Rather than being motivated primarily by colonizing ventures, travels were now undertaken for other purposes.

In much of Europe, traditional social structures broke down and more mobile ways of life emerged during the third millennium BC. It has been argued that '...the new maritime links that were forged in this process ... gave it such an international character'; it was a time when '...the diverse regions of Europe were linked as never before' (Sherratt 1998: 251, 256). In European part of the Mediterranean, that time was marked by vertical gradations of status and wealth, and an aggressive, individualizing ideology expressed through a common symbolic system that was centered on drinking cups, weapons and warrior values, clearly conveyed in individual burials. It was a new age of truly long-range contacts by land, and especially by sea (Broodbank 2013: 260, 306, 325).

The main archaeological indicator of social change in the eastern Adriatic is the appearance of individual burials under stone cairns like those in Tivatsko polje (Primas 1996), around the source of river Cetina (Marović 1991), and many other. Those burials sometimes contain carefully made and richly decorated drinking cups, metal daggers, battle axes made of stone or metal, and archery equipment. They suggest that social reproduction became dependent on circulation of the new status goods among the local elites, requiring communication that, in this region, would have been primarily by sea (Kaiser and Forenbaher 1999: 322).

It follows that the main attraction that brought the people back to Palagruža in the third millennium BC was neither its chert source nor its deep-sea fishery. More likely, the special significance of Palagruža to trans-Adriatic communication was fully recognized at the time when long-distance maritime links assumed paramount importance.

3.1.5 Remote islands and long distance interaction

There are two outstanding periods of continental-scale stylistic unity during the post-Pleistocene prehistory of the European part of the Mediterranean. One is the first half of the sixth millennium BC, with the Impressed wares distributed in discontinuous patches along the shores and islands of southern Europe, from the straits of Otranto to the Atlantic facade of Portugal. The other is the third millennium BC, when the Bell Beakers are found, again discontinuously, across an even larger area from Scotland to Sicily and from Portugal to Poland, while similarly shaped and decorated pottery (including Ljubljana-Adriatic and Cetina) is even more widespread (Maran 1997; 2007; Nicolis 2001a; 2005).

Ethnoarchaeological research has shown conclusively that there is no direct correlation between stylistic similarity and interaction (Hodder 1979). To the contrary, stylistic diversity often reflects intensive interaction among neighboring competing groups, which use style as a means of expressing and maintaining group identity. The Middle Neolithic of the Adriatic may provide a good example, with its variety of regional pottery styles, paralleled by good evidence of long-distance exchange.

On the other hand, stylistic phenomena spanning large parts of a continent would be hard to explain without invoking regular long-distance contacts. The early sixth millennium and the third millennium BC were times when radical innovations were introduced over vast parts of Europe: first, a subsistence economy based on food production, and second, a social organization based on an aggressive, individualizing ideology. In both cases, long-distance travel and interaction would have played a crucial role.

This chapter opened with the assumption that assemblages from small, remote islands might provide a crude instrument for measurement (Binford 1972: 456) of long-distance interaction. The archaeological record of the Adriatic remote islands supports this assumption rather well. It indicates that the importance of those islands was particularly great during periods marked by migration or intensive interaction among various communities occupying the Adriatic shores.

3.2 Palagruža and early farming

3.2.1 Palagruža before the transition to farming

In recent geological past, Palagruža probably always remained an island. During the Last Glacial Maximum, when the global sea level was at its lowest, it may have been roughly the size of the middle Dalmatian island of Šolta, some thirty kilometers away from mainland Italy. Sea level rose considerably by the end of Pleistocene, but it was still about fifty meters lower than today (Lambeck *et al.* 2014: Figure 4a). By then, Palagruža was already much smaller, but due to relatively steep shores, its distance from the mainland increased by only about ten kilometers.

Forty kilometers of open sea did not present an insurmountable obstacle to hunter-gatherers who inhabited the Mediterranean shores during the Pleistocene to Holocene transition. Settlement of Cyprus in the eleventh millennium BC and Melian obsidian from the roughly coeval levels of Franchthi Cave on Peloponnesus testify of their seafaring capabilities (Broodbank 2006: 208-209; 2013: 148, 152-154). While people may have visited Palagruža already at that time, it is hard to come up with a motive for

a sea crossing to a fairly small and distant island with limited resources. The wide plain that today constitutes the bottom of northern Adriatic Sea would have been much more attractive to bands of hunter-gatherers. At the time, its relatively dry steppe environment would have provided appropriate habitat for large herds of herbivore macrofauna (Miracle and O'Brian 1998: 44-45). Marshy ecotones along its coasts (Bortolami *et al.* 1977: 141), as well as woods and thickets adjacent to the extended lower courses of Po River and its tributaries, would have supported diverse and maybe even more productive flora and fauna (van Andel and Shackleton 1982: 451).

If Palagruža was visited during that period, people probably would have kept to its shores, which would have offered a relative abundance of coastal and maritime food resources. Evidence of those visits therefore should be sought primarily below the current sea level. The island's summit might have served as a vantage point for monitoring the movement of game animals (if and while they were present on the island), but not a single find among the rich archaeological evidence presented in previous chapters speaks of hunter-gatherer presence. The earliest visits to Palagruža that left a trace took place around the beginning of the sixth millennium BC, at the time when farming was spreading across the Adriatic region.

Two finds reported in literature supposedly testify of earlier visits. The chapter on Palagruža's role in the spread of farming therefore must begin with a critical discussion of those finds.

3.2.1.1 An object made of gabbro from Vela Cave

A stone object of an unknown purpose, a cobble shaped by grinding and polishing was found in Vela Cave on the island of Korčula (Radić and Lugović 2004: 8-9, Figure 4; Radić 2009: 13-14, Figure 2). It was recovered by controlled excavation from a level attributed to late Mesolithic according to other diagnostic finds, and dated by radiocarbon to the second half of the eighth millennium or the beginning of the seventh millennium BC (Radić 2009: Table 1). The object is made of gabbro, an intrusive igneous rock of a dark color and a coarse grainy structure. Similar igneous rocks are rare in Dalmatia. According to recent geological research, they appear in middle Adriatic along the line linking Jabuka Shoal, via the islets of Jabuka and Brusnik, with Komiža on the island of Vis (Juračić *et al.* 2004: 83).

Palagruža is offset from that line about seventy kilometers towards the southeast. The confusion about its alleged volcanic origin was initiated in late 18th century by Albeto Fortis. The broken cliffs of Palagruža reminded him of Vesuvius and led him to conclude, without ever disembarking, that the islet must be of volcanic origin (Fortis 1984: 248). His claim was refuted already by Marchesetti (Marchesetti 1876: 292), while a recent geological survey (Korbar *et al.* 2009) has ascertained the absence of igneous rocks throughout the Palagruža Archipelago, apart from the microscopic, wind-deposited particles of tephra that testify of volcanic activity somewhere within the region during the Middle Triassic period (Kirigin 2012: 17). The sole exception are isolated cobbles of igneous rock at the beach of Zolo, which geologists presumed had been brought by fishermen, probably from the islet of Brusnik (Korbar 2013). Consequently, even a conditional reference to what used to be called 'the volcanic triangle of Jabuka – Komiža – Palagruža' should be abandoned.

Why then is the gabbro object from Vela Cave sometimes linked to Palagruža? About fifteen years ago, petrographic and geochemical correlative analyses were carried out of the object from Vela Cave, rock samples from Brusnik, Jabuka and Vis outcrops, and a single cobble from Zolo beach at Palagruža (Radić and Lugović 2004: 12). Their purpose was to establish the source of raw material for the artifact from Vela Cave. Aside from the sample from Vis, all of the analyzed samples proved to be closely similar, but the cobble from the secondary source at Palagruža provided the closest match to the object from Vela Cave (Radić and Lugović 2004: 14, 16). This led the authors to conclude that the object from Vela Cave was made of a rock that came from Palagruža. That conclusion is unwarranted.

Petrographic and geochemical analyses were carried out on a minimal number of samples, one from each primary outcrop. This sampling procedure cannot be regarded as representative. 'Relevant and reliable data of analyses cited in earlier publications' that are shown in diagrams together with their own analyses results (Radić and Lugović 2004: 15, Figures 7 and 8) point towards considerable internal variability of the Brusnik gabbro, suggesting that the most accessible primary source was not sampled adequately. Samples from Vela Cave and Palagruža fall pretty close to some of those formerly analyzed and published samples, and they fit among them quite well. A more comprehensive sampling of Brusnik probably would show that the object from Vela Cave and the cobble from Palagruža fall within the internal variability span of that source.

Even more important is the question, how did the gabbro cobbles end up on a Palagruža beach? Since there are no primary outcrops of gabbro at Palagruža, it may be presumed that fishermen brought them there as ballast, the dead weight needed to stabilize their empty boats. When the boat is laden (in the case of Palagruža, with barrels full of salted sardines), ballast is no longer needed and is left behind on the beach. Gabbro serves that purpose excellently, since it is hard,

resilient and extraordinary heavy, with specific weight of around 3000 kg/m^3, as compared to 2300 kg/m^3 for an average carbonate rock. Fishermen from Komiža, who traditionally exploit Palagruža fisheries, also often fish around Brusnik, where entire beaches are made of gabbro cobbles.

Close petrographic and geochemical similarity between the gabbro artifact from Vela Cave and the cobble from Palagruža's Zolo is unquestionable, but both of those objects probably were brought from Brusnik. The first one was brought to Vela Cave some nine thousand years ago, while the second was brought to Palagruža a few decades or a few centuries ago. Since Brusnik in the eight millennium BC was a remote island, separated from Korčula by several sea crossings, each at least 15 kilometers long, the object from Vela Cave remains the only indisputable evidence of pre-Neolithic open-sea navigation in the Adriatic (Radić 2009: 14).

3.2.1.2 Perforated Columbella rustica

Columbella rustica (rustic dove shell) is a small (10-15 mm) but attractive sea snail, its glossy shell marked by a yellowish brown reticular pattern (Perlès 2016). Dove shells are common and widely distributed in the Mediterranean, and can be collected from Dalmatian beaches by the hundred after storms driven by the Jugo wind.

Salamandrija yielded a chance find of a perforated *Columbella rustica* shell (Radić 2009: 15, Figure 3). Jewelry made of such shells, either threaded on a string or worn as pendants, was common during the Late Upper Paleolithic and Mesolithic (Komšo and Vukosavljević 2011; Vujević and Bodružić 2013; Cristiani *et al.* 2014; Vukosavljević and Karavanić 2015), but is not limited to those periods. It is not surprising that it also appears later, on Neolithic sites in Dalmatia (Kukoč 2012: 182-183, Figure 20), Italy (Zamagni 2006) and the Aegean (Perlès 2016), given its appeal and easy availability. A single perforated dove shell does not necessarily testify of visits to Palagruža in times before the transition to farming.

3.2.2 The spread of farming

The earliest finds from Palagruža that can be attributed safely to a specific period belong to the time when farming was spreading across the Adriatic region. Only a few temporally sensitive finds are present, fragments of four different vessels decorated in the characteristic Impressed Ware manner. Fragments of two of those vessels were recovered from Jankotova Njiva, while one fragment each was found at Salamandrija and Pod Lozje (Figures 22, 95: 1, 2 and 97). To the same period probably belong the remaining modest finds from Jankotova Njiva (Figure 95: 3-7), and maybe also the rare 'generic Neolithic' potsherds from Salamandrija (Figure 23: 1-6), as well as an unknown part of the lithic assemblage from the same site.

All decorated Impressed Ware potsherds belong to the typologically early variant of that pottery style (Batović 1979: 496-509; Čečuk and Radić 2005: 71-77), which corresponds to Müller's 'Impressed Ware A' phase (Müller 1994). Stratigraphic sequence and radiocarbon dating at Nakovana Cave support the temporal primacy of 'Impressed Ware A' style, although the dates for 'Impressed Ware B' at that site are less than a century younger than those for 'Impressed Ware A' (Forenbaher and Perhoč 2015: 9-10). At many other sites, 'Impressed Ware A' appears together with 'Impressed Ware B' potsherds. Rare radiocarbon dates that can be linked explicitly with 'Impressed Ware A' pottery do not suggest that this style is restricted only to the very beginning of the sixth millennium BC (Forenbaher *et al.* 2013: 598). This leads us to conclude that the typologically early Impressed Ware pottery from Palagruža may easily belong to the time around year 6000 BC, which would make it contemporaneous with the earliest similar finds from Apulia and Dalmatia (Skeates 2003: 184; Forenbaher *et al.* 2013: 597), but it may also be several centuries younger.

3.2.2.1 The role of Palagruža in the spread of farming

Small quantity and high dispersion of the early sixth millennium BC finds belie the existence of a substantial settlement on Palagruža. The recovered evidence more likely testifies of occasional sojourns and modest generalized activities like temporary sheltering, overnighting, consuming imported food and maybe preparation of food obtained from the sea. Such activities would be in agreement with using this small, strategically located islet as a stopover on a transadriatic crossing.

Why did the unique geographic location of Palagruža first become important precisely at that moment? The Mediterranean Sea itself (as opposed to its littoral) apparently played a crucial role during the spread of farming into Europe, by becoming a highway for the westward spread of innovations (Broodbank 2006: 214). It is now beyond question that the main early domesticates were introduced into Mediterranean Europe from Western Asia (Rowley-Conwy 2003; Zohary and Hopf 1993). Since it seems unlikely that they would have moved into the region without human involvement, we must consider at least some form of population transfer during the foraging-to-farming transition. A growing body of genetic evidence supports this assumption (Richards *et al.* 2002).

The transition to farming in Europe has been explained by a wide variety of models, ranging from those that

rely primarily on migrating farmers (*e.g.,* Ammerman and Cavalli-Sforza 1984) to those that highlight the contribution of Mesolithic foragers (*e.g.,* Tringham 2000; Zvelebil 2002). At the regional (Adriatic) level, most of the explanations that have been put forward over the last few decades take into account primarily the immigrants, while acknowledging a greater or lesser contribution by autochthonous populations (Müller 1994; Bass 2004; Forenbaher and Miracle 2005; 2014a; 2014b). An exception is Budja's model that envisions an autochthonous population taking up a limited number of innovations, but rejects the possibility of any form of migration (Budja 1999). One of the reasons for emphasizing the role of incoming farmers is the scarcity of information on the autochthonous foragers (Komšo 2008). Nonetheless, today it is clear that the Mesolithic-Neolithic transition can no longer be considered in simple dichotomous terms such as acculturation versus colonization.

The arrival of the earliest domesticates in the Adriatic is accompanied by several technological innovations, most conspicuous of which is pottery. A long-established regional archaeological tradition equates the appearance of farming with the appearance of the Impressed Ware. We have presented the evidence on which that equation is based and discussed it in detail elsewhere (Forenbaher and Miracle 2006: 485-491). To summarize, domestic animals do indeed dominate faunal assemblages associated with the earliest pottery in open-air settlement sites. Caves exhibit much more variability: domestic animals dominate the assemblages at many of them, but at others the appearance of pottery is associated with mixed (wild and domestic) faunal assemblages or (less frequently) with assemblages dominated by wild taxa. There are always, however, at least a few remains of domestic animals that appear along with the first pottery. Thus one can safely use the appearance of Impressed Ware (or other pottery wares at the north-western end of the Adriatic) as a reliable proxy for the appearance of herding, and possibly also of cereal cultivation. The latter is now supported by an accumulating body of direct evidence (Chapman and Müller 1990: 130, 132; Karg and Müller 1990; Chapman *et al.* 1996: 187-189; Pessina and Rottoli 1996: 91-93; Rottoli 1999; Moore *et al.* 2007a: 20; 2007b: 30; Šoštarić 2009; Legge and Moore 2011: 188; Reed and Podrug 2016; Reed and Colledge 2016).

Most of the Impressed Ware sites are located on Adriatic islands, along the coast, or within a narrow strip of its hinterland. Their spatial distribution suggests that the sea was the main avenue along which immigrants, domesticates, sedentary lifestyle and other innovations spread into the region (Forenbaher and Kaiser 2011: 107, Figure 5.1). The earliest reliably dated Adriatic farming villages were founded at the very end of the seventh millennium BC in northern Apulia (Skeates 2003: 169), in a large plain that provided an unusually favorable natural setting for early agriculture. Initial leapfrogging of the less attractive southeastern end of the Italian Peninsula may be seen as an expected consequence of maritime colonization (Zvelebil and Lillie 2000: 62).

Soon after, around year 6000 BC, domesticates and other innovations spread along the Adriatic all the way to the Kvarner Bay, but at first they appear only in caves (Forenbaher and Miracle 2014b: 122-125). That time would have been marked by mobility and probably also exploration, since any migration must be preceded by information gathering about the destinations of potential interest to the migrants (Anthony 1990: 899-901; 1997: 23-24; Rockman 2003). During that period, members of farming communities in search of new land may have negotiated with autochthonous hunter-gatherers while spreading only selective elements of the new subsistence strategy. Equally possible is that, for a while, almost the entire Adriatic became an agricultural frontier zone (Zvelebil and Lillie 2000: 64-67) within which new technologies, domesticates, practices and knowledge were embraced selectively by the autochthonous communities before their eventual full transition to farming. Most likely, both of those scenarios played out simultaneously.

At the beginning of the sixth millennium BC, roughly a century after the first herders had appeared in Dalmatian caves, the first farming villages were founded on the eastern Adriatic coast (Legge and Moore 2011; McClure and Podrug 2016). They appeared in northern Dalmatia, a region that is best suited for agriculture after Apulia. From there, the next area towards the northwest with substantial agricultural potential is Istria. Farming villages were founded in southern Istria a couple of centuries after those in Dalmatia. Another century later, around year 5600 BC, farming spread across the Friuli Plain up to the Alpine foothills (Ferrari and Pessina 1999), while the Impressed Ware was being replaced by Danilo style pottery (Forenbaher and Miracle 2006).

By which route did farming reach Dalmatia? Since the evidence for early contacts and exploration is scattered across the Adriatic region, one should presume that farming spread by more than one route. Its spread is closely related to the question of the origin and spread of the Impressed Ware. The well-made Impressed Ware vessels do not look like products of beginners experimenting with pottery technology. Rather, they suggest that the already perfected pottery making skills and knowledge arrived from the southern Balkan Peninsula, where pottery first came into use a few centuries earlier (Perlès 2001: 99, 210-220). There is no indication, however, that the clearly defined Impressed Ware style arrived from there together with the pottery technology.

Until recently, a group of potsherds from Sidari on the island of Corfu, located in the Ionian Sea to the south of the Strait of Otranto, could be considered the earliest Impressed Ware pottery (Sordinas 1969: 401, Plates 3 and 4; Forenbaher and Miracle 2006: 508), although their temporal primacy relied on a single radiocarbon date.[1] Recent fieldwork conducted at the site has shown, however, that the dated layer was a mixture of younger and older deposits, created by a series of erosional and depositional events (Berger *et al.* 2014). The old Sordinas' date therefore should be discarded. A new radiocarbon date from an undisturbed Impressed Ware context is about two centuries younger,[2] indicating that at Corfu this ware is roughly contemporary with, or even a bit younger than, the Impressed Ware from the earliest Italian farming villages. Judging from the number of the early dated Italian Impressed Ware sites, that pottery style may be an Adriatic (or, more specifically, northern Apulian) innovation. This assumption is further supported by the pattern of the earliest radiocarbon dates for the appearance of pottery along the western Adriatic coast, which become younger not only from Apulia towards the northwest, but also towards the southeast (Skeates 2003: 169-171).

One of the routes along which Impressed Ware pottery (and farming) may have arrived to Dalmatia would have led northwards from Corfu, along the Albanian and Montenegrin coasts. It may have spread by land or by sea, but the supporting evidence is extremely scarce (Marković 1985; Bunguri 2014). For the moment, not a single radiocarbon date is available from the few Impressed Ware sites located in the coastal zone between northern Greece and southern Dalmatia (Allen and Gjipali 2014: 108) to lend support to the southeastern coastal route of the spread of farming into the Adriatic.[3]

Another route would have led from northern Apulia via Palagruža to the islands of middle and southern Dalmatia. The earliest radiocarbon dates, which are slightly earlier in Apulia than in Dalmatia, are in agreement with that proposal. The sudden change of lithic raw material acquisition practices in Dalmatia, where local cherts are replaced by Gargano cherts (Vukosavljević *et al.* 2011; 2014; Forenbaher and Perhoč 2015), testifies of intensification of transadriatic contacts at the time of transition to farming. The finds from Palagruža highlight the role of navigation for the spread of farming into the region. We do not know from which shore were brought the Impressed Ware vessels whose fragments we recovered from the island, since stylistically identical sherds are known from both sides of the Adriatic. Pottery fabric analyses may provide an answer to that question, but they have not been carried out yet. As opposed to that, lithic artifacts from Palagruža, made of Gargano cherts, testify of visitors who arrived from Apulia and probably left for Dalmatia.

3.2.2.2 Seafarers and their craft

Finds from Palagruža testify that the early sixth millennium BC navigational technology, knowledge and skills allowed fairly rapid movement of people, goods and ideas across substantial stretches of open sea. One might say that the success of farmers and shepherds in the Adriatic was contingent on the prior success of navigators and mariners (Kaiser and Forenbaher 2016a: 157, 160), although we know next to nothing about their boats (Farr 2006: 90-91). Judging by the toolkits of the time, they may have used small reed-built or skin-and-frame craft, or somewhat larger fire-hollowed dugout canoes. The only boat from that period that was recovered in central Mediterranean is an oak dugout, ten meters long and just over one meter wide, found at La Marmotta near Rome (Broodbank 2013: 154, 214). Presumably, those vessels were propelled by human muscles (by paddles), since there is no evidence for sailing anywhere in the Mediterranean before the late fourth millennium BC (Broodbank 2000: 342-343). In addition to paddlers, they could have carried a few hundred kilograms of cargo at best (Broodbank 2000: 102, Table 3). During its experimental navigation, a replica of the dugout from La Marmotta with a crew of eleven paddlers covered about 25 kilometers per day.

In contrast to the lightly equipped hunter-gatherers who could have achieved maritime mobility fairly easily, farmers faced much greater risks, since they had to transport domestic animals and enough grain to last them until the next harvest (Broodbank and Strasser 1991: 239-242). Their potentially dangerous journeys required skillful boat handling in various conditions and over extended periods, and sound knowledge of winds, currents, and marine and land-based landmarks (Broodbank 2006: 210, 216). In addition to this knowledge, which was essential for orientation and for following the course during navigation, preparatory knowledge had to be obtained about desirable destinations, about when to go and how to go, and what, and possibly who, to take. Knowledge of the communities living along the way and communication with those communities in order to secure drinking water, food and shelter must have been of crucial importance for the successful completion of a long sea journey. Travelling season was limited by the weather conditions and probably also by the freedom to leave one's home, since the extended

[1] GXO-772: 7340±180 bp (calibrated 1SD range: 6391-6057 BC) (Sordinas 1967).
[2] Lyon-5633 (SacA-13393) 7170±40 bp (calibrated 1SD range: 6062-6009 BC) (Berger *et al.* 2014: 223, Figure 6).
[3] In an earlier publication (Forenbaher and Kaiser 2011: 108) we have proposed that pottery may have reached Apulia in a roundabout way, from Corfu along the eastern Adriatic shore to Dalmatia, and then across the Adriatic to Gargano. The modified chronology of Sidari makes that proposition untenable.

absences of seafarers had to be reconciled with the schedule of farming activities (Robb and Farr 2005: 26, 27; Farr 2006: 93-96).

Who were the early Adriatic seafarers? There is no doubt that the Holocene hunter-gatherers have mastered some of the seafaring skills, although the direct evidence of their maritime journeys, such as the aforementioned object made of Gabbro from Vela Cave, is extremely scarce. Mesolithic levels of that site yielded impressive quantities of fish remains, heavily dominated by mackerel bones (Rainsford *et al.* 2014: 315, 318), but mackerel schools sometimes move near to the shore, where they can be netted from small boats. Remains of large, deep-sea fish species and sea mammals are also mentioned (Čečuk and Radić 2005: 53), but they are present in very small numbers and do not indicate systematic deep-sea fishing. Furthermore, according to the currently available data, lithic artifacts made of Gargano cherts and other western Adriatic cherts are virtually absent from eastern Adriatic Mesolithic sites (Vukosavljević *et al.* 2014: 42, 46, 55), which suggests that transadriatic contacts were limited or absent. This is corroborated by the lack of evidence of Holocene hunter-gatherers' visits to Palagruža. It seems that long maritime journeys were an exception before the transition to farming.

While the mobility of Holocene hunter-gatherers would have been seasonal, cyclical and logistically organized, groups of farmers travelled with the aim of permanent resettlement (Broodbank and Strasser 1991: 239-242; Broodbank 2006: 217). Probably formed by fission from already established village communities, such groups sometimes migrated across fairly large distances, although they would not have travelled from the far ends of the Mediterranean. Everything we know about the early Adriatic farmers suggests that they lived in small communities, usually consisting of several dozen people (Robb 2007: 40-42). Economic resources and organizational capabilities of such communities would have allowed them to build and muster a miniature fleet of dugout canoes, embark and lade them with a few animals and pots full of seeds and, relying on the knowledge acquired during earlier reconnaissance, launch into the adventure of farming colonization. Contrary to what one might expect, the importance of fishing dropped with the intensification of maritime travel at the time of transition to farming. While the necessary knowledge and skills for those two activities partially overlap, their social context and motivation for their practice are very different. Therefore, fishing does not necessarily lead to development of seafaring, nor vice versa (Rainsford *et al.* 2014: 317-319).

A certain extent of individual and small-group mobility exists among farmers and hunter-gatherers as a part of the normal social process (Robb and Miracle 2007: 106-107). How might the Mesolithic seafaring have influenced the spread of farming into the Adriatic? Due to scarcity of evidence for Mesolithic maritime interaction networks, it would be hard to envisage the spread of farming through exchange of goods along such networks, culminating in acculturation of hunter-gatherers. While one must presume some local autochthonous contribution to maritime knowledge, the maritime mode of the spread indicates that farming and seafaring were simultaneous and combined (Broodbank 2006: 215, 217).

3.2.3 Circulation of chert artifacts

Palagruža yielded more than 4400 flaked stone artifacts. Over 1600 pieces were recovered from nine 1x1 meter test trenches, excavated within the surface scatter of artifacts that covers 3500m^2 of Salamandrija's north slope. Based on that information, it can be roughly estimated that hundreds of thousands of lithic artifacts are contained within this area alone. How can one explain the presence of such quantities of artifacts made almost exclusively of Gargano cherts on a remote islet, unsuitable for permanent settlement? In order to answer this question, one should consider the patterns of circulation of chert artifacts.

Before transition to farming, artifacts made of cherts originating from the western Adriatic coast were virtually absent from Dalmatian sites (Vukosavljević *et al.* 2014: 54-55, Figure 12; Vukosavljević and Perhoč 2016: 9). Such artifacts made of Gargano cherts appear in Dalmatia together with the earliest indicators of farming. This raw material substitution is abrupt and very conspicuous. The earliest Dalmatian farmers use Gargano cherts from the very beginning, at some sites almost exclusively, and at other sites predominantly (Forenbaher and Perhoč 2015).[4] Local cherts, sometimes of quite adequate technical quality, are used much less often, or not used at all. With the arrival of farming, Dalmatia turns away decidedly from the eastern Adriatic chert sources towards those in the western Adriatic (Forenbaher and Perhoč 2017).

The fact that the earliest Dalmatian farmers did not use the locally available cherts suggests that they were immigrants who did not possess the necessary locational knowledge (Rockman 2003: 4-5, 19). Put more simply, it seems that they did not know where to find good chert for their sharp-edged tools in the immediate neighborhood. They continued to acquire it from the outcrops that they knew beforehand, which were located in the area from where they came. Since the

[4] Analyses of lithic raw materials for about twenty other Dalmatian Neolithic sites (Smilčić, Danilo, Pokrovnik, Crno vrilo, Veliš tak, Sušac and Vela spila on the island of Korčula) are near completion. It is already clear that Gargano cherts predominate at all of those sites (Perhoč 2017, pers. comm.).

earliest farming villages in the Adriatic were located in northern Apulia, in the immediate neighborhood of Gargano (Skeates 2003: 169, 184), domination of Gargano cherts in the earliest Dalmatian farming contexts supports the hypothesis that migration played an important role in the spread of farming from Apulia to Dalmatia (Forenbaher and Miracle 2014a; 2014b).

In Dalmatian sites, domination of Gargano cherts is not limited to assemblages from the time of transition to farming, but continues until the Late Bronze Age (Forenbaher and Perhoč 2015: 47-49). This long continuity cannot be explained by the lack of knowledge of local sources, because such locational knowledge can be gained most quickly and easily (Rockman 2003: 4-5). Continuous reliance on Gargano cherts might be explained in part by their extraordinary technical quality, which is of decisive importance in production of prismatic blades[5] that appear in the Adriatic together with farming.

Great majority of prismatic blades from Dalmatian sites was made of Gargano cherts. Questions of geographic location and social context of their production are key issues about which we know very little. Cores from which such blades are detached usually are shaped at or near the chert source, in order to avoid transport of deficient pieces of raw material and unnecessary waste, while blades may be struck from cores later and at a different location. Characteristic waste produced during reduction of prismatic blade cores, such as exhausted or mangled cores, overshot blades and core rejuvenation elements, are exceptionally rare at Dalmatian sites (Forenbaher 2006a: 107; Korona 2009: 150; Forenbaher and Perhoč 2015: 39), while the waste from initial shaping of such cores is even less common. It seems, therefore, that most of the prismatic blades had arrived to Dalmatia as finished artifacts.

Recent research has indicated that the Gargano area was an important center of prismatic blade production that supplied much of southern Italy (Guilbeau 2010: 41–116). It seems that Dalmatia belonged to the same production region, but comprehensive typological, technological and raw material analyses of at least a few more large assemblages will have to be completed before that hypothesis can be corroborated. For the moment, any discussion about the possible degree of specialization, centralization or maybe even monopoly over blade production remains conjectural. In the decentralized world of autonomous farming villages, 'specialization' in production would have been essentially an aspect of personal identity rather than a formal division of labor (Robb and Farr 2005: 39).

[5] See Chapter 2.1.3.4 on prismatic blades from Palagruža.

Extraordinary quality of Gargano cherts does not explain, however, why the simple expedient tools were not made more often from the reasonably good cherts that were available locally in Dalmatia. To the contrary, at some of the sites, *ad-hoc* production of flakes and tools also relied almost exclusively on Gargano cherts (Forenbaher and Perhoč 2015). One should remember here that satisfying the needs for raw materials and artifacts is just one of the reasons for the existence of trade and exchange. Practical value of objects exchanged over great distances is not always obvious. For instance, bladelets made of Liparian obsidian reached Palagruža by travelling at least 450 kilometers (or 800 kilometers, if they arrived by sea), but their use-life is very short. It is limited by the brittleness of the unusually sharp edges, which dull much more quickly than the tough edges of chert blades. Sometimes it is presumed that obsidian was valued primarily as a symbol of the journey, the knowledge, skill and risk that had been undertaken (Farr 2006: 89, 96).

This brings us to another, equally important role of exchange, which is creation and maintenance of social relationships that rely on exchange mechanisms (Mauss 2002: 91-96). In many traditional forms of exchange, the exchanged object itself was less important than the social relationships that it created or symbolized. In such circumstances, the main promoters of travel were not the exchanged objects, but the need for social communication (Robb and Farr 2005: 24; Farr 2006: 96). Maybe the true value and purpose of the exchange of Gargano cherts was maintenance of social networks that linked the small farming communities scattered around the Adriatic shores and islands. Its importance is proclaimed by the very fact that it continued over a period of five millennia (roughly, from year 6000 until 1000 BC), despite major changes in Dalmatian prehistoric societies that in the meantime were transformed from autonomous villages without social ranking to a mosaic of hierarchically organized societies led by rival elites. The latter will be further discussed in the following chapters.

Regardless of what motivated exchange, Gargano cherts kept circulating in the Adriatic for millennia, and those who conveyed them passed by Palagruža and occasionally landed there. But why did they leave a substantial amount of their valuable cargo on an uninhabited islet in the middle of the open sea? It might be easier to answer that question if the temporal dynamics of flaked stone artifact deposition on Palagruža were better known. Unfortunately, most of those finds may be attributed only very generally to the period between 6000 and 2000 BC. We presume that some of them (probably, relatively few) were deposited around the beginning of the sixth millennium BC, during short visits by the earliest Adriatic farmers that are attested by the rare Impressed Ware sherds.

Another relatively small group of temporally sensitive artifacts (microlithic crescents, and Type 3 and Type 4 bifacial points) definitely were deposited during the third millennium BC, together with the polished stone wristguards and most of the temporally sensitive prehistoric pottery fragments.

The remaining, largest part of the lithic assemblage also may belong to the third millennium BC, but in fact it may belong to any period between the sixth and the third millennium BC. Because of that, prehistory of Palagruža between years 5500 and 3000 BC currently represents an insoluble problem. Since no specific temporally sensitive material from that period has been recovered, we would attribute most of the temporally indefinite lithics to the third millennium BC, when intensive activity on the island is guaranteed. One should not discount the possibility, however, that some of those lithic artifacts (*e.g.,* obsidian bladelets and Type 1 tanged points) reached Palagruža earlier. If that were true, then their deposition might be a prelude for the symbolically charged activities that will get into full swing during the third millennium BC. Those later activities will be discussed in the last chapter of this book.

3.3 Pottery styles of the third millennium BC

When discussing the evidence that lies in the focus of this chapter, most archaeologists talk about Ljubljana culture and Cetina culture, and the Late Copper Age and Early Bronze Age periods. Burdened by the heavy baggage that has accumulated during their long and often uncritical use, these deceptively clear terms are in fact replete with traps and ambiguities.

Archaeological cultures are temporally and spatially more or less clearly demarcated entities, defined by specific types of finds that supposedly should always appear together (for example, specific kinds of pottery, tools, decoration, burials, or houses). There is still a tendency for such entities to be regarded as absolute, sharply bounded units that, consciously or unconsciously, are equated with 'what today would be called a people' (Kossina 1911: 3; Childe 1929: v-vi). Instead of remaining a practical and flexible tool for preliminary classification of the evidence (Broodbank 2000: 54), archaeological cultures are converted to agents on the scene of history, while forgetting that they are constructs created by the archaeologists in their attempts to answer quite specific questions related to culture-historical paradigm (Trigger 1989: 148-206).

It has been a while since we had realized that ethnic communities are anything but clearly bounded, homogeneous and static units (Barth 1969). Cultural identity is a fluid category susceptible to continuous change, while the relationship between ethnicity and material culture is complex and indirect (Jones 1997). Furthermore, the spatial and temporal variability of the archaeological evidence is a consequence of many different factors, and not just of the cultural identity of the people who left that evidence behind (Binford 1965). For these and other reasons, the concept of archaeological culture was strongly and rightly criticized over the last fifty years (Shennan 1989: 5-17). Regardless of that, most of us still routinely describe the archaeological evidence in accordance with the culture-historical paradigm, despite the fact that it did more harm than good to archaeology by muddling the study of social and historical processes, distorting the image of the past, and diverting research into blind alleys.

Division of the past into archaeological periods is twice as old as the concept of archaeological culture (Trigger 1989: 73-79). Thomsen's three-age system and its numerous later improvements played out its positive role in times when stratigraphy and typology were the only available means of assessing the relative age of prehistoric finds. That system is still firmly ingrained in the archaeological jargon, despite the fact that the namesake periods are not always contemporaneous in different regions, while the transitions from one period to the next sometimes do not coincide with evident changes of the archaeological record (Robb and Farr 2005: 25; Broodbank 2013: 13-14, 203). Thanks to the increasing number of chronometric dates, today we can express time by calendar years in millennia, centuries, or sometimes even decades, rather than talk about archaeological periods.

The eastern Adriatic Copper Age (or Eneolithic) is particularly fraught with all of the aforementioned problems. Evident continuities link the Early Copper Age with Neolithic, and the Late Copper Age with Bronze Age, while the crucial transformations of material culture and society take place right in the middle of the Copper Age. Usually, the Early Copper Age is equated with Nakovana culture, while the Late Copper Age and Early Bronze Age are equated with Ljubljana culture and Cetina culture, respectively.

Definitions of Ljubljana and Cetina cultures, and their different regional and temporal variants, are based mainly on pottery styles (Dimitrijević 1967; 1979a: 317-328; Marović 1976: 67-71; Marović and Čović 1983; Govedarica 1989b). Therefore it is fairly easy to reformulate the discussion of those cultures into a discussion of pottery styles, including their temporal and spatial distribution. By abandoning the concepts of archaeological periods and cultures we might get a step closer to reality, while avoiding barren discussions, such as whether or not a proposed culture represented 'an independent and complete cultural group' (Govedarica

1989a: 407; 1989b: 95; Marijanović 1991a: 217, 236-238; 1997; 2000: 126), or whether it belonged to the Late Copper Age or the Early Bronze Age (Dimitrijević 1967: 8, 18; 1979a: 317; Batović 1973b: 108, 113; Marović 1976: 71; Marović and Čović 1983: 197-198; Govedarica 1989a: 409; 1989b: 11, 13-15; Marijanović 1991a: 242; 1997: 1; Forenbaher and Kaiser 1997: 18). In this chapter, reference to cultures and periods will be avoided quite consciously and intentionally. Instead, I shall be writing about pottery styles, and the third millennium BC. For the sake of convenience, 'third millennium' connotes the period that begins around or soon after year 3000 BC, and ends around or soon after year 2000 BC, according to the currently available chronometric dates.

3.3.1 Incised, impressed and incrusted decoration

Two major styles of decorated pottery marked the third millennium BC in the eastern Adriatic. More or less following the established terminology, we shall refer to them as Ljubljana-Adriatic and Cetina styles. The first term is a simplification of the rather cumbersome formulation 'Adriatic type of Ljubljana culture'; it emphasizes Adriatic as the main region of the style's distribution, while honoring the fact that its original definition was based primarily on the finds from Ljubljansko bare. The second term derives directly from the term 'Cetina culture'.

The common trait of both styles is geometric decoration executed by a combination of incision, impression and incrustation. Dramatic enhancement of the motif on the dark vessel surface is accomplished by filling the incisions and the tiny impressions with a white paste. Although the incrustation had disappeared from most of the sherds, or only its traces remain, it is widely distributed, and common enough to presume that originally it was omnipresent.

Before turning to specific traits of these styles, one should note that small Ljubljana-Adriatic sherds sometimes are hard to distinguish from Cetina sherds. Vessel shapes may be very similar, while decorative techniques, basic decorative elements, and even parts of motifs may be identical. Because of that, many small fragments can be determined only in general as characteristic third millennium BC pottery, even though they might come from vessels that, if complete, would be easily recognizable as Ljubljana-Adriatic or Cetina.

The second important fact that needs to be pointed out is that, as a rule, the decorated pottery in question comprises only a small fraction of the total pottery assemblage, even if the published reports sometimes suggest the opposite. Unsurprisingly, the attractively decorated fragments usually dominate in the illustrations, while the far more common plain pottery is much less represented. While for most of the old excavations there is no information about what was or was not kept, the high frequency of decorated pottery in assemblages like the one from Ig reflects selective recovery of finds, rather than the real situation at the site (Korošec and Korošec 1969: 12). Precise information about the ratio between decorated and plain pottery is rarely provided even in recent publications. Subjective assessments prevail, stating that decoration is scant (*e.g.,* Marijanović 2012: 93), or that a 'relatively large percentage' of pottery is decorated (Milošević and Govedarica 1986: 61).

Quantitative information is scarce, and most of it comes from recently excavated cave sites. Characteristically decorated sherds of Ljubljana-Adriatic and/or Cetina pottery constitute 4,2% of the assemblage from Phase 4 of Grapčeva Cave (Forenbaher and Kaiser 2008: 64),[6] but that figure must be viewed with caution due to small sample size (212 sherds in total). More reliable are data from Phase 3 of Pupićina peć, where characteristic decorated sherds constitute only 0,4% of the 1566 potsherds (Hulina *et al.* 2012: 158).[7] Information is also available from two unpublished pottery assemblages that were recovered from caves in relatively recent excavations. At Spila Nakovana, decorated Ljubljana-Adriatic and/or Cetina sherds constitute only 0,4% of the 2296 potsherds from Phase 5b in Sector 3 (Forenbaher and Perhoč 2015: 172), while at Vela spila on the island of Korčula, they constitute 1,8% of the 2402 potsherds from contexts attributed to the third millennium BC.[8] Furthermore, only nine of the 638 sherds (1,5%) that were recovered from the mantle of Velika gruda burial mound were decorated in a manner that resembles Cetina style. In comparison, 218 of the 4334 potsherds that were recovered from the mantle of Mala glavica burial mound were decorated (Batović and Kukoč 1988b), but ninety were 'decorated by *barbotine*' (a coarse slip), while only a fraction of the remaining 128 decorated sherds (3%) may be attributed to Cetina and/or Ljubljana-Adriatic styles. Finally, with 15,5% of decorated Ljubljana-Adriatic and/or Cetina style sherds, Salamandrija surpasses all other sites with quantitative information by an order of magnitude.

3.3.2 Ljubljana-Adriatic style

The following definition of Ljubljana-Adriatic style, based on published finds from 80 sites, roughly coincides with the existing definitions of 'Ljubljana

[6] The previously published frequency of decorated pottery, 5,2% (Forenbaher and Kaiser 2008: 64), includes several decorated sherds that cannot be attributed to either Ljubljana-Adriatic or Cetina style.
[7] The previously published frequency of decorated pottery, 2,1% (Hulina *et al.* 2012: 158), includes a considerable number of decorated sherds that cannot be attributed to either Ljubljana-Adriatic or Cetina style.
[8] The finds in question from Vela Spila were recovered during the excavation seasons 2010-2013.

culture' pottery (Dimitrijević 1967: 10-12; 1979a: 320-322; Govedarica 1989b: 41-43). Basic information about all sites is provided in the Appendix at the end of this book, accompanied for each site by comprehensive bibliography. Characteristic pottery usually is decorated by a combination of incision and impression. Various tools are used for making impressions, from simple tools that produce isolated dots, triangles, or elongated impressions, to special instruments that create regular series of tightly packed, almost identical, and sometimes very tiny impressions. Experiments indicated that such decoration can be replicated easily and convincingly by using tools made by wrapping a cord around small, thin laths made of wood or bone (Leghissa 2015). Different tools may have been used as well, such as coiled wire, combs, or denticulate plaques or wheels. For the sake of simplicity, a common term 'comb impression' will be used here to cover all variants of fine impression made by special instruments. It should be added that, since Ljubljana-Adriatic decoration tends to be carefully made, it is not always easy to establish whether it was made by careful free-hand impression, or by one of those special instruments.

Particularly characteristic are designs composed of narrow bands (usually, less than 5 millimeters wide) delimited by incision or comb impression and filled with alternating dots, elongated impressions, or triangles defining between them a tiny zigzag pattern. These bands may be single, paired, or multiple, crowded next to each other, or set apart. Another popular design is a series of hatched triangles, or a double series of alternating hatched triangles that, like the impressed ones, delimit a zigzag pattern. The design usually runs in horizontal zones. Parallel narrow bands alternate with series of hatched triangles, or bands consisting of 'metopes' (vertically hatched rectangles bounded on both ends by short sections of narrow bands). Possible variations and combinations of these standard elements are virtually endless, which creates an impression that each vessel was decorated in a distinctive way.

The repertoire of vessel shapes decorated by characteristic Ljubljana-Adriatic designs is rather limited. Round-bellied jars with a volume from a few deciliters to several liters are common (Figure 104: 10-13). Their body is spheroid, sometimes slightly flattened, or with a barely indicated carinated shoulder. Usually, their constricted neck is low and cylindrical or slightly funnel-shaped, while tall cylindrical necks are much less common. Larger jars may have wide, horizontal, subcutaneously pierced lugs or short vertical strap handles placed at the shoulder. Decoration usually covers the neck and shoulder, and often continues across the lug or handle.

Open bowls of different sizes are another well-represented group (Figure 104: 2-4). Many of them are fairly small (cup-size), while other are medium-size. Their shape varies from shallow to relatively deep vessels with a rounded body that expands towards the rim. The rim itself is often flat and thickened, and a short strap handle may be placed below it vertically or horizontally. These bowls are sometimes supported by a massive cruciform or star-shaped pedestal, by a hollow cylindrical or funnel-shaped pedestal (Figure 104: 9), or by peg-shaped feet. Decoration may cover the entire exterior and interior surface, including the wide top surface of the rim, the handle, and the pedestal. Double series of alternating dots or triangular impressions delimiting a zigzag pattern, or small hatched triangles, lozenges, and other geometric shapes made by comb impression usually run along the top of the rim. Exterior and interior decoration may be cruciform, star-shaped, or organized in horizontal zones.

Deep carinated bowls are very characteristic, but not very common (Figure 104: 5-8). Most of them also are fairly small, ranging in size from a large cup to a medium-size bowl. Their body consists of a rounded lower part and a relatively tall, concave neck that meet at a carinated shoulder. This vessel shape is often referred to as 'terrine' (Dimitrijević 1979a: 320). Sometimes they have a wide, horizontal, subcutaneously pierced lug above the shoulder, or a vertical strap handle connecting the shoulder with the upper part of the neck. Neck may be decorated in horizontal zones, by metopes, or by grid-like designs. A closely related shape is a small, tall and slender vessel resembling a Bell Beaker (Figure 104: 1).

A few other distinctive vessel shapes are known only from the southern part of the Ljubljana-Adriatic style distribution area, from burial mounds of Velika gruda, Mala gruda, Boljevića gruda, Rubež, and Mogila na rake (Figure 104: 14-17). Among them are five examples of asymmetric dishes with slab handles,[9] all of them decorated on interior and exterior sides, three round-bellied beakers with a high, slightly concave neck and a long strap handle connecting the shoulder with the rim, and a tall funnel.

3.3.2.1 Geographic distribution and site types

Ljubljana-Adriatic pottery style is distributed along the eastern Adriatic coast (Figure 105), from Trieste Karst to Lake Shkodër, including the islands and an up to 50 kilometers wide stretch of hinterland that gravitates towards the coast. Variable density of sites within this area (*e.g.,* abundance of sites in Karst, or scarcity of sites in Kvarner Bay and Croatian Littoral) primarily

[9] The frequently published reconstruction of a dish from Mala gruda is unreliable, since it is based on just a few fragments. A different reconstruction is plausible that would make it asymmetric and much more similar to dishes from the other three aforementioned Montenegrin sites (Primas 1996: 55-56).

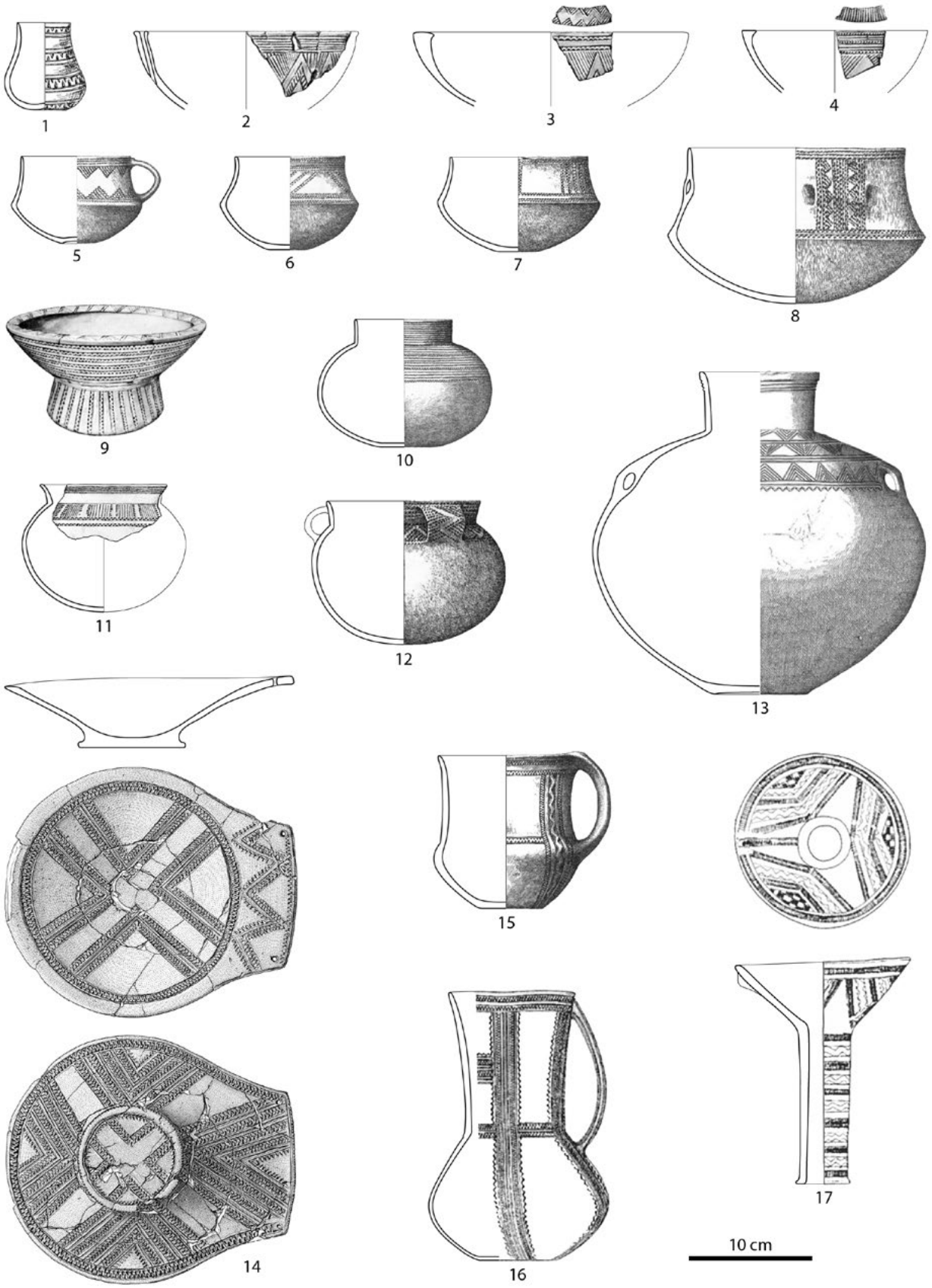

Figure 104. Characteristic Ljubljana-Adriatic style pottery: 1, 5-8, 10, 12 Ig (after Korošec and Korošec 1969 and Dimitrijević 1979a); 2-4, 9 Otišić (after Milošević and Govedarica 1986); 11 Vaganačka pećina (after Forenbaher and Vranjican 1985); 13 Marina (after Radić Rossi 2011); 14 Velika gruda (after Primas 1996); 15 Mala gruda (after Dimitrijević 1979a); 16, 17 Boljevića gruda (after Baković and Govedarica 2009).

reflects unequal intensity of research. Beyond that area, a small number of more-or-less similar finds have been published from a few sites in Po River valley, in central Bosnia, and in northern and central Albania. A conspicuous exception is Ig in Ljubljansko barje, the site that yielded numerous characteristic finds, although it is located within the Sava River drainage area, some 70 kilometers away from the Adriatic coast.

Half of the eighty sites that yielded Ljubljana-Adriatic pottery are caves. Most of them yielded only a few characteristic sherds, or sometimes just a single sherd. A considerable number of Ljubljana-Adriatic sherds were recovered from five caves (Grotta dei Ciclami, Grotta del Mitreo, Grapčeva spilja, Vela spila on the island of Korčula, and Ravlića pećina), but the number of published sherds does not exceed a few dozen for any of those sites.

Open-air settlements are the next best represented site type. Ten out of twenty are hillforts, five are lake dwellings at Ljubljansko barje, while we know next to nothing about the remaining five. Abundant Ljubljana-Adriatic pottery was recovered only from the lake dwelling at Ig, and from the site in a small karstic doline at Otišić. A fairly large number of similar, though less characteristic sherds was recovered from Varvara and Pod, two hillforts located deep in the Adriatic hinterland. Only isolated characteristic sherds were recovered from all other settlement sites.

Ljubljana-Adriatic pottery was found in burial mounds at seventeen sites. Vessels deposited in stone cists next to the flexed body of the deceased were found only at the three Montenegrin sites (Velika gruda, Mala gruda, and Mogila na rake). In all other cases, Ljubljana-Adriatic pottery was recovered from the mantle of the mound, or from the underlying soil. Distribution of the fragments

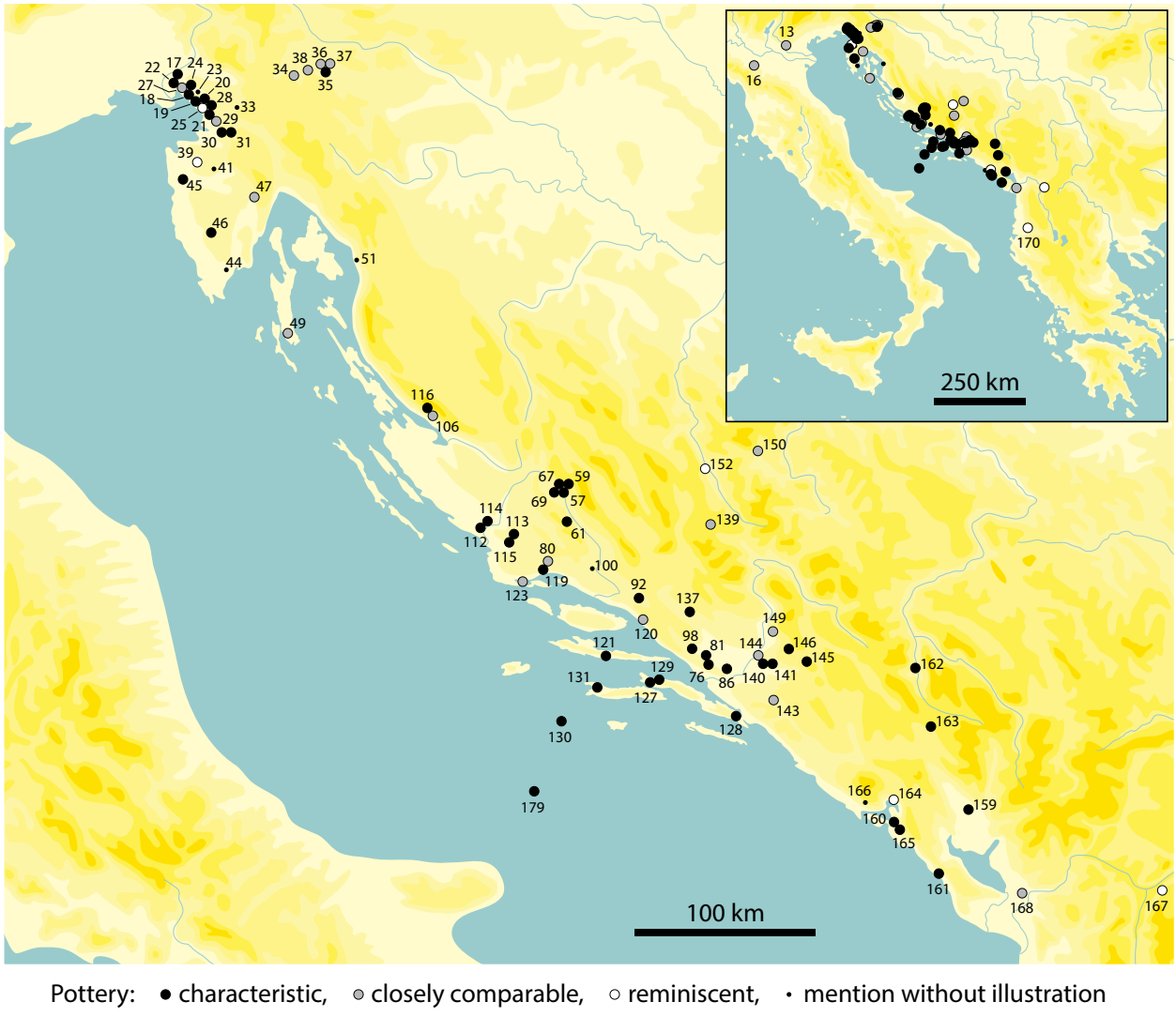

Figure 105. Map of Ljubljana-Adriatic pottery style distribution. Numbers on the map correspond to numbers of sites in the Appendix.

sometimes suggests that the vessels were deposited in the course of burial ritual (*e.g.,* at Boljevića gruda). Elsewhere it seems that the fragments ended up in the mantle by accident, together with soil and rocks used in the mound's construction. While only a few characteristic sherds tend to be present, relatively numerous sherds were published from burial mounds at five sites (Gomile više lada and Lukovača near the source of Cetina River, Eraci near Ploče, Boljevića gruda near Podgorica, and Bardhoc in Albania).

Salamandrija, a special-purpose site on Palagruža that yielded a large number of Ljubljana-Adriatic sherds, belongs to a separate category. The only submerged find is a round-bellied jar, a chance find from the sea bottom near Marina (Trogir).

3.3.2.2 Spatial and temporal variability

It is quite clear that Ljubljana-Adriatic style is not homogenous across its distribution area. For example, open bowls on massive cruciform or star-shaped foot appear only in Karst and in central Slovenia, while asymmetric dishes with a slab handle and tall-necked beakers with a long strap handle are restricted to Montenegrin sites. While a thorough analysis probably would detect other, less obvious regional differences, it is important to note that the basic shapes and decorative motifs can be found throughout the area.

A certain amount of local variability is expected, since everything that we know about the economy and organization of Adriatic societies in the third millennium BC suggests that pottery production was not centralized. Potters from different parts of the eastern Adriatic region shared common views about what their vessels should look like, but their products differed in details of shape and decoration. One should be able to distinguish among several subregional variants of Ljubljana-Adriatic style, but due to high fragmentation and relatively small total quantity of finds, such subregional styles currently cannot be clearly defined, despite some worthy attempts (Dimitrijević 1967; Govedarica 1989b). Pottery from Montenegrin sites is unusually distinct and uniform, but one should remember that, for the moment, those sites yielded only a small number of finds, all of them from burial mounds.

The attempt to split the 'classical type of Ljubljana culture' into two chronological phases is even less convincing (Govedarica 1989b: 39-47). That attempt relies on uncertain stratigraphies of three caves in Trieste Karst (Grotta del Mitreo, Grotta degli Zingari, and Grotta Tartaruga) that yielded modest quantities of Ljubljana-Adriatic and Cetina (or Cetina-like) pottery, sometimes both appearing together within the same layer. A reliable temporal division would require an adequate number of clearly stratified and securely dated characteristic finds. Since such finds simply are not available, the Ljubljana-Adriatic style currently may only be regarded as a single chronological horizon. The only exception may be the aforementioned finds from Montenegrin burial mounds, which are associated with the earliest radiocarbon dates, a topic to be discussed below.

3.3.3 Cetina style

The following definition of Cetina style, based on published finds from 103 sites, roughly coincides with the existing definitions of 'second phase of Cetina culture' pottery (Marović 1976: 70-71; Marović and Čović 1983: 197-198; Govedarica 1989b: 135-137). Basic information about all sites can be found in the Appendix at the end of this book, together with comprehensive bibliography for each site. Like Ljubljana-Adriatic pottery, the characteristic Cetina pottery usually is decorated by a combination of incision and impression, but only simple tools were used to produce impressions of single dots and triangles. Comb impression does not appear on characteristically shaped Cetina vessels, which means that special tools (such as thin, cord-wrapped laths, combs, or coils) were not employed. Decoration was made by free hand, and was less precisely executed than on Ljubljana-Adriatic pottery.

Most often, the decoration is organized in horizontal zones, but in a manner that differs from Ljubljana-Adriatic zonal decoration. Cetina-style zones are delimited by incised lines that girdle the vessel below the rim, at the transition from neck to shoulder, at the widest point of belly, and at the top and bottom of pedestal, if there is one. These delimiting lines may be the only decoration, or they may be accompanied by a series of impressions or incised triangles. On richly decorated vessels, the zones contain various geometric shapes. Among the most common are segments of slanted bands, angular V-shape or inverted V-shape bands, triangles and lozenges, or designs composed of such bands and shapes. Areas delimited by incision may be hatched, but more often they are filled with impressed dots or triangles, with the latter usually distributed in regular rows, while the former may be scattered irregularly across the entire area of the outlined shape. Also common are bands made of several incised lines oriented lengthwise and sometimes accompanied by a series of impressions. Compared to Ljubljana-Adriatic bands described above, Cetina-style bands are relatively wide.

As a rule, the lines that delimit decorative zones circumvent the lower end of the handle and frame it within a right-angled motif. This kind of integration of the handle within the decorative design, as well as the lines incised lengthwise along both sides of the handle itself, are specific traits of Cetina style. Among

easily recognizable and very characteristic motifs are hanging semicircles that interrupt the horizontal course of decoration. They may consist of a curved band comprised of several parallel incised lines or filled with impressions, or a semicircle outlined by incision and filled with impressions. Also characteristic are lozenges and other geometric shapes that 'hang' from a band at the spot where that band zigzags at right angles, as well as small incised or impressed circles that sometimes 'hang' like cherries at the end of an incised line. A rare but easily recognized motif, consisting of a short V-shaped segment of incised band with curled ends, also is regarded as a specific Cetina trait (Marović and Čović 1983: 211, 212; Govedarica 1989b: 137), although only in one case is it clear that this motif adorned a vessel somewhat resembling a Cetina beaker (Dörpfeld 1935: Plate 22: 1, Supplement No. 25a). On the other hand, certain motifs do not differ at all from those on Ljubljana-Adriatic pottery. This is true primarily for double series of alternating triangular impressions that delimit a zigzag pattern, which are common in both styles. The great variability of decorative elements and freedom of their combination creates an impression that each Cetina style vessel is unique despite their general similarity.

The repertoire of vessel shapes decorated by characteristic Cetina designs is even more limited than the Ljubljana-Adriatic repertoire. Beakers of various sizes with a volume from a few deciliters to over one liter are very characteristic (Figure 106: 7-10). The body of a typical Cetina beaker usually is spheroid or lens-shaped, but it may be markedly carinated. The neck is roughly as tall as the body, rather wide and usually cylindrical, although it may be slightly conical or funnel-shaped. It ends in an everted rim that is clearly separated from the neck by a sharp break in profile, but is not particularly wide. A characteristically shaped strap handle connects the shoulder with the top of the neck. Its curved sides gradually converge towards a narrowest point near its middle. The term 'constricted handle' describes its shape better than the customary term 'X-shaped handle' (*iksoidna ručka*). Exceptionally, such handles may have triangular perforations near both ends (*e.g.,* Marović 1991: Figure 47: 1; Livadie 2010: Figure 15); for them, the term 'X-shaped' seems more justified.

Cetina beakers sometimes stand on a cylindrical or funnel-shaped pedestal that makes up a third of the vessel's height (Figure 106: 11-15). Vessels of this conspicuous shape are often called 'Kotorac type vessels', after a find collected about a century ago from Gradac at Kotorac near Sarajevo. Due to fragmentation of finds, one cannot estimate reliably how common were such pedestalled beakers, compared to simple beakers with flat or rounded bases. Fragments of pedestals are relatively common, but in most cases it is impossible to decide whether they belonged to a beaker or a bowl. Aside from Kotorac, unquestionable examples of pedestalled Cetina beakers have been published from just four more sites, three of them at the source of Cetina River (Gomile više lada, Lukovača, and Zelenovića ogradice), and one in the hinterland of Middle Dalmatia (Vlake). Among them are two small pedestalled beakers with a series of triangular perforations at their shoulder (Marović 1991: Figure 73: 1, Figure 64: 1), an exceptionally rare variant of this vessel type (Figure 106: 14, 15). All of the published pedestalled beakers were found in burial mounds, except the one from Gradac at Kotorac.

Another well-represented group of vessels are open bowls of various sizes (Figure 106: 1-6). Most of them do not differ in shape from Ljubljana-Adriatic open bowls. They vary in size from small cups to bowls some 20 centimeters across. They can be shallow or relatively deep, and have a conical or slightly rounded body that expands towards the rim. The top side of the rim is flat and sometimes very wide, horizontal, or inclined towards the middle of the vessel. A short, constricted strap handle may be placed vertically below the rim. Cetina-style open bowls probably also may stand on hollow cylindrical or funnel-shaped pedestals, although unquestionable examples of such vessels have not been published. They differ from Ljubljana-Adriatic open bowls primarily by their decoration. As a rule, the top side of the rim and the exterior zone below the rim are decorated, while the interior is left plain. Subcutaneous lugs and massive feet are absent. Other decisively Cetina characteristics are constricted handles outlined by incised lines, and protruding bases that are wider than the bottom part of the vessel.

Wide beakers with two opposing handles are much less common (Figure 106: 16, 17). These are relatively small vessels with a volume of about one liter. Their belly is rounded, while their inconspicuous shoulder continues into a wide, slightly funnel-shaped neck. The two opposing constricted handles connect the shoulder to the rim. All of the well-preserved examples were recovered from burial mounds (Bajagić, Jukića gomile, and Shtoj).

3.3.3.1 Geographic distribution and site types

The density of sites with Cetina style pottery is especially high in a 50-kilometer wide stretch of middle Dalmatia's hinterland between Krka and Neretva rivers (Figure 107). In some measure, this conspicuous concentration is a consequence of intensive exploration of burial mounds along the upper reaches of Cetina River that was carried out around the middle of the past century, and of many recent rescue excavations along the route of the Dalmatian motorway. Characteristic Cetina finds appear in a much wider area that includes

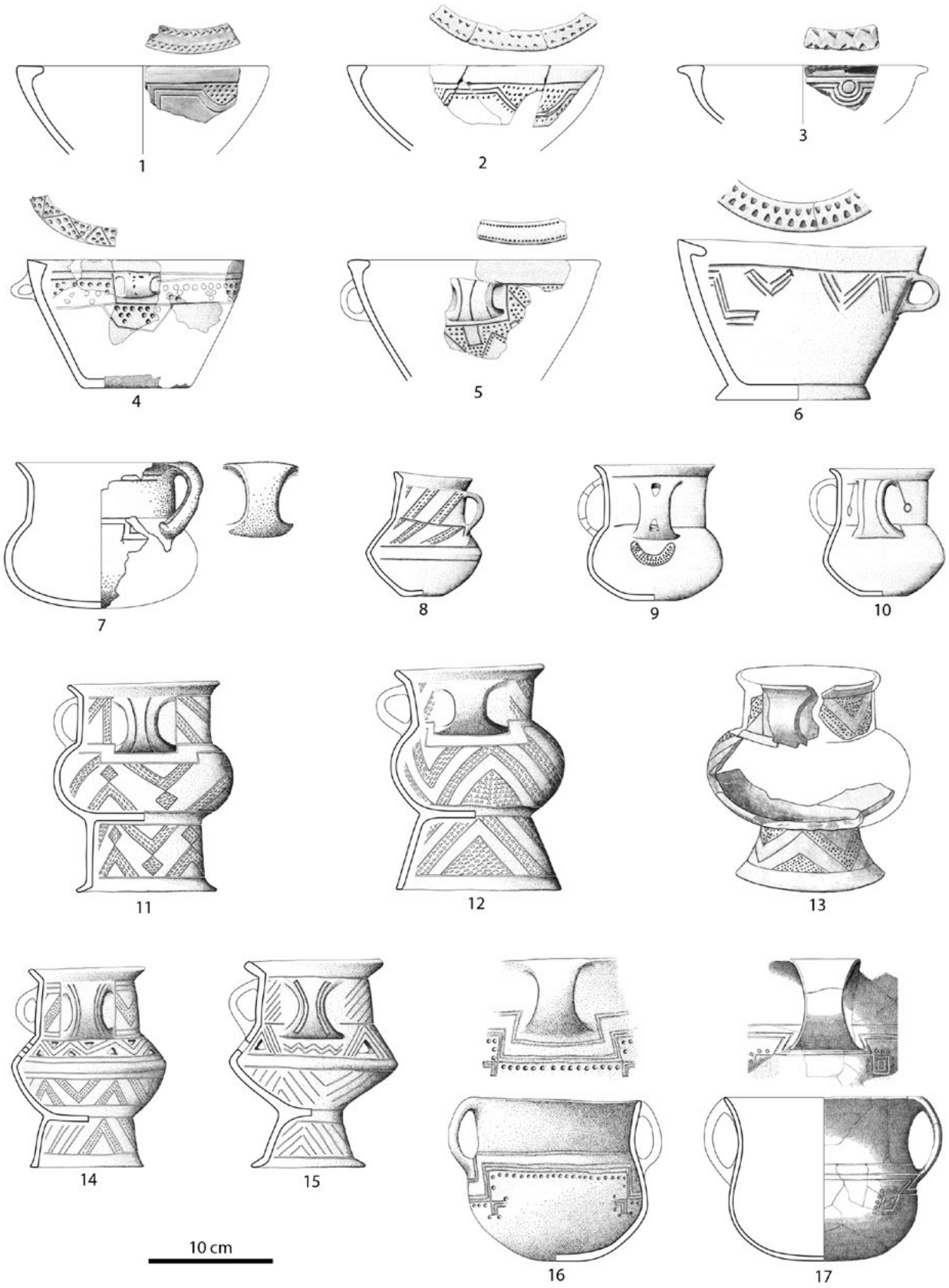

Figure 106. Characteristic Cetina style pottery: 1 Škarin Samograd (after Marović and Čović 1983); 2, 5, 6, 8-10, 12 Lukovača (after Marović 1991); 3 Ljubomir (after Marović and Čović 1983); 4 Rudine (after Marović 1991); 7 Pisciulo (after Cataldo 1996); 11, 15 Gomile više lada (after Marović 1991); 13 Gradac (after Govedarica 2006a); 14 Zelenovića ogradice (after Marović 1991); 16 Bajagić (after Marović 1991); 17 Jukića gomile (after Olujić 2012).

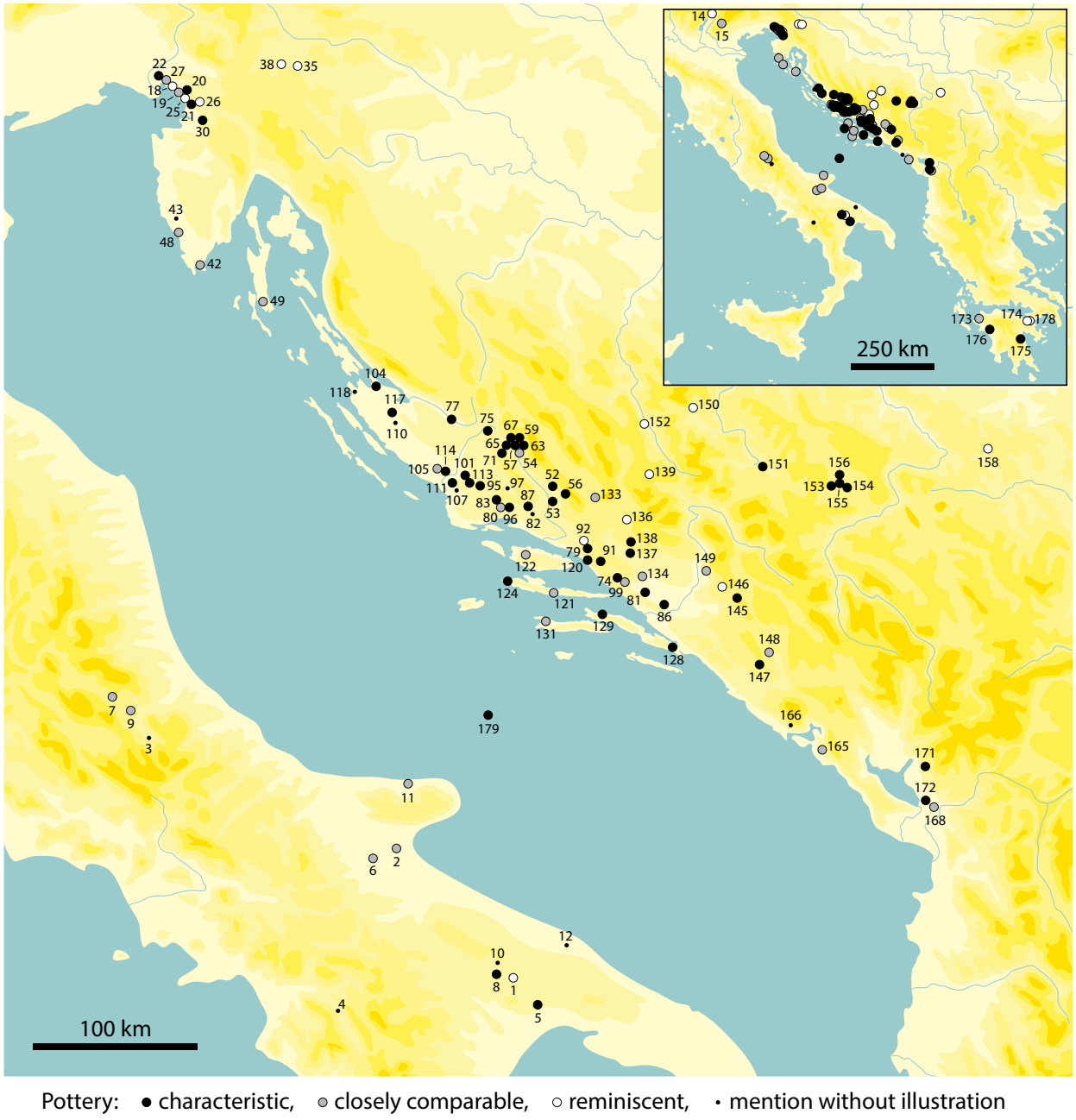

Figure 107. Map of Cetina pottery style distribution. Numbers on the map correspond to numbers of sites in the Appendix.

the eastern Adriatic coast, islands and hinterland from Trieste Karst to Lake Shkodër, as well as eastern Bosnia, southern Italy, and Peloponnesus. Some of the lapses in their distribution (*e.g.*, in Croatian Littoral and Kvarner Bay) may be due to the low level of research, while other probably reflect real situation, like the gap almost 500 kilometers wide that isolates the group of Peloponnesus sites. At Ljubljansko barje, the conspicuous absence of Cetina finds cannot be accidental, given the intensity of exploration.

More than a third of the 103 sites that have yielded Cetina pottery are mound cemeteries, although one should note that human remains were not found in some of the mounds. Most of them yielded only a handful of characteristic sherds, or an isolated vessel. Substantial amounts of finds were recovered from nine sites, of which eight are located in the upper reaches of Cetina River (Bajagić, Balajića gomila, Gomile više lada, Lukovača, Preočanska kosa, Rudine, Šparevine and Zelenovića ogradice), while one is in the upper reaches of Zrmanja River (Ervenik). Gomile više lada, Lukovača and Rudine, all of them located near the source of Cetina, yielded particularly abundant Cetina pottery finds.

In most cases, Cetina pottery fragments are scattered haphazardly throughout the mound mantle. Only occasionally it seems that vessels were deposited near the cremated remains of the deceased, while even less often there are hints that a vessel might have served as an urn. Elsewhere it seems that the rare Cetina sherds ended up in the mantle by accident, while quite often such sherds are found in the underlying soil. Only two cases have been documented where Cetina vessels were found within stone burial cists. In both cases, these are characteristically decorated wide beakers with two opposing handles. Two or three such vessels were found in Mound 1, Grave 3, at Jukića gomile in Dalmatinska Zagora, next to some cremation debris and two inhumations (Olujić 2012: 60, 64, Figures 11-13, Plates 8-10). A very similar vessel was found in Mound 6, Grave 14, at Shtoj near Shkodër in Albania, next to a contracted inhumation burial (Oikonomidis *et al.* 2011: 187, Figure 1: i).

The next best represented are caves, which constitute a quarter of all sites. Most of them yielded only a few characteristic sherds, or often just a single sherd. Four of the caves (Grotta dei Ciclami, Stubica, Škarin samograd and Ravlića pećina) yielded relatively numerous Cetina finds, but their number never exceeds a few dozen.

Open-air settlement sites are just as common as the cave sites. Nine out of 25 are hillforts, while we know next to nothing about the rest. The lake dwellings of Ljubljansko barje are an exception, but they yielded only a few finds reminiscent of Cetina style. Generally speaking, most of the pottery from settlements may be described as similar to Cetina style pottery or reminiscent of it, while very characteristic examples of Cetina pottery are rather rare. Interestingly, the relatively greatest quantity of such pottery (several complete vessels and several dozen sherds, including some very characteristic ones) was recovered from two sites on Peloponnesus (Lerna and Olympia), which probably reflects their thorough exploration. All other settlement sites yielded only isolated characteristic sherds.

In Apulia, Cetina style pottery was recovered from three repeatedly used rock-cut burial chambers. Beakers from burial contexts in Laterza and Pisciulo are particularly characteristic, while the finds from Casal Sabini burial are only reminiscent of Cetina. Finally, the special-purpose site at Salamandrija on Palagruža, which yielded a large number of Cetina potsherds, belongs to a category of its own.

3.3.3.2 Spatial and temporal variability

The Cetina pottery style is fairly uniform across a large area. The majority of characteristic finds is concentrated in middle Dalmatia, but equally characteristic Cetina pottery appears from Trieste Karst to Peloponnesus, and from Apulia to Bosnia. Spatial variability is manifest primarily by the fact that characteristic Cetina finds are rare in peripheral areas, where most of the Cetina-like finds are not particularly characteristic, or display peculiar variants of decoration and shape. As opposed to 'Ljubljana culture', nobody has attempted to split 'Cetina culture' regionally. Instead, a separate 'Posušje culture' was proposed for Dalmatian hinterland, with an early 'Nečajno phase' that would be contemporaneous to 'Cetina culture' (Čović 1989). The assertion that those two cultures '...not only are synchronous, but also coexistent... since their distribution areas... coincide geographically' (Čović 1989: 93) ceases to be problematic if one talks about Cetina and Posušje *styles* instead of cultures.

Marović and Čović proposed a tripartite division of 'Cetina culture' (Marović and Čović 1983: 196-199). Their first phase is marked by a mixture of Ljubljana-Adriatic and Cetina pottery (most of it modestly decorated and not quite characteristic), the second phase is marked by characteristically decorated and shaped Cetina style pottery, while the third phase is marked by mostly plain pottery of the developed Bronze Age, accompanied by occasional sherds decorated in a Cetina manner. Govedarica essentially agreed with that division. His 'Protocetina facies' (Govedarica 1989b: 113-121) corresponds to the first phase of 'Cetina culture' as defined by Marović and Čović, his 'Cetina culture' in the narrow sense (Govedarica 1989b: 129-138) corresponds to their second phase, while their third phase is perceived by Govedarica as the earliest phase of his 'Dinaric culture' of the developed Bronze Age (Govedarica 1989b: 145-147). Most researchers have accepted one of these divisions (*e.g.,* Marijanović 1991a: 240; 1997). In contrast, in my earlier writings I have used the terms 'first phase of Cetina culture' (Forenbaher and Kaiser 1997: 18; Kaiser and Forenbaher 1999: 315), 'early Cetina' (Forenbaher and Kaiser 2008: 62), and 'early Cetina style' (Forenbaher 2011: 691) as synonyms for the 'Adriatic type of Ljubljana culture', that is, for Ljubljana-Adriatic pottery.

Unfortunately, both aforementioned temporal divisions of 'Cetina culture' rely heavily on dubious associations of finds from burial mounds, and unsound, often badly documented cave stratigraphies (Della Casa 1995: 570-571; 1996: 128-131; Forenbaher and Kaiser 1997: 18; Velušček 1999: 69). Absence of reliable information about context and association has been substituted by the unwarranted assumption that any style must 'evolve' from a modest, simple and less characteristic form to an opulent, complex and characteristic form, and end in degeneration. Detailed discussion of these problems follows later in this chapter, related to dating of the pottery styles.

Here, it suffices to say that an 'early Cetina' or 'Protocetina' style that would be clearly distinguishable

from Ljubljana-Adriatic and Cetina styles, while fitting chronologically between them, has not yet been defined convincingly. What exist in its stead are assemblages containing both Ljubljana-Adriatic and Cetina pottery, but not in a single case can one establish with certainty whether that is a consequence of their contemporaneity, disturbance of deposit, or inappropriate excavation technique. While eventually it might prove possible to discern diachronic variability within Cetina style, currently there is no hard evidence for it.

3.3.4 Other kinds of decoration

Fragments decorated by coarse incision and impression, *furchenstich* (stab-and-drag style incisions), excision, and cord impression are found occasionally together with Ljubljana-Adriatic or Cetina style pottery.

3.3.4.1 Coarse incision

This is a specific kind of incision that is sometimes combined with impression, but in contrast to decorative techniques described above, it is executed by a relatively crude and blunt instrument, such as a wooden stick or lath. Pottery decorated in this manner usually is called *žlijebljena keramika* (Čović 1991a), the Croatian word *žlijeb* meaning gutter or channel.

Coarse incised decoration usually consists of several wide horizontal bands that run around the vessel. Each band may consist of densely packed incised lines oriented along, across, or at an angle to the band, of diamond lattice incision, alternating hatched triangles, or other geometric shapes. Series of round, elongated, or triangular impressions sometimes accompany the band, and there are also bands filled by alternating impressions. Combinations of these motifs may constitute complex geometric designs. Incrustation that enhanced the decorative design has been preserved in a few cases. The only ascertained vessel shape is a round-bellied jar with a low neck that is cylindrical or slightly funnel-shaped (Figure 108). At the shoulder sometimes it has wide, horizontally pierced lugs, or short vertical strap handles.

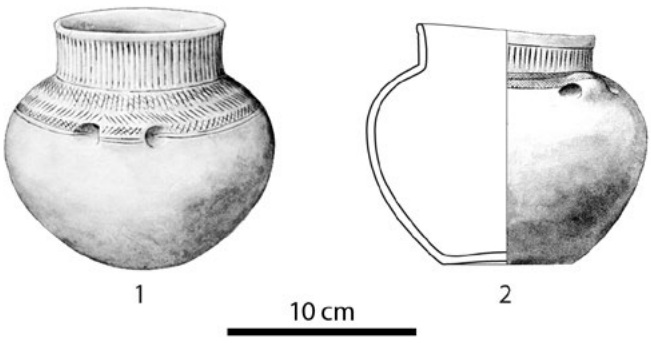

Figure 108. Characteristic pottery decorated by coarse incision: 1 Otišić (after Milošević and Govedarica 1986); 2 Gomile više lada (after Marović and Čović 1983).

Geographic distribution of the coarse incised pottery (Figure 109) is restricted to Dalmatia and Herzegovina, including the islands, the coast, and a wide swath of the hinterland. Beyond that area, only a few finds have been published from Montenegro (from Odmut, and from Spila at Perast), and a couple from Istria (from Pupićina Cave and Cingarela). Half of the total of 33 sites are caves, but only a few sherds have been published from most of them, frequently just a single one. Somewhat larger quantity of finds were recovered from four caves, two of them in southern Dalmatia (Vela Cave on Korčula and Gudnja), and two in Herzegovina (Ravlića Cave and Lazaruša). Coarse incised pottery was found also in burial mounds at ten sites, but these are almost always isolated potsherds that were recovered from the mantle. An exception is a complete little jar from the mantle of Mound 3 at Gomile više lada. This kind of pottery also was recovered from five open-air settlement sites, including three hillforts and two sites in small karstic dolines. A larger number of finds was recovered only from Otišić (vrtača 1) and from Sveti Spas hillfort in Knin (for references, see list of sites in the Appendix).

The coarse incised pottery shares many traits with the Ljubljana-Adriatic style. Their jar shapes are almost identical, while the decorative motifs and compositions of the coarse incised pottery are similar to the Ljubljana-Adriatic ones, although they consist of larger elements and are more roughly executed. Coarse incised pottery was found together with Ljubljana-Adriatic pottery at the only three stratified cave sites where Ljubljana-Adriatic levels and Cetina levels can be set apart clearly (Gudnja, Ravlića Cave and Vela spila on Korčula), as well as at Varvara hillfort at the source of Rama. Aside from that, it is present at ten other sites that contained Ljubljana-Adriatic pottery only, the most important of which is Otišić. Finally, coarse incised pottery was found in only three burial mounds that contained Cetina pottery only: Mound 3 at Gomile više lada and Mound 68 at Lukovača (both at the source of Cetina River), and Grabovica near Tomislavgrad. It is not surprising, therefore, that the coarse incised pottery sometimes is regarded as a constituent part of the 'Adriatic type of Ljubljana culture' (Milošević and Govedarica 1986: 67; Govedarica 1989b: 103-105; for an opposing view, see Marijanović 1991a: 224, 235; 2000: 156). If their geographic distributions coincided, one might say that these were the coarse products of Ljubljana-Adriatic pottery style. In northern Adriatic and Slovenia, however, the coarse incised pottery is

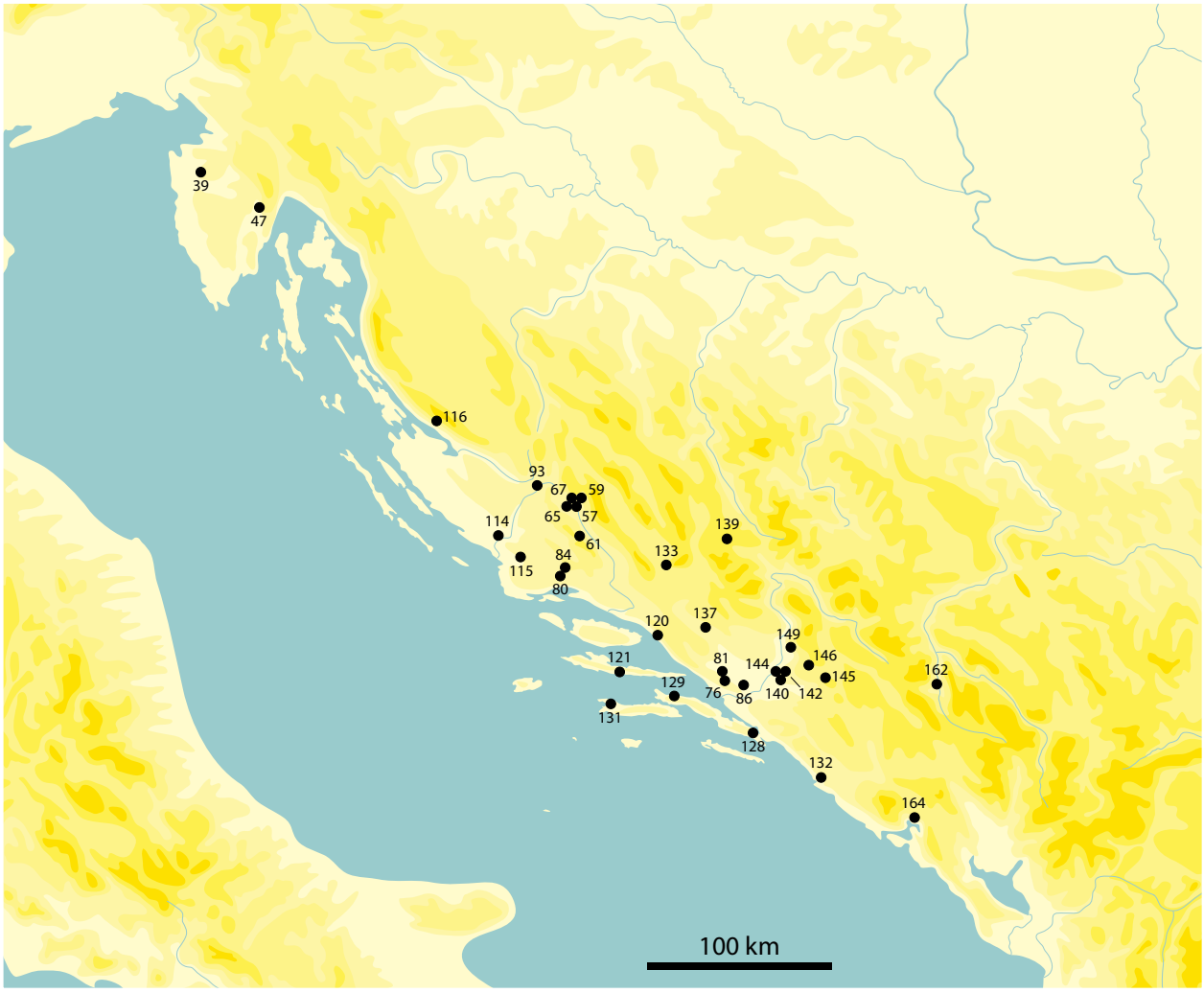

Figure 109. Map of coarse incised pottery distribution. Numbers on the map correspond to numbers of sites in the Appendix.

virtually absent. Its distribution coincides better with the main concentration of Cetina style finds, which probably is not accidental.

3.3.4.2 Furchenstich *incision*

A line produced by *furchenstich* incision (in Croatian, *brazdasto urezivanje*) consists of a series of short overlapping incisions, where each incision's beginning and end are clearly visible. It is made by a sharp instrument and sometimes contains traces of incrustation. Pottery decorated in this manner is relatively common in caves of the Karst and is very well known from the lake dwellings of Ljubljansko barje, where it tends to be assigned to Vučedol or Vinkovci-Somogyvár pottery styles (Dimitrijević 1967; 1979a; Parzinger 1984; Šavel and Sankovič 2010; Velušček and Čufar 2014). At those sites, *furchenstich* incision may adorn vessels of various shapes, including many open bowls with wide rim and several round-bellied jars whose shapes, decorative motifs and compositions closely resemble Ljubljana-Adriatic style.

With the exception of the Karst, *furchenstich* incision is rare in the wider eastern Adriatic region. Isolated fragments of this kind were recovered from just a few widely scattered caves and burial mounds. The scarce contextual information suggests that they belong to the third millennium BC, but it does not allow unequivocal association with either Ljubljana-Adriatic or Cetina style pottery. The motif of a V-shaped band with curled ends, executed by *furchenstich* incision, appears on several potsherds from Mound 3 at Gomile više lada, and maybe also on those from Škarin samograd (Marović and Čović 1983: Plate 29: 6, 10, Plate 31: 11; Govedarica 1989b: Plate 28: 5, Plate 31: 6) (for references, see list of sites in the Appendix). As mentioned above, this motif is sometimes considered as a specific Cetina trait.

3.3.4.3 Excision

Decoration by excision or carving (in Croatian, *duborez*) is accomplished by removing small parts of the well-dried vessel wall by using knives or chisels. The result can sometimes closely resemble impressed decoration,

especially if the motif is filled with incrustation. Numerous vessels decorated by excision from the lake dwellings of Ljubljansko barje are usually assigned to Vučedol pottery style (Dimitrijević 1979a; Velušček and Čufar 2014). As opposed to that, only a very few such fragments from the wider eastern Adriatic region have been published, most of them from cave contexts marked by Ljubljana-Adriatic pottery: about a dozen from Gudnja, and a few more from Ravlića Cave and Vela Cave on Korčula. To these one may add a single sherd from Renja hillfort near Vrpolje, three vessels from Boljevića gruda, and fragments of a shallow bowl with a slab handle from the ransacked mound at Rubež near Nikšić, as well as a previously unpublished fragments of a small bowl from the open-air site in Duga cove (Figure 102) on the island of Sušac (for references, see list of sites in the Appendix). Other excision-decorated sherds may be unrecognizable in published illustrations, but even then, their total number cannot be great. Among the partially preserved motifs are series of triangles, narrow bands filled by alternating triangles, and triangles aligned along an incised line. Clearly recognizable vessel shapes include shallow bowls with decorated interior and exterior, as well as a beaker and a funnel from Boljevića gruda. Other fragments may come from jars with a low cylindrical neck, or from deep carinated bowls. All of those elements correspond closely to the Ljubljana-Adriatic pottery style.

3.3.4.4 Cord impression

This kind of decoration consists of a series of short, slanted and rounded impressions that follow each other at an angle of about 45° (Leghissa 2015: 281) in straight or curving lines. Often, this is referred to as *Schnurkeramik* or *Litzenkeramik*. According to Čović, the decoration on *Schnurkeramik* (in Croatian, *vrpčasta keramika*) would have been created by cord impression, while the decoration on *Litzenkeramik* would have been produced by pressing a more complex woven or knitted textile against the wet and soft vessel surface (Čović 1980a: 35, 41, footnote 1). Experiments have shown, however, that both of those decorations can be produced easily by impressing a twisted double cord. In the first case, such a cord is used individually, while in the second case, one or two cords are impressed repeatedly in such a manner that their impressions create a band (Grömer and Kern 2010; Leghissa 2015: 284-285). Remains of twisted double cords were recovered from the lake dwellings at Ljubljansko barje (Leghissa 2015: Figure 3: 2). Careful examination of impressed band decorations indicated that these could not have been created by woven or knitted textiles, since their radically different structures would be evident in impressions.

Only parts of motifs were preserved in most cases. Straight and wavy bands composed of several parallel cord impressions predominate. Usually, they run horizontally, while sometimes they are vertical, slanted, or stretched along a strap handle. Series of hatched triangles and circles placed between the bands are less common. In a few cases, cord impression is combined with impressed dots, small circles or ovals. Incrustation filling the motif was preserved in rare examples. Only a few finds hint at the shapes of vessels that were decorated in this manner. Among them are deep bowls with spheroid, slightly flattened body and severely restricted mouth (Čović 1980a: Figure 1: 1-4), deep bowls with a rounded belly, slightly restricted mouth, and a double vertically pierced lug at the rim (Marijanović 2005: Figure 30; 2000: Figure 8), as well as jars with a vaguely marked shoulder and slightly restricted neck (Korošec and Korošec 1969: Plate 7: 10; Gilli and Montagnari Kokelj 1993: Figure 37: 362).

Relatively few cord-impressed fragments have been published from the wider eastern Adriatic region. They were recovered from seventeen sites, most of them in the Dalmatian hinterland (Dalmatinska Zagora and Herzegovina). More than five fragments have been published from only four sites: Trostruka gradina, Pod, Ravlića Cave and Lazaruša. Aside from these, there are a few finds from lake dwellings at Ljubljansko barje and a couple of caves in the Karst. With the exception of finds from Gudnja Cave, none have been reported so far from the coast and the islands.

Cord-impressed potsherds appear in quite diverse contexts, including those marked by Ljubljana-Adriatic pottery (Gudnja, Phase 5; Lazaruša, Phase 2; Pod, Phase A), contexts that precede Cetina contexts (Ljubomir, Mound 11), contexts marked by Cetina pottery (Zagomilje 2; Rudine, location 'Okruglo'), contexts that contain both Cetina and later Bronze Age pottery (Ravlića Cave, Phase 4), contexts considered to be younger than Cetina (Trostruka gradina; Nečajno) and contexts where cord-impressed, Ljubljana-Adriatic, and Cetina potsherds appear together (Grotta dei Ciclami, Kovačina, Zelena Cave) (for references, see list of sites in the Appendix). Motifs on bowls from Gudnja and Lazaruša, created by combining cord-impressed bands with impressed dots and triangles, closely resemble Ljubljana-Adriatic decorative motifs.

3.3.5 Dating of Ljubljana-Adriatic and Cetina styles

We have three different classes of data at our disposal for establishing the age of Ljubljana-Adriatic and Cetina styles: information about time-sensitive metal objects[10] that were found in association with characteristic pottery, information about stratigraphic relationships

[10] In old publications, implements made of metal are routinely reported as 'bronze' or 'copper' finds, without any further specifics. Since the composition of metal cannot be ascertained without elemental analysis, I have used a neutral term 'metal objects' for all such finds.

between contexts that contained characteristic pottery, and radiocarbon dates. All existing attempts to date those styles rely rather imprudently on unsound information about site stratigraphy and association of finds (Della Casa 1995: 570-571; 1996: 128-131; Forenbaher and Kaiser 1997: 18; Velušček 1999: 69). Since most of the available information comes from old, poorly documented and selectively published excavations, or from informal digs, critical reassessment of their reliability is due. Until now, radiocarbon dates related to Ljubljana-Adriatic and Cetina pottery have not been discussed systematically.

3.3.5.1 Association with metal finds

One of the traditional dating methods is based on association between finds of unknown age and time-sensitive metal implements of a known age. Unfortunately, in times under discussion, metal implements are not nearly as reliable time indicators as in some later prehistoric periods. Most of those objects are plain, simply shaped, basic types of metal implements that changed little over the centuries are not particularly time-sensitive. Their typological characteristics allow only a rough and rather general age attribution. Additional uncertainty stems from the fact that their analogies, which are often sought in distant parts of Europe or eastern Mediterranean, are themselves unreliably dated. For illustration, one might mention two outstanding examples: the hatchet that was found with the 'Iceman' on Similaun Glacier, and the golden dagger from the central burial at Mala gruda. Following typological criteria, initially the hatchet was thought to date from around year 2000 BC (Sjøvold 1992), while the dagger was ascribed to year 1900-1800 BC (Parović-Pešikan 1976: 80). Today, both finds are considered to be roughly a thousand years older than those first estimates.

Furthermore, the association between metal objects and Ljubljana-Adriatic or Cetina pottery is often questionable or even nonexistent. Most of the metal finds that were recovered from the upper reaches of Cetina River, and are considered as key components of 'Cetina culture' (Marović and Čović 1983; Govedarica 1989b), came from burial mounds that contained neither Cetina nor Ljubljana-Adriatic style pottery, and therefore cannot be used to date either of those two styles. Among them are the short sword and daggers from Živalji, daggers from Penića njivice, Veliki Rumin and Župna kuća in Bajagić, the knife from Kekezova gomila, as well as the shaft-hole ax and a ring-shaped hair ornament from Velike gomile (for references, see list of sites in the Appendix). Lake settlements of Ljubljansko barje also yielded numerous metal finds and an abundance of Ljubljana-Adriatic and other pottery, but there is no information about the mutual relationship between those two categories of finds. The same is true for metal finds and Cetina style vessels from the burial chamber #3 at Laterza. The copper shaft-hole ax from vela Cave on Korčula (Čečuk and Radić 2005: Figure 38), recovered from Layer 2 that contained Ljubljana-Adriatic and coarse incised pottery, is not time-sensitive; it may belong to the fourth or the third millennium BC. All of those finds are of little use for dating Ljubljana-Adriatic and Cetina pottery styles.

Metal implements and Cetina pottery were found together in only five burial mounds, where they were scattered across the mound mantle, or recovered in a haphazard way. A short and flat dagger blade with a rounded base and three rivets was recovered from Mound 3 at Gomile više lada (Marović 1991: Figure 75: 17); aside from Cetina style pottery, this mound also yielded coarse incised potsherds. A short and flat dagger blade with two rivet holes, disfigured by corrosion, was recovered from a mound at Begovići (Beg Jerončić 2011: Plate 1: 4). Two small gold ornaments decorated by repoussé concentric circles and a bent tube made of sheet gold were recovered from a mound at Mali Mosor (Periša 2006: 368). A square-sectioned awl bit was recovered from a pillaged Mound 10A at Rudine (Marović 1991: Figure 9: 7). A heart-shaped cast metal pendant was recovered from an n obliterated mound at Ferizovići (Govedarica 2006a: Plate 2: 9). Assuming that the small, simple daggers were deposited simultaneously with the potsherds, they might serve as a rough chronological indicator, suggesting that Cetina pottery from the mound mantle probably belonged to the third millennium BC. The square-sectioned awl bit is less time-sensitive, while the heart-shaped pendant from Ferizovići belongs to the middle of the second millennium BC, according to its typological characteristics (Hänsel 1968: 116-118). One should note that the association between metal finds and Cetina pottery is not completely reliable in any of these cases, since different objects may have ended up in the mantle at different times. Recent carefully executed and documented excavations point in that direction by demonstrating that many burial mounds were used repeatedly, sometimes over long periods of time, or with lapses that lasted several centuries.

Metal objects and Ljubljana-Adriatic pottery were found together in three relatively well preserved and thoroughly documented Montenegrin sites. In each case, clearly associated finds from burial mounds were recovered from safe contexts by controlled excavation. The central burial at Mala gruda contained five square-sectioned golden hair rings with one end blunt and mushroom-shaped, an elongated dagger with a midrib and a well-defined angular plate with three rivet holes for handle attachment made of an alloy of gold and silver, a silver shaft-hole battle ax with a repoussé-decorated gold sheet cap that covered the handle top, as well as fragments of characteristic Ljubljana-Adriatic

shallow bowl and a beaker (Parović-Pešikan 1976: Plates 3 and 4). The central cist grave at Velika gruda contained eight square-sectioned golden hair rings (three of them with one end blunt and mushroom-shaped, the rest with overlapping terminations), a flat ax made of arsenic copper, two double-edged knives (at least one of them made of tin bronze), and a characteristic Ljubljana-Adriatic shallow bowl (Primas 1996: Figures 5.1-5.4, 6.4-6.5, 7.1, 7.2 and 7.5). At Boljevića gruda, two lozenge-sectioned golden hair rings with one end blunt and mushroom-shaped, an elongated blade of a small dagger with a rhombic section and a rounded base disfigured by corrosion, a stone battle ax with a repoussé-and-incision-decorated gold leaf cap that covered the handle top, as well as a shallow bowl, a beaker, and a funnel displaying characteristic Ljubljana-Adriatic stylistic traits, were found above the central burial that did not contain any grave goods (Baković 2011: Figures 1-7).

A couple more sites that yielded metal finds and Ljubljana-Adriatic pottery may be mentioned for the sake of completeness. Two burial mounds at Bardhoc in Albania contained numerous burials from diverse periods. Among the finds are flat dagger blades, a pin terminating in a repoussé-decorated hammered cone, and potsherds reminiscent of Ljubljana-Adriatic pottery (Hoti 1982), but detailed information about mutual relationship between those finds remains unpublished. Finally, an object resembling a pin with a small and slanted discoid head and a series of slight spherical and ring-shaped bulges along the neck was found in a cleft near the mound edge at Sridnja gora, while several characteristic fragments of Ljubljana-Adriatic pottery were recovered from the mound mantle and the underlying soil. Mutual association of those finds is extremely questionable. Based on its typological traits, the object resembling a pin was attributed to mid-second millennium BC (Milošević 2011: 32, 36, Figures 9 and 10). More likely, this is an ear syringe from the Roman period (Latinović *et al.* 2017: 170, Figure 90).

Golden hair rings from Montenegrin burial mounds are closely similar to those from Burial R15b at Steno. Most of the finds from that mound cemetery on the island of Leukas in western Greece are attributed to EH II Period (Maran 1997: 175; 2007: 9), while Burial R15b itself is sometimes attributed to the early part of that period (Primas 1996: 85, Figure 6: 13A, 1-3), or maybe an even earlier time (Müller Celka 2011). The golden dagger from Mala gruda was compared at first to Cretan daggers (Parović-Pešikan 1976: 81), then to Levantine daggers (Primas 1996: 89-90), and finally (and most convincingly) to Anatolian daggers attributable to the second phase of the Anatolian Early Bronze Age, which is roughly contemporaneous with EH II Period (Maran 1997: 175, Figures 5: 2-5; 2007: 9). As for the silver battle ax from Mala gruda, many similar objects were found in the western Balkan Peninsula and the middle Danubian regions, most of them attributed to the Vučedol horizon (Durman 1983; Primas 1996: 105-109, 154; Maran 2001: 278). The flat copper ax belongs to a class of simple, rather diversely shaped and widely distributed objects that are not particularly time-sensitive, but are present during the fourth and third millennia BC (Primas 1996: 94). Only general analogies are proposed for double-edged knives, dated rather loosely to the late fourth or third millennium BC (Primas 1996: 98).

While a general agreement about the absolute dating of EH II Period has not been reached yet, most specialists maintain that this rather long-lasting period covered roughly the second and third quarter of the third millennium BC (Manning 1995; Broodbank 2000; Renfrew *et al.* 2012). The Vučedol horizon has been dated by radiocarbon and dendrochronology to the first half of the third millennium BC, probably from around year 2900 to 2600 BC (Forenbaher 1993: 247; Velušček and Čufar 2014: 42-43). It follows that, based on association with metal objects, the Ljubljana-Adriatic pottery style at the southeastern end of its geographic distribution should belong to the second quarter of the third millennium BC.

3.3.5.2 Stratigraphic relationships

Another traditional way of establishing relative age relies on stratigraphic position of the finds. Both kinds of pottery whose mutual temporal relationship is of interest to us have been reported from about forty sites. Unfortunately, Ljubljana-Adriatic and Cetina style fragments usually have been found mixed together within the same context, less commonly in different, stratigraphically unrelated contexts, or their context is unknown. Based on published information, at only six sites one may learn something about the stratigraphic relationship between Ljubljana-Adriatic and Cetina finds, although the situation is not completely clear at any of those sites.

Škarin samograd Cave is among the most often cited sites. Both temporal divisions of Cetina culture that are in current use refer to its stratigraphy (Marović and Čović 1983; Govedarica 1989b), despite the fact that Marović's extensive excavations, carried out more than half a century ago, remain unpublished. A small number of characteristic potsherds is scattered across different publications and published without detailed stratigraphic information. From the existing documentation (Marijanović 2005: 26-27) one may conclude that excavation proceeded in arbitrary layers that sometimes were about thirty centimeters thick, which must have led to mixing of finds from different periods. Aside from a few photographs and sketches of trench profiles, the scanty field notes lack information about stratigraphic relations and the nature of the

sediments. The available information leads one to conclude that Cetina style pottery appears through a layer that is more than 1,5 meter thick (from depth 2,7 to 1,1 meter), while the rare Ljubljana-Adriatic potsherds appear alongside Cetina pottery in the lower part of that layer (from depth 2,7 to 2,0 meters) (Govedarica 1989b: 113, 130, 132).

Gudnja Cave is another often cited site. Like in the previous case, results of extensive excavations that were carried out half a century ago have not been published during the lifetime of its excavator, Spomenka Petrak. Her excavation likewise proceeded in arbitrary layers that sometimes were about thirty centimeters thick (Marijanović 2005: 11-12). Based on his inspection of the fairly numerous Late Copper Age finds, and relying on typological traits of the pottery, Dimitrijević had predicted (while withholding the details) that Gudnja may be harboring two horizons of the 'Adriatic type of Ljubljana culture', but he could not support his claim with stratigraphic information (Dimitrijević 1979a: 322; 1979b: 378). Limited re-excavation aimed at reconstructing the site's stratigraphy was undertaken a decade ago in order to fit the old finds, which were accompanied by scant and deficient original documentation, into an updated stratigraphic sequence (Marijanović 2005: 11). Unfortunately, results of those excavations were '...not presented separately, since they served only to resolve problems posed by the already existing body of finds' (Marijanović 2005: 12). According to Marijanović, Ljubljana-Adriatic and coarse incised pottery dominated in Phase 5, while the following Phase 6 contained Bronze Age finds, among which there were several characteristic Cetina style potsherds (Marijanović 2005: 88). Marijanović does not state explicitly, however, whether his phase attributions were based primarily on the available stratigraphic information accompanying the old finds, or whether their typological traits prevailed in most cases (Marijanović 2005: 73-92).

Ravlića Cave was excavated twice during the last four decades (Marijanović 1981; 2012). Compared to Gudnja and Škarin samograd, both excavations were much better documented and extensively published. The earlier excavations proceeded in 10-15 centimeters thick arbitrary levels (Marijanović 1981: 7), while later excavations followed the principles of stratigraphic excavation (Marijanović 2012: 15). Phase 3 was attributed to the developed Copper Age and an early stage of the Early Bronze Age. In earlier excavations, this phase was represented by a layer with a thickness of 1,7 meters, while in later excavations the corresponding layer was only about twenty centimeters thick (Marijanović 2012: 20). All characteristic Ljubljana-Adriatic potsherds, as well as a few fragments with decoration that closely resembles Cetina style, were attributed to an older Subphase 3a, while the majority of characteristic Cetina pottery was attributed to a younger Subphase 3b (Marijanović 1981: 36-41; 2012: 89-102). Based on published information, it is remains unclear whether this division reflects primarily the actual contents of stratigraphic contexts, or attribution of characteristic potsherds to subphases according to their typological traits. The second is suggested by the fact that several characteristic fragments of Nakovana bowls, attributed to Phase 3a in the older publication (Marijanović 1981: Plate 33: 5-12), were reattributed in the more recent publication to Phase 2c without any further explanation (Marijanović 2012: Plate 54: 1-8).

The only cave in the Karst that provides hints about stratigraphic relationship between Ljubljana-Adriatic and Cetina pottery is Grotta Caterina. Among the finds from Trench AB, a single sherd from Layer 4 and a few sherds from Layer 3 were decorated in a characteristic Ljubljana-Adriatic manner (Canarella and Pitti 1981: Figure 5: 3-5, Figure 4: 11), while a plain vessel resembling a Cetina beaker was recovered from the overlying Layer 2 (Canarella and Pitti 1981: Figure 4: 5).

The only burial mound with a documented stratigraphic sequence of Ljubljana-Adriatic and Cetina pottery is Velika gruda at Tivat. A cist grave, located near the center of the original mound, contained an inhumation, accompanied by a characteristic Ljubljana-Adriatic shallow bowl (Primas 1996: Figure 5.3). A later enlargement of the mound mantle, Layer C1 contained Late Bronze Age burials and yielded many potsherds, including a few that closely resemble Cetina style pottery (Primas 1996: 67, Figure 5.13B; Della Casa 1996: 66, 126, Figure 92: 110-118). While stratigraphic relationship between those two contexts is beyond doubt, the highly fragmented and worn potsherds from Layer C1, scattered haphazardly across the mound, cannot be trusted for chronostratigraphic purposes. Judging by their typological heterogeneity, they belong to diverse periods, and they ended up in the mantle accidentally, where they are considered to be in a secondary context (Della Casa 1995: 567, 568).

Finally, at Gajtan, a settlement site near Shkodër, fragments akin to Ljubljana-Adriatic pottery were recovered from an underlying Layer 1 that also contained Neolithic and/or earlier Copper Age pottery, while fragments akin to Cetina style were recovered from an overlying Layer 2 that also contained Late Bronze Age and Iron Age pottery, according to the scarce published information (Jubani 1972).

Despite uncertainties outlined above, the rather uniform stratigraphies of these six sites suggest that Ljubljana-Adriatic style precedes Cetina style. The reverse situation is mentioned only at Grapčeva Cave, where a layer attributed to Phase 4 yielded a few small decorated potsherds attributable to the

third millennium BC. Among them, fragments akin to Cetina style were recovered from stratigraphically older contexts of Phase 4, while Ljubljana-Adriatic and coarse incised fragments were recovered from stratigraphically younger contexts of the same phase (Kaiser and Forenbaher 1999: 316; Forenbaher and Kaiser 2008: 62-64). This apparent inversion should not be given too much weight, since the total number of characteristic sherds is very small, and their reliable stylistic determination is hampered by their small size. Furthermore, a sherd akin to Cetina style, recovered from the earliest context of Phase 5 (which overlies Phase 4), cautions of possible context disturbance.

On the other hand, frequent appearance of Ljubljana-Adriatic and Cetina finds within same contexts suggests the possibility that these two styles may overlap in time. Some might prefer to call this stylistic overlap (if indeed it exists) the 'younger phase of classic Ljubljana culture' (Govedarica 1989b: 46-47), 'proto-Cetina facies of Cetina culture' (Govedarica 1989b: 129-144), 'first stage of Cetina culture' (Marović and Čović 1983: 196) or 'early phase of Cetina culture' (Marijanović 1997: 7). Based on the available stratigraphic information, however, it is impossible to say whether the contexts containing potsherds of both styles reflect their synchronicity, mixing of finds of different ages, or poorly conducted excavations.

3.3.5.3 Radiocarbon dates

We have only nineteen radiocarbon determinations at our disposal for chronometric dating of Ljubljana-Adriatic and Cetina pottery (Table 16). These were calibrated by OxCal 4.2 calibration program (Bronk Ramsey 2009), using IntCal 13 atmospheric calibration curve (Reimer *et al.* 2013).

Begovići, Beta-248564, 3670±40 bp, calibrated 1SD range: 2134-1979 BC, a human dental sample taken from a concentration of partially burned human bones that was located near the center of the burial mound. A small number of characteristic Cetina style potsherds were recovered from the mound mantle, some of them from near the concentration of human remains (Beg Jerončić 2011: 98; Jerončić, pers. com.).

Fossa Aimone, CIRCE-DSH-123, 3868±75 bp, calibrated 1SD range: 2464-2212 BC, a charcoal sample from a settlement context marked by pottery attributed to Cetina culture (Livadie 2010: 163; Passariello *et al.* 2010: 30). The finds remain unpublished.

Grapčeva spilja yielded two radiocarbon dates: Beta-103478, 4190±50 bp, calibrated 1SD range: 2882-2678 BC, a charcoal sample from Stratigraphic Unit 1220 around the middle of Phase 4, and Beta-103477, 3880±120 bp, calibrated 1SD range: 2551-2144 BC, a charcoal sample from Stratigraphic Unit 1200 near the top of Phase 4. Both contexts (SU 1220 and SU 1200) contained occasional Ljubljana-Adriatic and coarse incised potsherds, while fragments akin to Cetina style were recovered from the overlying and the underlying contexts (Forenbaher and Kaiser 2008: 62-64, Table 1), signaling possible disturbance. Consequently, radiocarbon dates cannot be linked directly to either one of those styles, but may be related to either of them.

Grotta dei Ciclami, R-1037, 4160±50 bp, calibrated 1SD range: 2874-2674 BC, a sample from Layer 4, which contained numerous characteristic Ljubljana-Adriatic and Cetina potsherds (Gilli and Montagnari Kokelj 1993: 157).

Grotta del Mitreo yielded two radiocarbon dates: R-903a, 3720±50 bp, calibrated 1SD range: 2198-2036 BC, a charcoal sample from an underlying Layer 5, which contained numerous Ljubljana-Adriatic potsherds, a fragment of a characteristic Cetina beaker, and several other fragments akin to Cetina style, and R-902, 3820±50 bp, calibrated 1SD range: 2391-2150 BC, a charcoal sample from an overlying Layer 4, which contained fragments of plain vessels whose shapes resemble Cetina pottery (Montagnari Kokelj and Crismani 1997: 13). Inversion of radiocarbon dates relative to stratigraphic sequence signals uncertain contexts.

Boljevića gruda, KIA-19424, 4440±35 bp, calibrated 1SD range: 3321-3018 BC, a human bone sample from an inhumation burial in a pit located near the center of the mound (Guštin and Preložnik 2015: 31-32). The burial itself did not contain any grave goods. Three vessels were found in the mantle above the central burial, all of them decorated in a characteristic Ljubljana-Adriatic manner. Invoking undisturbed stratigraphy, one of the excavators deems that those vessels were deposited during the funeral (Baković and Govedarica 2009: 13, 15). Others doubt the soundness of stratigraphy and attribute those three vessels to a hypothetical second burial, while noting the absence of a second body (Guštin and Preložnik 2015: 21, 23-25). They regard the radiocarbon date as too early, explaining it away by reservoir effect without any further discussion (Guštin and Preložnik 2015: 17).

Reservoir effect influences the accuracy of radiocarbon dates when aquatic animals or plants are sampled for dating. The apparent age of such samples may be several centuries too old (Jull *et al.* 2013). Reservoir effect may be transferred to land dwellers through the food chain. If a community bases its diet on marine or fresh water food resources, a human bone sample will yield an anomalously old date (Philippsen 2013). There are no indications, however, that the exploitation of marine, riverine, or lake resources played a major role in the diet of the eastern Adriatic communities during

Site	Laboratory no.	Sample	Pottery style	Reliability*	Radiocarbon age	Calibrated 1SD range BC
Begovići	Beta-248564	human tooth	Cetina	C	3670±40	2134-1979
Fossa Aimone	CIRCE-DSH-123	charcoal	Cetina	C	3868±75	2464-2212
Grapčeva	Beta-103478	charcoal	Ljubljana-Adriatic or Cetina	C	4190±50	2887-2681
Grapčeva	Beta-103477	charcoal	Ljubljana-Adriatic or Cetina	C	3880±120	2559-2149
Grotta dei Ciclami	R-1037		Ljubljana-Adriatic or Cetina	C	4160±50	2874-2675
Grotta del Mitreo	R-903a	charcoal	Ljubljana-Adriatic or Cetina	C	3720±50	2198-2036
Grotta del Mitreo	R-902	charcoal	Cetina	C	3820±50	2391-2150
Gruda Boljevića	KIA-19424	human bone	Ljubljana-Adriatic	C	4440±35	3321-3018
Jukića gomile	Beta-241024	'soot remains'	Cetina	C	3590±40	2014-1892
Jukića gomile	Beta-241020	'soot remains'	Cetina	C	3850±60	2454-2209
Odmut	z-409	charcoal	Ljubljana-Adriatic	C	4280±120	3089-2674
Pupićina peć	OxA-18180	charcoal (*salix*)	Ljubljana-Adriatic	C	3963±27	2561-2464
Spila (Nakovana)	z-3478	charcoal	Ljubljana-Adriatic or Cetina	C	4185±95	2892-2633
Spila (Nakovana)	z-3480	charcoal	Ljubljana-Adriatic or Cetina	C	4160±75	2877-2647
Spila (Nakovana)	z-3481	charcoal	Ljubljana-Adriatic or Cetina	C	3485±90	1917-1691
Velika gruda	UZ-2696/ETH-7685	charcoal (*leguminosae*)	Ljubljana-Adriatic	A	4355±65	3086-2900
Velika gruda	UZ-2692/ETH-7631	charcoal (*picea*)	Ljubljana-Adriatic	B	4335±80	3090-2886
Velika gruda	UZ-2693/ETH-7579	charcoal (*acer, pomoidae, leguminosae*)	Ljubljana-Adriatic or Cetina	C	4155±65	2874-2639
Zagomilje 2	Beta-260022	human bone	Cetina (*terminus ante quem*)	C	3400±40	1744-1643

*A short-life sample from safe context, B long-life sample from safe context, C sample from uncertain context

Table 16. Radiocarbon dates for Ljubljana-Adriatic and Cetina style pottery

the third millennium BC. Boljevića gruda is some thirty kilometers distant from the Adriatic coast, about ten kilometers from Lake Shkodër, and about two kilometers from Morača River; its location does not suggest a diet based on fish or mollusks. The radiocarbon date from Boljevića gruda therefore should not be dismissed out of hand, just because it seems to be surprisingly early.

Jukića gomile yielded two radiocarbon dates, both from Mound 1: Beta-241024: 3590±40 bp, calibrated 1SD range: 2014-1892 BC, a sample of 'soot remains' from Burial 3 located near the center of the mound, and Beta-241020, 3850±60 bp, calibrated 1SD range: 2454-2209 BC, a sample of 'soot remains' from the mantle. The central stone cist of Burial 3 contained remains of at least two inhumations and one cremation, hinting at multiple episodes of use, as well as fragments of at least three vessels shaped and decorated in a characteristic Cetina manner. It remains unclear which of the burial episodes was dated by radiocarbon, and whether the Cetina pottery belonged to that episode. Likewise, the association of the other radiocarbon-dated sample with Cetina pottery is possible, but by no means certain (Olujić 2011: 661; 2012: 64, 68).

Odmut, Z-409, 2330±120 bp, calibrated 1SD range: 3089-2674 BC, a charcoal sample collected near the top of Stratum VI or Layer 3 (Srdoč *et al.* 1977: 473; Breunig 1987: 104). The same radiocarbon date was reported slightly differently in two other publications, first as z-37, 2335±90 bp (Marković 1977: 11), and then as z-409, 2335±90 bp 'from Stratum IV' [*sic!*] (Marković 1985: 44). Most of the characteristic Ljubljana-Adriatic potsherds were recovered from the upper part of Stratum VI or Layer 3.

Pupićina, OxA-18180, 3963±27 bp, calibrated 1SD range: 2561-2464 BC, a charcoal sample of a willow tree recovered from Context 605 of Phase 3, which contained

rare Ljubljana-Adriatic and coarse incised fragments, but also some typologically older and younger pottery finds (Hulina *et al.* 2012: 141, 158-164).

Spila (Nakovana) yielded three radiocarbon dates, all from Sector 3: z-3478, 4185±95 bp, calibrated 1SD range: 2892-2633 BC, a charcoal sample from the earliest context (Stratigraphic Unit 1013) of Phase 5a; z-3480, 4160±75 bp, calibrated 1SD range: 2877-2647 BC, a charcoal sample from the latest context (Stratigraphic Unit 1010)[11] of Phase 5a; and z-3481, 3485±90 bp, calibrated 1SD range: 1917-1691 BC, a charcoal sample from Stratigraphic Unit 1002 of the overlying Phase 5b. Sector 3 was located in the narrow passage that connects the cave entrance with the interior of the cave. In that area, the transition between stratigraphic units was not always clear. In such circumstances, excavation proceeded in arbitrary levels, which inevitably resulted in mixing of finds from the neighboring stratigraphic contexts. About a dozen characteristic Ljubljana-Adriatic and Cetina potsherds, as well as five coarse incised sherd, were scattered throughout the layer attributed to Phase 5. Plain Nakovana style pottery dominates in the lower part of that layer (Phase 5a), while its upper part (Phase 5b) is dominated by plain pottery of the third millennium BC, which is accompanied by occasional later Bronze Age potsherds (Forenbaher and Perhoč 2015: 42, Table 2).

Velika gruda yielded three radiocarbon dates: UZ-2692/ETH-7631, 4335±80 bp, calibrated 1SD range: 3090-2886 BC, a fir wood sample from the central burial; UZ-2696/ETH-7685, 4355±65 bp, calibrated 1SD range: 3086-2900 BC, a charred pulse plant sample from the top part of the primary mound mantle; and UZ-2693/ETH-7579, 4155±65 bp, calibrated 1SD range: 2874-2639 BC, an aggregate charcoal sample (fruit seeds, pulses, maple tree) from two charcoal concentrations found in a pit that was sunk into the mantle of the primary mound above the central burial. The central stone cist contained an inhumation burial, accompanied by a characteristic Ljubljana-Adriatic shallow bowl. Among numerous small and weathered potsherds that were recovered from the upper part of the mantle (a secondary enlargement of the primary mound) are several decorated potsherds akin to Cetina style.

The excavator Margarita Primas regarded the first two dates as too early, the first one maybe due to old wood effect, the second one due to the possibility that old charcoal was introduced into the mantle together with the soil. She relied on the third date, the one from the pit above the burial, while admitting that this pit may have been disturbed, if not excavated, at some later point in time (Primas 1996: 48-52, 72). The date in question (UZ-2693/ETH-7579) is doubly unreliable, however, due to its aggregate composition, and its uncertain context. Since it is not clear whether the pit was excavated immediately after the primary burial or during some later intervention, one cannot decide whether the sample dates Ljubljana-Adriatic or Cetina pottery. Compared to this, contexts of the first two radiocarbon dates (UZ-2692/ETH-7631 and UZ-2696/ETH-7685) are sounder, the date from the primary mound mantle comes from a short-life sample, and the very fact that both of them are statistically identical suggests that they are reliable, rather than a product of chance. They should not be easily dismissed just because they seem to be too early.

Zagomilje 2, Beta-260022, 3400±40 bp, calibrated 1SD range: 1744-1643 BC, a human bone sample from an inhumation burial without any grave goods, cut into the settlement deposits (Mucić and Kovačević Bokarica 2011: 139). Among the pottery fragments that were recovered from the settlement are decorated potsherds akin to Cetina style. The radiocarbon date from the burial may serve as a *terminus ante quem* for the pottery finds from the settlement.

Based on the above, and with appropriate caution, five radiocarbon dates may be associated with Ljubljana-Adriatic pottery, six may be associated with Cetina pottery, while the remaining eight dates may be associated with either one of those styles. The small total number of dates and dubious contexts from which most of the samples were recovered prevent the accurate dating of those pottery styles. If one would stick firmly with the stern criteria of 'chronometric hygiene' (Spriggs 1989: 590-605; Taché and Hart 2013: 363-365), one should discard them all. Despite that, when taken at their face value, these radiocarbon dates provide a rather convincing general chronological outline (Figure 110). The dates for Ljubljana-Adriatic style begin just before year 3000 BC and cover the first half of the third millennium, while the dates for Cetina style cover the second half of the third millennium and end soon after year 2000 BC. Accordingly, the dates for the contexts containing a mixture of Ljubljana-Adriatic and Cetina pottery cover almost the entire third millennium BC, and maybe also the first centuries of the second millennium BC if one includes the date from Phase 5b of Spila (Nakovana), which contained some later Bronze Age pottery in addition to Ljubljana-Adriatic and Cetina sherds. Finally, the date from the Zagomilje burial, which may serve as *terminus ante quem* for Cetina pottery at that site, falls around year 1700 BC and is younger than any of the dates from Cetina contexts.

Bayesian statistical modeling of start and ending dates for each style was carried out by OxCal 4.2 computer

[11] Based on preliminary analysis of the pottery assemblage, Stratigraphic Unit 1010 initially was attributed to Phase 5b (Forenbaher and Perhoč 2015: Table 2); following the detailed analysis, it was reattributed to Phase 5a.

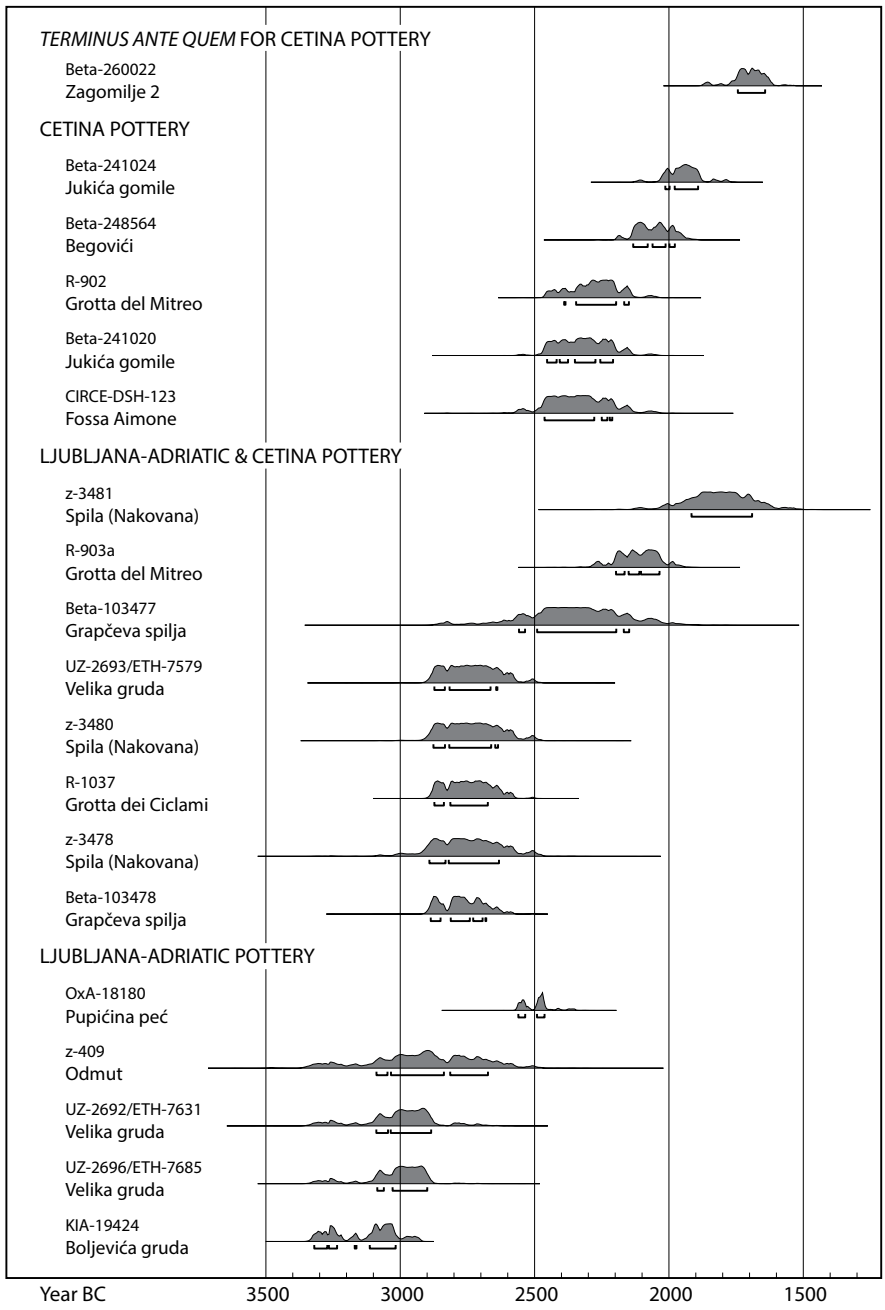

Figure 110. Radiocarbon dates for Ljubljana-Adriatic and Cetina pottery styles (probability density distributions and calibrated 1SD ranges).

program (Bronk Ramsey 2009), first by applying the overlapping phases model. That model assumes that each group of dates for a specific pottery style is independent, and estimates the start and the end for each style separately (Figure 111). With 68% probability, the modeled start of Ljubljana-Adriatic style would be between years 3352 and 3031 BC, while its end would be between years 2552 and 2321 BC; the modeled start of Cetina style would be between 2526 and 2259 BC, and its end between years 2019 and 1796 BC.

Since radiocarbon dates do not suggest a temporal overlap between the two styles, Bayesian modeling was repeated by applying the sequential phases model. That model assumes that the group of dates for one pottery style immediately precedes the group of dates for the other pottery style, in a chronological order established by archaeological evidence, and estimates the time of transition from one style to the other (Figure 112). With 68% probability, the modeled transition from Ljubljana-Adriatic to Cetina style would have taken place between year 2494 and 2340BC.

Montenegrin burial mounds yielded the earliest radiocarbon dates for Ljubljana-Adriatic style. Farther up the Adriatic towards the northwest, the earliest

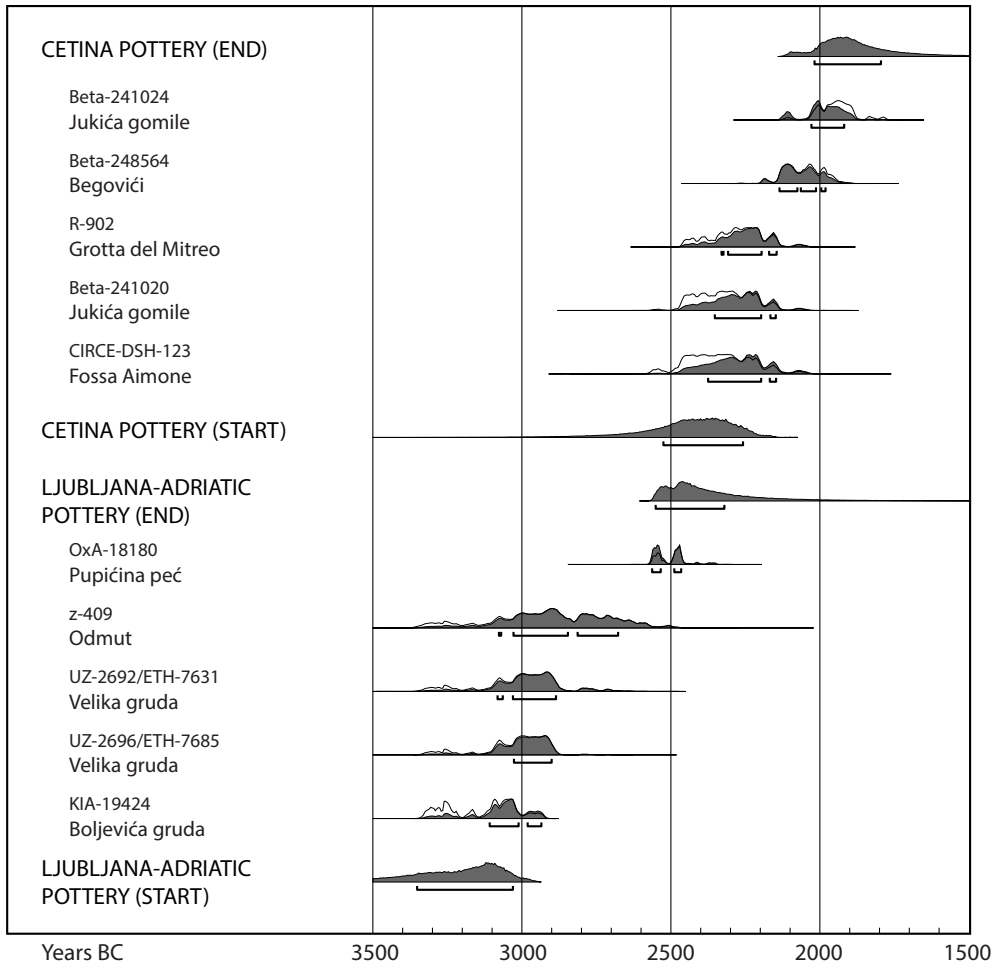

Figure 111. Modeled start and end dates for Ljubljana-Adriatic and Cetina styles (probability density distributions and calibrated 1SD ranges).

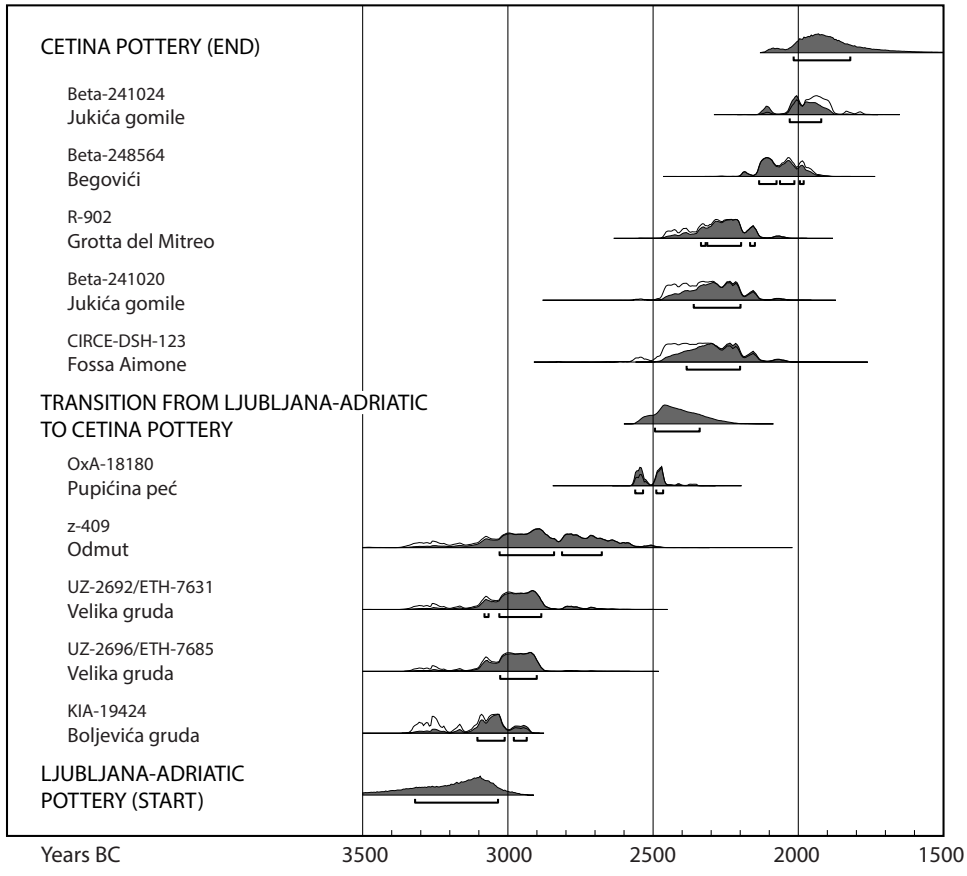

Figure 112. Modeled dates for the transition from Ljubljana-Adriatic to Cetina style (probability density distributions and calibrated 1SD ranges).

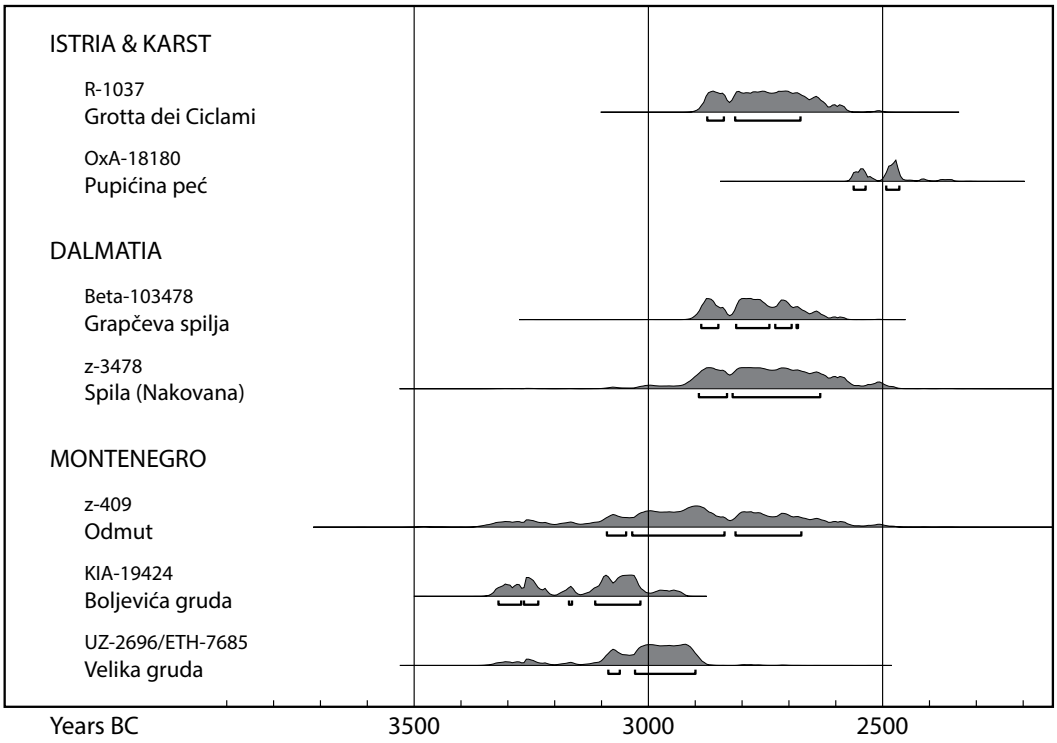

Figure 113. Radiocarbon dates for Ljubljana-Adriatic style (probability density distributions and calibrated 1SD ranges) grouped by region. Dates from mixed (Ljubljana-Adriatic and Cetina) contexts of Grapčeva and Nakovana caves have been included. Only the earliest date from each site is shown.

available dates are at least two centuries younger (Figure 113). If the apparent temporal priority of the southern Adriatic sites gains further support from future radiocarbon dates, that would have major consequences for interpretation of the origin of Ljubljana-Adriatic pottery style and other important changes that accompanied its appearance. For now, however, it would be irresponsible to draw far-reaching conclusions based on a few uncertain dates.

3.3.5.4 Concluding remarks on dating of the pottery styles

All of the three discussed dating techniques indicate that Ljubljana-Adriatic style preceded Cetina style, while the typological traits of the associated metal implements and the radiocarbon dates place both styles roughly within the third millennium BC. According to cross-dating of metal implements, Ljubljana-Adriatic style would belong to the second quarter of the third millennium, while according to radiocarbon dates it would cover the entire first half of the third millennium BC. Dendrochronological analyses that were carried out at Ljubljansko barje suggest similar dates, by dating the abandonment of the Parte-Iščica lake dwelling around the transition from 28th to 27th century BC (Velušček and Čufar 2014: Table 2). Unfortunately, Ljubljana-Adriatic style has not been firmly dated yet at Ljubljansko barje. Apparently, it precedes Vinkovci-Somogyvár style in that area, but the mutual relationship of those two styles remains unclear (Velušček 2014: 640-641).

If one accepted the radiocarbon date from Boljevića gruda, Ljubljana-Adriatic style would have begun in southern Adriatic shortly before year 3000 BC. Due to a plateau in the calibration curve (Reimer *et al.* 2013), the calibrated 1SD range of that date spans the entire last third of the fourth millennium BC, but it seems unlikely that Ljubljana-Adriatic style could have appeared much before year 3000 BC, since the earliest dates for Nakovana pottery fall within that range (Forenbaher 2000: 380, Table 2). Duration of Ljubljana-Adriatic style until about year 2400 BC is questionable, since it relies on a single late date from Pupićina Cave, from a context that, aside from Ljubljana-Adriatic potsherds, also contained later finds. Furthermore, several sites at Ljubljansko barje that were marked by Vinkovci-Somogyvár pottery style and dated by dendrochronology around the middle of the third millennium BC (Parte, Založnica, Črni graben and Špica) yielded very few Ljubljana-Adriatic finds. It seems more likely, therefore, that Ljubljana-Adriatic style did not last more than five centuries, and went out of use around year 2500 BC.

Cetina style replaces Ljubljana-Adriatic style pottery around the middle of the third millennium BC. Based on the existing information, some temporal overlap between the two styles can neither be confirmed nor rejected. Typology of the associated metal finds does not provide grounds for a more precise dating of Cetina style within the third millennium BC. According to radiocarbon dates, that style covers the second half of

the third millennium BC and lasts about five centuries or slightly longer, until around year 1900 BC. Characteristic Cetina finds from Lerna and Olympia provide additional support to such dating. In both cases, Cetina finds were recovered from contexts attributed to EH III Period (Rutter 1982: 461, 481; Maran 1987: 79; Rambach 2007: 84), which covers roughly the last quarter of the third millennium BC (Manning 1995; Broodbank 2000).

It follows from the above that Ljubljana-Adriatic pottery style is contemporaneous with Vučedol style – not only with 'late Vučedol', but also with 'classic Vučedol' (Marijanović 1993: 56; Della Casa 1996: 135, Table 18; Velušček and Čufar 2003: 132; Maran 2007: 8). The earliest dates from Montenegrin burial mounds are even a bit earlier than the earliest date from Vučedol (Beta-252282, 4340±40 bp, calibrated 1SD range: 3011-2905 BC), while most of the dates for Vučedol fall around or after year 2900 BC (Forenbaher 1993: 267, Figure 6; Balen 2010: 111). Ljubljana-Adriatic style pottery appears two or three centuries before the Bell Beakers and overlaps with the early Bell Beakers only during the second quarter of the third millennium BC (Vander Linden 2006). Cetina style pottery overlaps widely in time with the late Bell Beakers (Vander Linden 2006) and Vinkovci-Somogyvár pottery (Forenbaher 1993: 247-248, Figure 8; Velušček and Čufar 2014: Table 2).

Ljubljana-Adriatic and Cetina pottery styles belong to a third millennium BC Pan-European artistic 'macro-tradition' (Robb 2015: 643) of pottery decorated by a combination of incision, impression and incrustation. Aside from the decorative technique, different styles of this macro-tradition are linked by similar basic decorative motifs, similar ways in which those motifs are combined into complex designs, similar kinds and shapes of vessels, and similar purpose and depositional contexts of decorated vessels. Despite large distances, those similarities sometimes can be striking. In regions to the west of Adriatic, from Iberian Peninsula to Central Europe and Sicily, vessels more or less akin to Ljubljana-Adriatic style pottery appear within Bell Beakers assemblages (Harrison 1977; Nicolis and Mottes 1998; Nicolis 2001a; Vander Linden 2006; Guilaine *et al.* 2009). In middle Danubian region, similar vessels may be found among Vučedol pottery (Schmidt 1945; Dimitrijević 1979a; Durman 1988), while Vinkovci-Somogyvár assemblages contain vessels akin to Cetina style pottery (Dimitrijević 1982; Bondár 1995; Velušček and Čufar 2003). To the east and south, Ljubljana-Adriatic and Cetina pottery may be compared to the southeast European *Schnurkeramik* (Roman 1992), the Cycladic EH II Period 'stamped-and-incised' pottery (Broodbank 2000: 202-203), and maybe even to some of the finds from Malta (Maran 1997: 173, 185). Fuzzy borders of their geographic distribution and similar finds from distant regions testify of mobility, connectedness, and shared ideological tenets. At this point one should remember that Ljubljana-Adriatic and Cetina styles extend across a strategically important region between Central Europe, Balkan Peninsula, and the eastern and western Mediterranean.

3.4 Palagruža in third millennium BC

3.4.1 Transformation of prehistoric Europe

Across Europe, the third millennium BC was marked by radical changes in social landscape. During preceding millennia, Europe was a continent of autonomous farming villages and small-scale societies that followed Neolithic traditions and expressed their group solidarity by burying their dead in communaAl tombs. People differed by their social roles, but that differentiation was primarily horizontal. Exalted individuals who could project their power to most members of the community were absent. This 'egalitarian' Neolithic world was transformed beyond recognition during the third millennium BC. Europe became a mosaic of hierarchically organized societies led by local elites. Richly furnished burials of prominent individuals testify of distinct vertical gradation of wealth, status and power.

Change in the nature of social organization was materially expressed in novel ways (Sherratt 1998: 275-276). New, different eating and drinking habits, clothing, furniture, means of transport, personal adornments and weaponry became symbols of social success. Leaders of the competing elites exchanged gifts and set up alliances in order to secure access to key status goods. None of those powerful individuals would have established permanent dominance over their neighbors, asserted territorial control over large regions, or enforced strict territorial boundaries (Harrison and Heyd 2007: 193; Broodbank 2013: 315). Their power would have depended on their capacity to demonstrate superiority over rivals by obtaining privilege and status symbols.

Changes in mortuary ritual reflect a new world view that, rather than emphasizing group solidarity, focuses on personal identity of the individual (Harrison and Heyd 2007: 132-133, 193; Broodbank 2013: 305-306). Gender distinctions are enhanced, with men playing the dominant role. Expression of warrior identity, related to an ideology that relishes acquisition and maintenance of power through social competition, becomes codified. Numerous fortifications and increased male mortality indicate that constant insecurity and more frequent conflicts are symptomatic corollaries of the new order.

Enhanced social inequality is simultaneously the background and the outcome of the flow of new kinds of commodities (Maran 2007: 11). Special objects made of rare raw materials, often exchanged across great

distances, give the third millennium BC an international character (Sherratt 1998: 251). Value of those objects is augmented by links to their previous owners, the alien and powerful inhabitants of distant lands. Across the continent, diverse tokens of wealth and power express similar values in similar ways. In particular, objects made of metal, weapons, and standardized ceremonial drinking sets gain conspicuous social significance.

The onset of these changes is roughly contemporaneous in many distant corners of Europe, and they unfold with uneven tempo and intensity throughout the third millennium BC, testifying for the first time that almost the entire continent is interconnected. Different authors assign special importance or temporal priority to specific regions, but very often they disagree in details. What seems certain is that the third millennium BC Europe was dynamic and complex, while our current perception of it is still rather out-of-focus. Three extensive interaction networks interconnected the European space. Each network encompassed a vast area and was characterized by a distinct assemblage of highly valued symbols of a specific way of life shared by the members of the elites.

In western and central Europe, from Scotland to Sicily and from Portugal to Poland, the appearance of Bell Beakers testifies of a process of structured interaction that involved circulation of a variety of new material culture elements (Vander Linden 2007: 346). Characteristic burial assemblages of pottery, weapons and personal adornments point to an aggressive ideology, enhanced gender distinctions and a deliberately ostentatious lifestyle (Sherratt 1998: 251-254; Vander Linden 2007: 348-350). Distinctive beakers for serving and drinking alcoholic beverages were not made for all members of the community, but only for the selected individuals whose mobility was crucial for the creation and maintenance of social inequality, that is, for gaining and consolidating power. While the details about the origins and directions of movement of those people remain ambiguous, analyses of oxygen and strontium stable isotopes from their bones have shown clearly that many of them have changed their place of residence during their lifetime, sometimes by traversing hundreds of kilometers (Price *et al.* 1998; 2004; Parker Pearson *et al.* 2007: 635-636).

The second interaction network extends from the Pontic steppe, across Eastern Europe, to the Carpathian Basin and the Balkan Peninsula (Harrison and Heyd 2007: 193-194). Like in western Europe, its existence is signaled by a series of new, widely distributed elements of material culture. Prominent among them are objects made of metal, such as shaft-hole battle axes. Anthony refers to this as 'Yamnaya horizon', a style or fashion in material culture that is rapidly accepted by and superimposed on local cultures across a wide area (Anthony 2007: 307). Other propose the term 'Yamnaya Package' that would be analogous to the 'Bell Beaker Package' (Harrison and Heyd 2007: 196), although its elements are less homogeneous. The eastern European societies also were led by bellicose elites, whose social reproduction depended on long-distance exchange. Settlements were often tightly packed and located strategically on tells above rivers or deep inlets. This suggests that long-distance contacts were achieved primarily by navigation along large rivers, but also by the sea (Sherratt 1998: 263; Anthony 2007: 354-359; Harrison and Heyd 2007: 201). While the mobility of individuals and small groups is unquestionable, the character of that mobility remains hotly discussed. Some maintain that substantial populations migrated from the Pontic steppe to the Carpathian Basin and the Balkan Peninsula, bringing radical change to those regions (Harrison and Heyd 2007: 196, 201, 203; Anthony 2007: 344-345, 369-370), but a general consensus is not in sight.

In the Aegean, prominent individuals appear to be dynamic, entrepreneurial and aggressive figures who mobilize their followers by feasting and gift-giving (Renfrew 1972: 362-406; Broodbank 2013: 320-325). Their status and power depend on their ability to accumulate, control and distribute specific kinds of prestigious goods such as metal weapons, marble figurines, and drinking and pouring vessels. Leaders of rival elites follow the widely agreed rules of competition by accumulating material symbols of social status through exchange or sponsored production. Seaward orientation and maritime connectivity of small island communities, which often are protected by fortifications, becomes especially important. During the third millennium BC, the Aegean network gradually becomes enmeshed by the wider eastern Mediterranean interaction networks (Maran 2007: 8; Broodbank 2013: 335-337). Like in western Europe, the new kinds of drinking vessels symbolize the social distinction of their owners and are integrated in local feasting customs (Maran 2007: 13).

Participants in long-distance interaction cultivated dual identities (Broodbank 2013: 333). While rooted in specific places, elites from distant lands constituted a virtual community that extended across far-flung regions and was recognizable by its emblems. Due to that duality, the apparent uniformity of archaeological evidence across vast areas breaks down when one focuses on specific contexts embedded in local traditions.

Both the local distinctions and the connections with distant lands are readily observable in the eastern Adriatic, an area where the three major European interaction networks adjoin each other. While the new, specific and attractive pottery styles (Ljubljana-Adriatic and Cetina) are inventions of the local potters, they also testify of contacts with the areas lying to the west (Bell Beakers), north (Vučedol and Vinkovci-

Somogyvár styles) and, to a lesser extent, southeast (Cycladic stamped-and-incised pottery). The altered social role of pottery is in complete accordance with contemporaneous pan-European trends. Different types of metal weapons and jewelry may be associated with different (often, distant) regions of central Europe, Carpathian Basin, Balkan Peninsula and Anatolia. Flaked stone and ground stone archery equipment corresponds to warrior assemblages that farther to the west usually are accompanied by the bell beakers.

Social change in the eastern Adriatic is concurrent with the appearance of monumental architecture. Burial cairns were erected above individual tombs since the very beginning of the third millennium BC (Primas 1996). Often they are situated at prominent locations, apparently in order to serve as conspicuous and lasting markers in the cultural landscape. They have been interpreted as ancestral monuments to members of the elite whose role was crucial for social integration of their communities (Della Casa 2011: 70). It seems that the first occupation of hillforts, the strategically important and easily defensible locations on prominent and flat hilltops, is roughly contemporaneous with the earliest burial cairns. Ljubljana-Adriatic or Cetina style pottery was recovered from about fifteen hillforts scattered along the entire eastern Adriatic (see Appendix). In most cases, however, only a few sherds have been collected, either from the surface, or from small test trenches. Due to inadequate research, this evidence cannot be linked reliably to any fortifications, which may have been erected at that time, or during later reoccupations of the same strategic positions.

Not so long ago, causes to those changes were sought in migrations from the interior to the eastern Adriatic coast (Batović 1973b; Dimitrijević 1979b: 370; 1988: 22-23; Marović and Čović 1983: 228; Durman 1988: 19). More recent theoretical discussions point out that it is virtually impossible to demonstrate migration relying only on geographic distribution of archaeological artifacts (Anthony 1990; 1992; 1997; Chapman and Dolukhanov 1992; Chapman and Hamerow 1997; Burmeister 2000). While there are no convincing indications of mass migration from continental interior and across western Balkan Peninsula to the eastern Adriatic littoral (Marijanović 1991a: 238), individual mobility, contacts and travel should not be ruled out. To the contrary, the archaeological evidence clearly testifies that the third millennium BC was the time of intensive long-distance interaction across those regions.

Connectedness of the Adriatic with its neighborhood was not immutable during the third millennium BC. At certain times, certain parts of the Adriatic region were more connected to their adjoining areas, while at other times those connections weakened. Judging by the geographic distribution of Ljubljana-Adriatic and Cetina pottery, as well as the rather late appearance of Cetina pottery in western Greece, connections with distant lands grew stronger during the second half, and towards the end, of the third millennium BC. Due to deficiency of the available archaeological record, especially due to its low temporal resolution and very few reliably dated finds, Maran's inspired and suggestive attempt of a more detailed and precise synthesis seems somewhat premature (Maran 2007: 8-16).

In the course of the third millennium BC, diverse regions of prehistoric Europe became interlinked as never before. The new long-range contacts by land and river, and especially sea, played the crucial role in that process (Sherratt 1998: 251-256; Maran 2007: 18; Broodbank 2013: 325), in which the sea-oriented communities of the eastern Adriatic gained a prominent position. Those communities were led by long-distance voyagers, the recently dubbed 'Argonauts of the West Balkans' (Maran 2007: 16).

3.4.2 Seafarers and their craft

What was it like to travel to Palagruža in the third millennium BC? Were the vessels that navigated the Adriatic already equipped with sails? Shipwrecks from that period have not been discovered anywhere in the Mediterranean, but thanks to depictions, we do have some information about the ships (Broodbank 2013: 290-292). Images suggest that the first sails were fitted on river ships that plied the Nile in the late fourth millennium BC. Seagoing vessels propelled by oars and sails appeared in the early third millennium BC along the coasts of Egypt and the neighboring Levant. Due to their size and technical complexity, those earliest sailing ships represented the pinnacle of technology and state-level entrepreneurship.

While some would argue that, roughly at the same time, vessels fitted with sails navigated the central Mediterranean as well (Maran 2007: 7), the archaeological evidence does not provide support for that claim (Broodbank 2000: 96, 342-343). In the Aegean, the earliest depictions of sailing vessels appear at the very end of the third millennium BC, and their advanced technical characteristics suggest adoption rather than long local tradition and innovation. It seems that the westwards spread of sailing along the Mediterranean was gradual and punctuated by delays, since sailing ships required a completely new approach to shipbuilding, and a capital investment that would have surpassed the economic potential of most of the small prehistoric polities (Broodbank 2000: 100; 2013: 327).

Rather than sailing, it seems that the building technology of large paddle-driven canoes was stretched to its ultimate limits. Incised images on

third millennium BC Cycladic pottery provide the best evidence. They show fairly large and slender vessels, possibly extended dugouts or long clinker-built vessels, with one decorated high end. The number of paddles shown suggests that they were about 15-20 meters long, crewed by more than twenty paddlers, and could carry only a modest amount of additional cargo. A beach was all that such boats would have required for landing, but they would not have been particularly trustworthy in rough seas. With full crew and negligible cargo, their daily range may have been about 50 kilometers. They were used primarily for warfare and ceremonial activities related to high social status and long-distance voyages (Broodbank 2000: 97-102; 2013: 327-329).

While movement of people between neighboring villages would always have been a part of normal social life (Robb and Farr 2005: 33), the ability to connect with distant lands became in hierarchical societies an important element of elite status legitimation. Social elites seek to control esoteric knowledge, which tends to be acquired far away. Ethnographic literature commonly cites curiosity, desire for adventure, the search for knowledge, pursuit of fame and prestige, and acquisition of tangible and intangible wealth among the motives for embarking on a voyage (Helms 1988: 264).

In central Mediterranean, only some of the communities (those that were large enough and led by most powerful individuals) would have possessed an adequate economic base to build, equip, and muster the vessels for long voyages. Those vessels would have provided the means for practical and symbolic control of the sea. Numerous depictions of such vessels on Cycladic special-purpose pottery vessels (the so-called 'frying pans') suggest that navigation to distant lands was imbued with cosmological and status-related connotations. Novelties and exotics brought from such voyages testified of encounters with eminent people. The happy return spoke of triumph over dangers and acquisition of esoteric knowledge. An ideal prototype of elite seafarer that is brave, persevering, experienced and wealthy through his heroic deeds seems to coalesce during the third millennium BC (Broodbank 2013: 329). It is entirely plausible that the origins of Mediterranean mythological tradition reach back to that period, especially myths like those about Odysseus or the Argonauts, where voyages as sources of knowledge are central to the narrative (Della Casa 2011: 68-69).

Those ancient seafarers sometimes would have been long absent from home, while the season of navigation overlapped with the growing season. Presumably, that was the reason why some of them would have become specialist travelers (Broodbank 2000: 94-96; 2013: 329; Farr 2006: 93). A new worldview was taking shape, strongly related to seagoing craft and the sea, which probably became ever more populated with supernatural beings (Broodbank 2013: 330).

Seen in context of the third millennium BC, Palaruža is much more than the key link in a chain of islands connecting the opposite Adriatic coasts. Metaphorically, it is the keystone in which the three European interaction networks come together. It is rare in archaeology that one can pinpoint with such precision a place that would have been a meeting point of different people, objects and ideas (Farr 2006: 97). The closing sections of this book present an attempt to discuss potential human activities that may best explain the peculiar character of Palagruža's archaeological record, most of which belongs to this period.

3.4.3 Settlement?

In Chapter 3.1 we have concluded that, by its size and location, Palagruža belongs to the category of small and remote islands that could not have been permanently settled (Bass 1998: 181). In a good year, terrestrial resources such as cultivable land, pasture, and firewood, might have sufficed for a tiny group of settlers (maybe, a family or two), but scarcity of potable water would have presented a major obstacle to extended stay (Kovačić 1997: 41; Kirigin *et al.* 2009: 139; Kirigin 2012: 119). Such a small community could not have functioned in isolation, and Palagruža's distance from land would have made regular commuting in a small boat extremely risky.

Nevertheless, does the rich archeological evidence from Salamandrija provide any indications of extended sojourns during the third millennium BC? In that case, one would expect to find remains of dwellings and furniture such as hearths. While none were encountered in the excavated areas of the site, one cannot rule out the possibility that they had been erased by later construction work, or that they still may exist in unexcavated areas.

Similarly uncertain is the information about food remains, which constitute a ubiquitous part of any settlement site. The relatively small faunal assemblage that falls into this category, recovered from Salamandrija in the course of area excavation, contains 2138 animal bones and bone fragments.[12] About 20% of those bones could be determined more closely. Almost three quarters of identifiable bones are from sheep and/or goats. Adult ovicaprines predominate, but there are also a few subadults and juveniles. Judging by the distribution of represented elements, the animals reached Palagruža

[12] The information about the faunal assemblage is from the unpublished report by Jane Sanford, who analyzed the animal bones.

alive and were butchered for consumption on the island. Pigs are represented with only seven bones, while dogs, cattle, and horses or donkeys are each represented by only a couple of bones. Also present are fish bones (20%) and bird bones (10%), while wild terrestrial animals are absent. Unfortunately, we do not know which of those bones may belong to prehistoric episodes of activity at Salamandrija, since all contexts with prehistoric finds had been heavily disturbed. It is quite possible that all of them were discarded at the site in more recent historic periods.

The third millennium BC pottery assemblage is much more informative. Its structure is quite different from the structure that is common for general-purpose settlement sites. Results of analyses reported in Chapter 2.1.2 point to a marked prevalence of small and decorated vessels, which probably were used in individual drinking or pouring ceremonies. A small number of vessels would have corresponded by size to drink-pouring jugs, while coarse vessels for food preparation and large storage jars are virtually absent. Aside from that, it seems that there was no place for damaged pottery on Salamandrija. That is suggested by the complete absence of secondary drilled holes that elsewhere were made for mending cracked vessels.

The lithic assemblages presented in chapters 2.1.3 and 2.1.4 likewise lack the common structure that characterizes settlement sites. Their most striking component is the highly specialized archery equipment, which is unrelated to domestic activities. Arrow armatures (bifacial points and microlithic crescents) constitute two thirds of all retouched flaked stone artifacts, while retouched blades, retouched flakes, scaled pieces, and other tool categories that normally prevail at general-purpose sites are markedly less common. While milling stones and ground stone axes that might serve as farming tools are absent, wristguards and other small decorative ground stone objects are surprisingly numerous.

Fishermen from the neighboring Dalmatian islands have been harvesting systematically the rich deep-water fisheries around Palagruža since the 16th century AD. They erected a few stone-built huts on Salamandrija, where they would be spending up to three weeks salting the sardines and packing them into small barrels. They used the same huts for storage of fishing equipment (Kirigin and Katunarić 2002: 299, 318). One might wonder whether a similar arrangement could have been possible already in third millennium BC. Were the earliest Adriatic elites able (and willing) to mobilize people and considerable resources needed for deep-water harvesting? Archaeological evidence that would support this hypothesis is not forthcoming anywhere in the Adriatic, and nothing in the archaeological record of Palagruža hints at fishing equipment being stored, or fish being processed there.

3.4.4 Fort?

While probably there has never been a permanent settlement on Palagruža, in historic times the island has seen episodes of prolonged occupation by specialized groups of people. Aside from lighthouse crews, military detachments have been stationed there during the last century, but also in much earlier times, in order to control the strategically important location. A testimony of the latter is the late Roman fortress at Salamandrija (Kirigin 2012: 90-93). Those military garrisons were firmly bound to their mainland bases and completely dependent on logistical support that was provided by various sates located along parts of the Adriatic coasts.

When we began our investigations at Palagruža, the unexpected abundance of archery equipment led us to presume that a small hillfort may have existed at Salamandrija in the third millennium BC (Forenbaher *et al.* 1994: 40), but during later exploration campaigns we did not encounter any trace of prehistoric fortifications. Due to the Palagruža's remoteness and absence of natural resources, the above hypothesis imposes a number of questions. What would the hillfort be defending on an otherwise uninhabited islet? Who would have constituted its garrison? Who would have supplied it with the basic necessities? None of those questions can be answered without postulating the existence of a large and powerful state-level polity, capable of controlling a substantial part of the Adriatic region, but there is no hint in the archaeological record that anything like that had existed in the third millennium BC. Formidable logistical requirements could not have been met by small and unstable communities headed by the local high-ranking individuals. Therefore, one should not look for remains of a prehistoric hillfort at Salamandrija.

3.4.5 Chipping station?

We have suggested in several previous publications (Forenbaher *et al.* 1994: 40-41; Forenbaher and Kaiser 1997: 23-24; Kaiser and Forenbaher 1999: 319) that flaked stone artifacts were produced at Salamandrija, and that they may have been produced by craft specialists in order to be exchanged. Presence of chert in the rocks of Vela and Mala Palagruža seemed very suggestive, but since similar or better cherts are available at many locations on both sides of the Adriatic (Perhoč 2009; Tarantini and Galiberti 2011), the reasons for locating a lithic workshop on a remote islet remained unclear. In the meantime, raw material analyses have shown that almost all flaked stone artifacts from Palagruža are made of Gargano cherts, while the local chert was not

used at all. With that, the hypothetic lithic production site at Salamandrija suddenly lost all credibility.

Regardless of that, flintknapping was one of the clearly attested activities at Salamandrija. About two thirds of the flaked stone assemblage consists of production waste such as flakes and chunks, as well as a few flake cores and amorphous core fragments. Contents and structure of that assemblage do not suggest, however, that Salamandrija was a specialist production site. A typical assemblage from a specialized lithic production site should contain almost nothing but chunks of raw material, chipping waste, and production tools such as hammerstones and pressure flakers made of bone or antler (Forenbaher 1999a: 16, 22; 2007: 233). A certain number of exhausted cores and broken or unfinished products should indicate what was produced there. Final products are removed from such sites to be used and discarded elsewhere, while household implements and equipment are not commonly introduced to them.

In contrast, final products constitute almost a third of the flaked stone assemblage from Salamandrija. Most common among them are prismatic blades, as well as bifacial points and other arrow armatures. The bare fact that they were made of non-local raw materials suggests that most of them were not made on Palagruža, but were imported in their final form. That is further supported by the very small quantity of primary debitage and an almost total absence of blade cores and core rejuvenation elements that would testify of on-site production of prismatic blades. Likewise, we did not find any evidence of bifacial point production, but one should admit that such evidence would be very hard to observe and document (Mussachio 1995). All of the above, as well as the presence of a substantial amount of pottery and other classes of prehistoric finds, makes it abundantly clear that Salamandrija was more than just a chipping station. Flintknapping was just one among the activities that occasionally were practiced at the site. That activity cannot explain the abundance of prismatic blades, bifacial points and microlithic crescents.

3.4.6 Cemetery?

Some of the most prominent and best represented categories of finds from the third millennium BC Salamandrija, such as the small and richly decorated Cetina style pottery and wrist guards, are otherwise best known from burial contexts. In contrast to some neighboring regions, arrows seldom appear in eastern Adriatic burials. This may be a regional peculiarity, or a consequence of rough excavation methods that were applied in old excavations.

The speculation about a possible prehistoric cemetery on Palagruža was initiated already by the island's first explorers. Burton mentioned 'ten skulls and a heap of bones from the Topich collection', but unfortunately he did not provide any other information (Burton 1879: 179). The report of a flaked stone arrow point that was found 'stuck into a skeleton'[13] is particularly intriguing (Marchesetti 1876: 289). If that point indeed was embedded in a human bone, it would have proved beyond doubt that the burial was prehistoric. However, if 'skeleton' is understood as a rough reference to the body of the deceased, the point would have been found among the bones, where it may have been introduced accidentally with the soil that was used to fill the burial pit. In the latter case, the burial may have belonged to any period. Unfortunately, since those bones had to be left on Palagruža due to local fishermen's superstition, one does not know whether Marchesetti's description should be taken literally.

We unearthed five burials in the course of our excavations at Salamandrija. One of them is late Roman, two are early medieval, one dates from the High Middle Ages, and one from the modern era (Forenbaher *et al.* 2015). Excellent preservation of human remains indicates that bone preserved well in the surrounding soil environment. If there had been any prehistoric burials within the excavated area, we would have found their remains. Such burials would have been heavily disturbed by later activities, but one would still expect to encounter isolated human bones scattered as residual finds in later archaeological deposits. A few such finds do exist, but all can be related to the five historic burials mentioned above, or to even later burials that had been destroyed since they lay at the modern soil surface (Forenbaher *et al.* 2015: 103-104). Finally, one should mention that some of the eastern Adriatic burial mounds from the third millennium BC contained cremation burials (Marović and Čović 1983: 203-205). Remains of such burials can be easily missed, especially if they have been badly disturbed.

One of the main reasons to doubt the existence of prehistoric cemetery on Palagruža is the sheer quantity of finds. The nine test trenches with a total area of 9,5 m^2 that were excavated on the northern slope of Salamandrija within the area of the surface scatter yielded 29 bifacial points, 26 microlithic crescents and a wristguard. Assuming that they have provided a representative sample from which one may extrapolate, the entire surface scatter (an area of 3500 m^2) would contain about ten thousand bifacial points, almost as many microlithic crescents and several hundred wristguards. This estimate omits the finds that have been recovered from the plateau, as well those collected during the surface survey of the northern slope (43 additional bifacial points, 20 microlithic crescents and

[13] *'Una di queste [cuspidi di freccia] venne ritrovata confitta in uno scheletro'* (Marchesetti 1876: 289)

about five wristguards). It is much harder to estimate the total number of deposited vessels due to their high fragmentation, but since the pottery analysis has indicated that the recovered assemblage contained at least 170 vessels, their total number would have been several times greater.

Even the richest third millennium BC burials contained incomparably smaller quantities of similar objects. Very few contained more than one wristguard and a few arrows. One would have to postulate the existence of hundreds of burials in order to explain the quantities of such finds on Palagruža. Regardless of the site's disturbed condition, such a huge cemetery would be virtually impossible to miss, unless maybe if it were a cremation cemetery, but in that case, where would all the wood for the pyres have come from?

Just like the hypothetical fortification, the hypothetical cemetery at Salamandrija raises unanswerable questions. If the islet was uninhabited, who would have been buried on it? While one might imagine a very exceptional funeral, taking place under exceptional circumstances, regular ferrying of the dead from the coast or the inhabited coastal islands seems quite improbable. Transport of the ashes of the deceased seems less improbable, but the archaeological record of Palagruža does not offer any hints in favor of that assumption.

3.4.7 Ritual focus?

A striking characteristic of the Salamandrija lithic assemblage is the great number of objects related to archery. Bifacial points, microlithic crescents and transversal points served as arrow armatures. Carefully shaped, polished and sometimes decorated wristguards made of attractively colored, exotic rock would have marked one's identity as an archer regardless whether their primary function was utilitarian, decorative or symbolic. Archery would have been directly related to warfare and prominent social status.

Salamandrija's pottery assemblage also stands out as exceptional. The greatest majority of potsherds belonged to small vessels, of an appropriate size to serve as drinking cups. Many were elaborately shaped and richly ornamented. Frequency of decorated potsherds is around 15%, as compared to less than 2% at most general purpose sites (see Section 2.1.2.2.2.4). Around 85% of the vessels were at least partially decorated. Within the context of the third millennium BC Adriatic, such vessels represented fine ceremonial ware.

In the area and period in question, archery equipment and fine pottery vessels may be regarded as 'choice artifacts' (Renfrew 2007: 430). Salamandrija contains such objects in an abnormally large number. The available archeological evidence suggests that, aside from metal weapons and jewelry, there would have been few other classes of choice artifacts to choose from. If the long-distance exchange depended on long maritime voyages, the seagoing craft with relatively small cargo capacity would have provided adequate means of transport for such small but valuable items. But why would the ancient seafarers have unloaded a substantial part of their precious cargo at Palagruža? What made Palagruža so unique?

When observed in a wider Mediterranean context, however, Palagruža may not be quite that unique. The place that offers possibilities of comparison is another 'unique site' on a small and barren island, located not in the Adriatic, but in the Aegean Sea. The site of Kavos at the western tip of the island of Keros contained vast quantities of potsherds, as well as many fragments of marble bowls and Early Cycladic figurines (Renfrew 2007; Renfrew *et al.* 2012). All of those objects were deliberately broken, and their fragments were systematically brought to the island for ritual disposal. Since those activities were practiced not only on a local but on a wider regional scale, Keros is regarded by its excavators as the oldest maritime sanctuary in the world (Renfrew *et al.* 2012: 145, 158).

Kavos and Salamandrija are roughly contemporaneous. Both sites cover a few centuries around the middle of the third millennium BC and share a series of common characteristics, such as an unparalleled richness in terms of artifacts of a special nature, otherwise best known from burial contexts. Renfrew notes that the very abundance of finds, outclassing by an order of magnitude those from the richest known Early Cycladic cemeteries, disqualifies the interpretation of Kavos as remains of rich but badly disturbed burials (Renfrew 2007: 434). The same argument stands for Salamandrija. Both sites are marked by the abundance of pottery finewares and special purpose vessels, as well as presence of exotics such as obsidian, but also by the omission of metal weapons and jewelry. Both sites yielded modest evidence of lithic production (Renfrew 2007: 430, 433). Unlike Keros, there are no marble figurines or marble vessels at Palagruža, but such objects are unknown in the third millennium BC Adriatic. Instead, wristguards, pendants and other kinds of small polished stone objects are unusually well represented. Finally, in contrast to Palagruža, a contemporary settlement existed on Daskalio, an islet separated from Kavos by a strait only a hundred meters wide (Renfrew *et al.* 2012: 146).

The choice of Palagruža for staging ritual activities does not come as a surprise. Its central location in the Adriatic is of great practical value. For prehistoric seafarers, it must have been an important landmark and a potential place of shelter. Its towering cliffs,

breaking the empty surface of the sea, provided a spectacular natural setting. Almost unavoidably, this major landscape feature would have carried symbolic overtones. At a time when many parts of Europe were connected by maritime travel as never before, Palagruža may have inspired elated feelings and required special treatment, eventually becoming a 'symbolic attractor' (Renfrew 2007), a place appropriate for ritual performances. Its archaeological record suggests that those performances involved votive offerings and conspicuous consumption.

When discussing Keros, Renfrew e*t al.* use the term 'sanctuary' for a place of assembly and structured deposition of symbolic artifacts, where (unlike in a temple) explicit iconography of the divine, with identifiable gods and goddesses, has not yet developed (Renfrew *et al.* 2012: 145, 158-159). While such places where pilgrims would have gathered in order to express devotion to transcendental powers can be recognized archaeologically, it is much more difficult to determine what kind of belief system brought the people to the sanctuary.

Since most of the finds from Salamandrija are otherwise best known from burials, was there a mortuary component to those activities? Were they just a part of a complex mortuary ritual that included pilgrimage, or even secondary deposition of the deceased? A similar possibility was carefully mentioned in the case of Kavos (Renfrew 2007: 437-438). Or, could it be that the Salamandrija sanctuary began as a place of burial (real or symbolic) of some great or legendary traveler, warrior or chief? Some of the more recent and careful excavations of contemporary burial mounds have clearly shown that they were not just simple burial monuments for single use, but places where ritual activities continued long after the burial. Is Salamandrija an extreme example of paying homage to a powerful ancestor or a legendary hero? Prehistoric Salamandrija may be too damaged to provide definite answers to these questions. Nevertheless, its archaeological record indicates that the third millennium cal BC seafarers recognized the unique importance of Palagruža and honored it in their own way.

Fifteen hundred years later, the ancient Greeks expressed that recognition by placing at Salamandrija a shrine devoted to Diomedes (Kirigin and Čače 1998; Kirigin 2012: 58-73). Diomedes was a legendary hero, a prominent participant of the Trojan War, traveler, wanderer and founder of Greek cities in southern Italy. Several ancient texts report that he was buried on an Adriatic island, and some of those texts mention that a mound was erected over his tomb (Kirigin 2012: 55-56). Just as nowadays the locals will speak of hillforts when referring to long-deserted prehistoric remains on hilltops, and will be vaguely aware that the ancients did something there despite the intervening millennia, so the ancient Greeks who brought offerings to Diomedes at Salamandrija probably would have been aware that something else had existed there long before their time. Arrow points made of stone would have been lying around even then, while remains might have been still visible of some prehistoric structure that later were completely erased and today can no longer be detected.

3.4.8 Palagruža after year 2000 BC

Judging by the almost complete absence of later prehistoric finds, activities at Salamandrija died down around year 2000 BC. This abandonment was related to changes in the wider Adriatic region, but currently one can only speculate what had caused those changes to occur.

Interaction networks that linked various parts of the Adriatic basin with its wider neighborhood collapsed soon after year 2000 BC (Kaiser and Forenbaher 1999: 322-323; Maran 2007: 18; Broodbank 2013: 351-352). While those networks would have supported the inherently unstable local elites, they also would have depended on those elites. It remains unclear why did the long-distance links break down. Changing interests of the elites at the time when true (tin) bronze was becoming ever more important, social and economic dynamics on Crete and climatic oscillations have all been offered as possible explanations. Notably, the reestablishment of trans-Adriatic connections around the middle of the second millennium BC and their intensification during the first millennium BC can be followed easily in the archaeological evidence from both sides of the Adriatic (*e.g.,* Batović 1976; Glogović 1979; Petrić 1999), but they are not even hinted at by the archaeological record of Palagruža.

Apparently, the intensive activity on remote Mediterranean islets lying close to longer sea connections is a peculiar characteristic of the times when long voyages were undertaken in large paddle-propelled vessels (Broodbank 2013: 331). Sailing ships would later tend to bypass such islets. Thanks to their greater speed and independence from human motive power, islets were no longer needed for stopover, while they still served as important landmarks (Kirigin *et al.* 2009: 139). The larger sailing ships could find shelter by anchoring in the lee, rather than by being pulled onto the beach. Landing and disembarking was no longer necessary. This is attested by numerous Hellenistic and Roman anchors from sheltered coves of remote Adriatic islands, including islands that yielded little terrestrial evidence from the same periods. Anchors of prehistoric sailing ships would be much harder to recognize, we know next to nothing about their appearance, and nobody is systematically looking for them.

In the Aegean, the earliest depictions of sailing ships appear on Minoan seals that date from the very end of the third millennium BC (Broodbank 2000: 342; 2013: 353). It is quite possible that, soon after that, sailing spread into the Adriatic. Cessation of ritual activity on Palagruža thus may be a direct consequence of a crucial seafaring innovation. But, why would the ancient Greeks, who were expert sailors, again establish a shrine on Palagruža? The unavoidable conclusion is that the introduction of sailing can offer at best a partial explanation.

4

Appendix to Chapter 3.3: List of Sites

This overview covers all sites from which at least one Ljubljana-Adriatic, Cetina, or stylistically similar potsherd has been published, as well as sites where such finds have been reported but not illustrated, plus a few sites whose finds have not been published yet, but which are known to me by personal involvement. Also included are sites that yielded stone and metal artifacts typologically attributable to the third millennium BC, while not yielding any characteristic incised, impressed and incrusted pottery.

Sites are grouped by region, and within each region they are listed in alphabetical order. A map showing locations of all sites (Figure 114) and a tabular overview (Table 17) are followed by concise descriptions of each site, including bibliographic references.

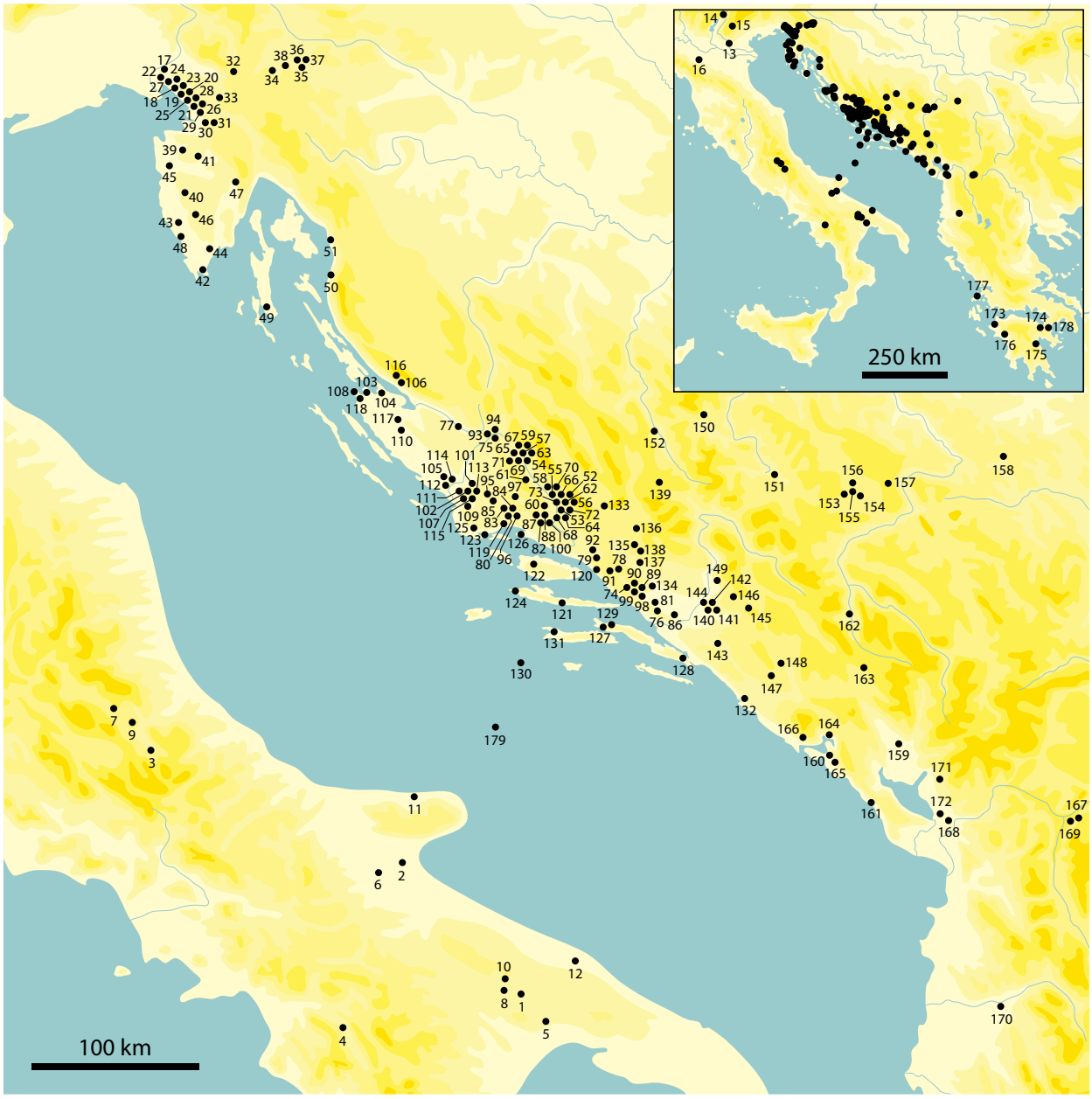

Figure 114. Geographic location of sites covered by this overview (numbers on the map correspond to numbers in the list).

SITE			POTTERY							STONE				
#	Name	Type	Ljubljana-Adriatic		Cetina		Coarse incised	Third millennium	Excised	Furchenstich incised	cord-impressed	Ground stone	Flaked stone	METAL OBJECTS
Southern Italy														
1	Casal Sabini	chamber t.			C	1								
2	Coppa Nevigata	settlement			B	1								
3	Fonti S. Callisto	?			D									
4	Fossa Aimone	settlement			D									
5	Laterza	chamber t.			A	2							x	x
6	Masseria Fontanarosa	?			B	1								
7	Navelli	?			B	1								
8	Pisciulo	chamber t.			A	2								
9	Popoli	?			B	1								
10	Pulo di Altamura	?			D									
11	Rodi Garganico	settlement			B	2								
12	Rutigliano	?			D									
Northern Italy														
13	Bernardine di Coriano	settlement?	B	2										
14	Monte Mezzana	?			C	2								
15	Montesei di Serso	?			B	2								
16	Sant'Ilario d'Enza	settlement	B	1										
Trieste Karst														
17	Castelazzo di Doberdò	hillfort	A	2									x	
18	Grotta Caterina	cave	A	2	C	1								
19	Grotta Cotariova	cave	A	1	B	1								
20	Grotta degli Zingari	cave	A	2	A	1				x			x	
21	Grotta dei Ciclami	cave	A	3	A	3					x	x	x	
22	Grotta del Mitreo	cave	A	3	A	2					x		x	
23	Grotta del Pettine	cave	D											
24	Grotta del Pettiroso	cave	A	2						x			x	
25	Grotta della Tartaruga	cave	C	1	C	1								
26	Grotta delle Gallerie	cave			C	1						x	x	
27	Grotta Teresiana	cave	B	2	B	1							x	
28	Riparo di Percedol	cave	A	1										
29	San Michele	hillfort	B	1										
Slovenian Karst														
30	Acijev spodmol	cave	A	2	A	1				x				
31	Podmol pri Kastelcu	cave	A	2										
32	Predjama	?						?		x			x	
33	Tominčeva jama	cave	D											
Central Slovenia														
34	Črni graben	settlement	B	1										
35	Ig	settlement	A	4	C	2			x	x	x	x	x	x
36	Parte	settlement	B	2						x				
37	Parte-Iščica	settlement	B	1										
38	Založnica	settlement	B	2	C	1				x				

Pottery style: A characteristic, B closely comparable, C reminiscent, D mention without illustration
Quantity: 1 single sherd, 2 several sherds, 3 many sherds, 4 abundant sherds

SITE			POTTERY							STONE				
#	Name	Type	Ljubljana-Adriatic		Cetina		Coarse incised	Third millennium	Excised	Furchenstich incised	cord-impressed	Ground stone	Flaked stone	METAL OBJECTS
Istria														
39	Cingarela	cave	C	1			1							
40	Dančeva pećina	cave						1						
41	Laganiši	cave	D	2										
42	Marlera	settlement?			B	1								
43	Monkodonja	hillfort			D									
44	Nezakcij	hillfort	D	1										
45	Pećina kod Srbana	cave	A	1										
46	Pećinovac	cave	A	2						x				
47	Pupićina peć	cave	B	2			1							
48	Uvala Marić	mound			B	2								
Croatian Littoral and the Kvarner Islands														
49	Jami na sredi	cave	B	1	B	1								
50	Lukovo	chance find												x
51	Vlaška peć	cave	D											
Upper reaches of Cetina River														
52	Bajagić	mound			A	3						x		
53	Balajića gomila	mound			A	3								
54	Baščina	mound			B	1							x	
55	Bitelić	chance find										x		
56	Efendići	chance find			A	2								
57	Gomile više lada	mound	A	3	A	4	2			x		x		x
58	Kekezova gomila	mound										x		x
59	Lukovača	mound	A	3	A	4	1						x	
60	Okruglo	hillfort						?						
61	Otišić	settlement	A	4			3					x	x	
62	Penića njivice	mound												x
63	Preočanska kosa	mound			A	3								
64	Rarina gomila	mound												x
65	Rudine	mound	A	2	A	4	1				x		x	x
66	Rumin – Lasića ograde	chance find									x			
67	Šparevine	mound	A	2	A	3	1					x	x	
68	Trilj	chance find												x
69	Velike gomile	mound												x
70	Veliki Rumin	mound						?						x
71	Zelenovića ogradice	mound			A	3								
72	Živalji	mound									x	x		x
73	Župna kuća	mound												x
Dalmatinska Zagora														
74	Begovići	mound			A	2						x	x	x
75	Biskupija	settlement?			A	2								
76	Eraci	mound	A	3			1						x	
77	Ervenik	mound			A	3								
78	Gradina	hillfort						2						

Pottery style: A characteristic, B closely comparable, C reminiscent, D mention without illustration
Quantity: 1 single sherd, 2 several sherds, 3 many sherds, 4 abundant sherds

SITE			POTTERY							STONE				
#	Name	Type	Ljubljana-Adriatic		Cetina		Coarse incised	Third millennium	Excised	Furchenstich incised	cord-impressed	Ground stone	Flaked stone	METAL OBJECTS
Dalmatinska Zagora continued														
79	Jukića gomile	mound			A	2								
80	Kovačina	settlement	B	1	B	1	1				x			
81	Kruške	mound	A	2	A	2	1			?				
82	Mali Mosor	mound			D								x	x
83	Matijin dolac - gomile	mound			A	2								
84	Matijin dolac - vrtače	chance find					1							
85	Nevest	chance find												x
86	Ograđe	mound	A	2	A	2	1							
87	Podi	mound			A	2								
88	Poljanice	mound										x		
89	Radović	mound						?						
90	Ravča	mound										x		x
91	Samogorska špilja	cave			A	2								
92	Sridnja gora	mound	A	2	C	1								x
93	Sveti Spas	hillfort					3							
94	Topolje	chance find												x
95	Unešić	chance find			A	1								
96	Vlake	mound			A	1								
97	Vrba	mound			D									
98	Vukosavi	mound	A	1										
99	Zagomilje 2	settlement			B	2					x	x	x	
100	Zemunica	cave	D	1									x	
Northern Dalmatia														
101	Gaj	mound			A	2								
102	Ivankovača	mound										x		x
103	Kosa kod mula	mound						?						
104	Mala glavica	mound			A	2						x	x	
105	Mrdakovica	hillfort?			B	1								
106	Pazjanice	cave	B	1										
107	Poljakuše	mound			D									
108	Privlaka	mound?												x
109	Renje	hillfort						1	x					
110	Stanine	mound			D									
111	Stubica	cave			A	3								
112	Šarina draga	cave	A	1										
113	Škarin samograd	cave	A	2	A	3				?				
114	Tradanj	cave	A	1	A	1	1							
115	Ulnovac	mound	A	2			1					x		
116	Vaganačka pećina	cave	A	2			1							
117	Vreline	settlement			A	2							x	
118	Zaton	mound			D									
Middle Dalmatia														
119	Biranj	hillfort	A	1										

Pottery style: A characteristic, B closely comparable, C reminiscent, D mention without illustration
Quantity: 1 single sherd, 2 several sherds, 3 many sherds, 4 abundant sherds

SITE			POTTERY							STONE				
#	Name	Type	Ljubljana-Adriatic		Cetina		Coarse incised	Third millennium	Excised	Furchenstich incised	cord-impressed	Ground stone	Flaked stone	METAL OBJECTS
Middle Dalmatia continued														
120	Bubnjavača	cave	B	1	A	1	2							
121	Grapčeva spilja	cave	A	3	B	1	1					x		
122	Kopačina	cave			B	1								
123	Marina	submarine	B	1										
124	Markova spilja	cave			A	1								
125	Spilja Sv. Filipa i Jakova	cave						x						
126	Split-Gripe	chance find												x
Southern Dalmatia														
127	Grad	hillfort	A	2										
128	Gudnja	cave	A	2	A	2	3		x		x			
129	Spila	cave	A	2	A	2	2							
130	Uvala Duga	chance find	A	1					x					
131	Vela spila	cave	A	3	B	1	3		x	x			x	x
132	Vilina pećina	cave					1							
Western Herzegovina														
133	Grabovica	mound			B	2	1							
134	Krstina	hillfort			B	2								
135	Nečajno	hillfort						3			x			
136	Orlov kuk	hillfort			C	1								
137	Ravlića pećina	cave	A	3	A	3	3		x		x	x	x	
138	Trostruka gradina	hillfort			A	2					x			
139	Varvara	hillfort	B	3	C	1	1						x	
Eastern Herzegovina														
140	Badanj	cave	A	1			1							
141	Džakulina glavica	hillfort	A	1										
142	Gornje Banje	mound					1							
143	Greben pećina	cave	B	1										
144	Guvnine	hillfort	B	1			2							
145	Hateljska pećina	cave	A	2	A	2	2							
146	Lazaruša	cave	A	2	C	1	3			x	x			
147	Ljubomir	mound			A	2					x	x		
148	Orah	mound			B	1								
149	Zelena pećina	cave	B	1	B	1	1				x			
Central Bosnia														
150	Alihodže	hillfort	B	1	C	1								
151	Gradac	hillfort			A	1								
152	Pod	hillfort	C	3	C	1					x	x	x	
Eastern Bosnia														
153	Borci	mound			A	2								
154	Ferizovići	mound			A	2						x	x	x
155	Rusanovići	mound			A	1								

Pottery style: A characteristic, B closely comparable, C reminiscent, D mention without illustration
Quantity: 1 single sherd, 2 several sherds, 3 many sherds, 4 abundant sherds

SITE			POTTERY							STONE				
#	Name	Type	Ljubljana-Adriatic		Cetina		Coarse incised	Third millennium	Excised	Furchenstich incised	cord-impressed	Ground stone	Flaked stone	METAL OBJECTS
Eastern Bosnia Continued														
156	Vrtanjak	mound			A	1								
157	Živaljevići	mound						?						
Western Serbia														
158	Anište	mound			C	1								
Montenegro														
159	Boljevića gruda	mound	A	3					x			x	x	x
160	Mala gruda	mound	A	2									x	x
161	Mogila na rake	mound	A	2									x	
162	Odmut	cave	A	2			2				x			
163	Rubež	mound	A	1					x					
164	Spila	cave	C	1			1							
165	Velika gruda	mound	A	1	B	2							x	x
166	Vranjaj	cave	D		D									
Albania														
167	Bardhoc	mound	C	3										x
168	Gajtan	settlement	B	2	B	2								
169	Këneta	mound						1						
170	Pazhok	mound	C	1										
171	Shkrel	mound			A	1								
172	Shtoj	mound			A	2								
Western Greece														
173	Andravida-Lechaina	settlement			B	2								
174	Korakou	settlement			C	2								
175	Lerna	settlement			A	3								
176	Olympia	settlement			A	3							x	
177	Steno	mound											x	x
178	Zygouries	settlement			C	1								
Center of the Adriatic														
179	Salamandrija	special	A	3	A	3						x	x	

Pottery style: A characteristic, B closely comparable, C reminiscent, D mention without illustration
Quantity: 1 single sherd, 2 several sherds, 3 many sherds, 4 abundant sherds

Table 17. Basic information about sites covered by this overview

4.1 Southern Italy

1. Casal Sabini (Altamura, Puglia) – rock-cut tombs. Several authors mention Cetina style pottery from Tomb 1 and Tomb 3 without providing illustrations (Cataldo 1996: 153; Recchia 2011: 487). Maran provides an illustration of the upper part of a small, plain beaker with cylindrical neck, everted rim, and two stocky vertical handles on the neck, reminiscent of Cetina style pottery (Maran 2007: Plate 2: 12).

2. Coppa Nevigata (Manfredonia, Puglia) – settlement. Fragment of an open bowl with wide rim decorated in a manner closely comparable to Cetina style (Recchia 2002: Figure 2: 1).

3. Fonti S. Callisto (Sulmona, Abruzzo) – site type has not been reported. Cetina style pottery is mentioned but not illustrated (Cataldo 1996: 153).

4. Fossa Aimone (Atena Lucana, Salerno, Campania) – settlement. Unpublished pottery finds have been attributed to 'Cetina culture' (Livadie 2010: 163). A charcoal sample from the same context yielded the radiocarbon date CIRCE-DSH-123, 3868±75 bp, calibrated 1SD range: 2464-2212 BC (Passariello *et al.* 2010: 30).

5. Laterza (Puglia) – rock-cut tombs. Tomb 3 (one of the five rock-cut tombs) contained remains of about a hundred individuals and several dozen vessels. Among them were two characteristic Cetina beakers (Biancofiore 1967: Figure 51: 3, 20; Batović 1973b: Plate 24: 3; Marović 1975: Plate 65: 2, 3; Petrić 1980: Plate 14: 3, 4; Čović 1980b: Figure 4, top). The same tomb yielded fragments of flat dagger blades made of metal, small bifacial points and microlithic crescents, as well as other finds that cover an extended period, probably from Late Neolithic until developed Bronze Age.

6. Masseria Fontanarosa (Foggia, Puglia) – site type has not been reported. A single potsherd shaped and decorated in a manner closely comparable to Cetina style (Recchia 2002: Figure 2: 2).

7. Navelli (L'Aquila, Abruzzo) – site type has not been reported. A single decorated potsherd closely comparable to Cetina style (Recchia 2002: Figure 2: 16).

8. Pisciulo (Altamura, Puglia) – rock-cut tombs. Tomb 2 (one of three rock-cut tombs) yielded abundant pottery finds, including two small Cetina beakers. One of them was characteristically shaped and decorated, while the other one was shaped very much like Cetina style vessels, but undecorated (Cataldo 1996: Figure 9: 1, 2; 1998: Figure 2; Recchia 2011: Figure 1: 4). Other finds from the tomb cover a very long period from Neolithic to Early Iron Age.

9. Popoli (Sulmona, Abruzzo) – site type has not been reported. A couple of potsherds closely similar to Cetina pottery (Recchia 2002: Figure 2: 12, 15).

10. Pulo di Altamura (Altamura, Puglia) – site type has not been reported. Cetina style pottery is mentioned but not illustrated (Cataldo 1996: 153; Recchia 2002: 332; 2011: 478).

11. Rodi Garganico (Rodi, Puglia) – settlement. A few decorated fragments closely comparable to Cetina style (Recchia 2002: Figure 2: 5, 6).

12. Rutigliano (Bari, Puglia) – site type has not been reported. Cetina style pottery is mentioned but not illustrated (Cataldo 1996: 153; Recchia 2002: 332; 2011: 478; Rambach 2007: 85; Heyd 2007: 97).

Unknown site. A characteristically shaped and decorated small Cetina beaker, kept by Museo Archeologico Nazionale di Napoli (Livadie 2010: Figure 15).

4.2 Northern Italy

13. Bernardine di Coriano (Albaredo d'Adige, Verona) – settlement (?). Several fragments of vessels shaped and decorated in a manner closely comparable to Ljubljana-Adriatic style (Nicolis 1998: Figure 1: 2, Figure 2: 1-16).

14. Monte Mezzana (Terlago, Trento) – site type has not been reported. Four decorated potsherds reminiscent of Cetina style (Nicolis and Mottes 1998: Figure 4: 23). The same site yielded a characteristic fragment of a bell beaker.

15. Montesei di Serso (Borgo Valsugana, Trento) – settlement (?). Several fragments more or less resembling Cetina style pottery (Nicolis 1998: Figure 1: 3-5; 2001b: Figure 220: 12; 2005: Plate 118: a; Nicolis and Mottes 1998: Figure 6 on p. 103, Figure 9 on p. 104, Figure 10 on p. 105).

16. Sant'Ilario d'Enza (Parma) – settlement. Fragments of two open bowls decorated in a manner closely comparable to Ljubljana-Adriatic style (Petrić 1980: Plate 14: 1, 2).

4.3 Trieste Karst

17. Castelazzo di Doberdò (Doberdò del Lago, Monfalcone) – hillfort. A few characteristically decorated sherds of Ljubljana-Adriatic pottery (Nicolis 1998: Figure 5: 4, 5; Borgna and Càssola Guida 2009: Figure 7, third row from top) and three small bifacial points (Borgna and Càssola Guida 2009: Figure 7, top) possibly from third millennium BC.

18. Grotta Caterina (Aurisina, Trieste) – cave, also known as 'Katrina pečina'. The finds from Trench AB include a sherd from Layer IV and several sherds from Layer III decorated in a characteristic Ljubljana-Adriatic manner (Canarella and Pitti 1981: Figure 5: 3-5, Figure 4: 11; Govedarica 1989b: Plate 5: 3, 4, Plate 6: 5), while the overlying Layer II yielded a plain vessel whose shape is reminiscent of a small Cetina beaker (Canarella and Pitti 1981: Figure 4: 5; Govedarica 1989b: Plate 8: 2, Plate 12: 2). Another small decorated fragment from Trench C may be attributed generally to the third millennium BC (Canarella and Pitti 1981: Figure 6: 1).

19. Grotta Cotariova (Sgonico, Trieste) – cave, also known as 'Kotarjeva jama' or 'Schutzhöhle bei Zgonik'. A fragment of an open bowl with wide rim, decorated in Ljubljana-Adriatic manner (Govedarica 1989b: Plate 4: 2; Nicolis 1998: Figure 5: 20), and a fragment of a small beaker, shaped and decorated in a manner closely comparable to Cetina style (Govedarica 1989b: Plate 10: 5).

20. Grotta degli Zingari (Sgonico, Trieste) – cave, also known as 'Ciganska jama'. Fragments of Ljubljana-Adriatic pottery were recovered from layers 3 and 2 (Govedarica 1989b: Plate 2: 5, Plate 4: 3, 5, Plate 7: 4; Gilli and Montagnari Kokelj 1996: Figure 34: 199, 200, 202, Figure 42: 299, 312, 313). Characteristic fragments of a small Cetina-style beaker were recovered from the underlying Layer 3 (Gilli and Montagnari Kokelj 1996: Figure 34: 201), while the overlying Layer 2 yielded numerous plain potsherds reminiscent by shape of Cetina style pottery (Gilli and Montagnari Kokelj 1996: Figure 37: 231-236, Figure 38: 237-243). Layer 3 also yielded eleven small bifacial points of different types (Gilli and Montagnari Kokelj 1996: Figure 35: 50-60).

21. Grotta dei Ciclami (Fernetti, Trieste) – cave, also known as 'Orehova pejca'. Layers 5 and 4 contained numerous characteristic Ljubljana-Adriatic potsherds (Leben 1967: Plate 5: 22, Plate 6: 1; Govedarica 1989b: Plate 4: 4, 7, Plate 5: 2; Gilli and Montagnari Kokelj 1993: Figure 37: 355, 362, Figure 38: 363-366, Figure 47: 464,465, Figure 51: 497; Nicolis 1998: Figure 5: 21-26) and Cetina potsherds (Govedarica 1989b: Plate 12: 1, 2; Gilli and Montagnari Kokelj 1993: Figure35: 343-344, Figure 39: 384, Figure 48: 467-469, 473-478; Nicolis 1998: Figure 5: 6-19; Borgna and Càssola Guida 2009: Figure 1: 1). Ljubljana-Adriatic sherds are equally well represented in both of those layers, while Cetina sherds are more numerous in the overlying Layer 4. Layer 5 yielded a single cord-impressed potsherd (Gilli and Montagnari Kokelj 1993: Figure 37: 362). About a dozen plain sherds reminiscent by shape of Cetina style pottery were recovered from the even younger layers 4-3, 3 and 2 (Gilli and Montagnari Kokelj 1993: Figure 55: 553-555, Figure 57: 589-590, Figure 61: 633-635, Figure 66: 690). Several bifacial points of various types (Gilli and Montagnari Kokelj 1993: Figure 73: 728-735) and a ground stone wristguard (Leben 1967: Plate 6: 13; Gilli and Montagnari Kokelj 1993: Figure 73: 737) were also recovered from unknown contexts.

Layer 4 was dated by radiocarbon: R-1037, 4160±50 bp, calibrated 1SD range: 2874-2674 BC (Gilli and Montagnari Kokelj 1993: 157).

22. Grotta del Mitreo (San Giovani di Duino, Monfalcone) – cave. Numerous characteristic Ljubljana-Adriatic potsherds (Govedarica 1989b: Plate 5: 6, 9, Plate 7: 6, Plate 8: 3, 4; Montagnari Kokelj and Crismani 1997: Figure 10: 75, Figure 13: 106-110, Figure 22: 203, Figure 31: 278, Figure 41: 388-391), as well as a fragment of a small, characteristically decorated Cetina beaker and a few other potsherds closely comparable to Cetina style (Govedarica 1989b: Plate 10: 4; Montagnari Kokelj and Crismani 1997: Figure 12: 99, 103, Figure 41: 392, Figure 44: 419, Figure 45: 434, Figure 50: 464) were recovered mostly from Layer 5 of Stalcul's excavations in years 1971 and 1972, and from Trench A excavated by Lonza and Canarela in years 1967 and 1968 (the latter lack any stratigraphic information). Plain potsherds reminiscent by shape of Cetina style pottery were recovered from Layers 5 and 4 of Stacul's excavations, and also from Lonza's and Canarella's trench (Montagnari Kokelj and Crismani 1997: Figure 17: 140-142, Figure 18: 160-162, Figure 19: 163, 167, Figure 44: 422, 424, 426, Figure 45: 427). The cord-impressed fragment was recovered from an unknown context (Montagnari Kokelj and Crismani 1997: Figure 51: 469).

A charcoal sample from Layer 5 yielded the radiocarbon date R-903a, 3720±50 bp, calibrated 1SD range: 2198-2036 BC. A charcoal sample from Layer 4 yielded the radiocarbon date R-902, 3820±50 bp, calibrated 1SD range: 2391-2150 BC (Montagnari Kokelj and Crismani 1997: 13).

23. Grotta del Pettine (Gabrovizza, Trieste) – cave, also known as 'Pečinka'. Ljubljana-Adriatic finds are mentioned, but not illustrated (Govedarica 1989a: 402).

24. Grotta del Pettiroso (Aurisina, Trieste) – cave, also known as 'Lašca', 'Vlašca', 'Pejca v Lašci', 'Vlaška jama', 'Rothgartlhöhle' or 'Fremdenhöhle'. Several characteristic Ljubljana-Adriatic potsherds (Korošec, P. 1956: Plate 1: 1, 2, Plate 2: 1, 3; Leben 1967: Plate 20: 15, Plate 21: 17, 18; Flego and Župančič 2012: Figures 17-19). A small bifacial point also may belong to the third millennium BC (Flego and Župančič 2012: Figure 16: 10).

25. Grotta della Tartaruga (Sgonico, Trieste) – cave, also known as 'Želvina jama'. A single decorated potsherd reminiscent of Ljubljana-Adriatic style (Govedarica 1989b: Plate 4: 8) and a couple of plain fragments reminiscent by shape of Cetina beakers

(Canarella and Redivo 1981: Figure 1: 9, Figure 4: 5; Govedarica 1989b: Plate 8: 9) were collected from layers attributed to Copper Age and Bronze Age.

26. Grotta delle Gallerie (Val Rosandra, Trieste) – cave, also known as 'Pečina pod steno'. Several decorated potsherds may be attributed generally to the third millennium BC (Leben 1967: Plate 1: 16; Govedarica 1989b: Plate 5: 1; Gilli and Montagnari Kokelj 1994: Figure 8: 22, 23, Figure 18: 112, Figure 21: 137, Figure 31: 261, Figure 34: 290), while several other, plain fragments are reminiscent by shape of Cetina beakers (Gilli and Montagnari Kokelj 1994: Figure 18: 108, Figure 27: 205, 207). A wristguard fragment and a couple of elongated pendants made of ground stone (Leben 1967: Plate 2: 6; Gilli and Montagnari Kokelj 1994: Figure 9: 38, Figure 24: 172, Figure 42: 420), as well as a small bifacial point (Leben 1967: Plate 2: 13; Gilli and Montagnari Kokelj 1994: Figure 42: 419) probably also belong to the third millennium BC.

27. Grotta Teresiana (Duino, Monfalcone) – cave, also known as 'Grotta Fioravante' or 'Terezina jama'. Three potsherds closely comparable to Ljubljana-Adriatic style (Barfield 1999: Figure 12: 46, Figure 13: 48, 49), a single one closely comparable to Cetina style (Barfield 1999: Figure 13: 50), as well as three small bifacial points (Leben 1967: Plate 23: 21, 23, 24) that may belong to the third millennium BC.

28. Riparo di Percedol (Col, Fernetti) – rock shelter, also known as 'Riparo di Monrupino' or 'Prčji Dol'. A round-bellied jar with cylindrical neck, shaped and decorated in a characteristic Ljubljana-Adriatic manner (Govedarica 1989b: Plate 3: 3).

29. San Michele (Bagnoli, Trieste) – hillfort. Fragment of an open bowl decorated in a manner that is closely comparable to Ljubljana-Adriatic style (Nicolis 1998: Figure 5: 1).

4.4 Slovenian Karst

30. Acijev spodmol (Petrinje, Črni Kal) – rock shelter. Phase 2, attributed to the Copper Age, yielded a characteristic Ljubljana-Adriatic potsherd (Turk *et al.* 1992: Plate 4: 13) and a couple of potsherds closely comparable to that style (Turk *et al.* 1992: Plate 3: 18, Plate 4: 11). Phase 1, attributed to the Late Neolithic, yielded a single characteristic Cetina potsherd (Turk *et al.* 1992: Plate 3: 6). Possible mixing of finds from different periods is mentioned repeatedly.

31. Podmol pri Kastelcu (Petrinje, Črni Kal) – cave. Characteristic Ljubljana-Adriatic potsherds were recovered from the upper part of Layer 5 (Turk *et al.* 1993: Plate 13: 22, Plate 14: 7, 15, 22, Plate 16: 5, 7, 15-21).

32. Predjama (Postojna) – cave. A couple of potsherds decorated by *furchenstich* incision and impression (Korošec, P. 1956: Plate 5: 1, 2; Korošec, J. 1956: Plate 8: 1, 2, Plate 33: 1) have been attributed to 'Slovenian type of Vučedol culture' (Leben 1975: 151) or 'Ljubljana culture' (Govedarica 1989b: 28), but they differ markedly from characteristic Ljubljana-Adriatic pottery. The same site yielded about a dozen small bifacial points (Korošec, J. 1956: Plate 20: 1-8, Plate 1-10).

33. Tominčeva jama (Škocjanske jame, Škocjan, Divača) – cave. Ljubljana-Adriatic potsherds finds are mentioned, but not illustrated (Leben 1975: 150; Govedarica 1989b: 28).

4.5 Central Slovenia

34. Črni **graben** (Bistra, Ljubljansko barje) – settlement. Among pottery finds attributed to 'Vinkovci-Somogyvár culture' is a fragment of an open bowl with wide rim decorated in a manner that is closely comparable to Ljubljana-Adriatic style (Velušček *et al.* 2011: Plate 3: 6).

35. Ig (Ljubljansko barje) – settlement. Finds from Dežman's excavations that were recovered in the second half of the 19th century from three different sites lack any information about context. Among them are fragments of many characteristically shaped and decorated pottery vessels that served as the basis for the definition of 'Ljubljana culture' (Dimitrijević 1961: 61; 1967: 1, 9-10; Govedarica 1989b: 25-63) and, by extension, of Ljubljana-Adriatic style (Korošec and Korošec 1969: Plate 10: 8, Plate 29: 1, Plate 33, Plate 34, Plate 35: 1, 6-10, Plate 36: 1-5, Plate 39: 6, Plate 40: 3, Plate 42: 2, Plate 45: 2, Plate 46: 8, 10, Plate 47: 3, Plate 48: 1-5, 7, 9, Plate 49: 4, 6, Plates 54-57, Plate 58: 16, Plate 59: 4, Plate 60: 6, Plate 61: 6; Govedarica 1989b: Plate 1: 1, 3-6, Plate 2: 2, Plate 3: 2, 4, Plate 4: 6, 9, Plate 5: 11, Plate 7: 3, 5). Several vessels were decorated by cord impression (Korošec and Korošec 1969: Plate 7: 10, Plate 55: 11; Leghissa 2015: Figure 1: 9, 10, Figure 2: 9, 10). A few other vessels are reminiscent of Cetina style pottery (Korošec and Korošec 1969: Plate 19: 7, Plate 20: 1, Plate 25: 6; Govedarica 1989b: Plate 7: 1). The same sites yielded copper awls, leaf-shaped points and tanged double-edged knives (Korošec and Korošec 1969: Plate 105), bifacially flaked points (Korošec and Korošec 1969: Plates 73, 74), shaft-hole hammer-axes (Korošec and Korošec 1969: Plates 76, 77, 78) and flat ground stone pendants (Korošec and Korošec 1969: Plate 76: 16, Plate 79: 1-6).

36. Parte (Ljubljansko barje) – settlement. Among the abundant pottery finds there are only a few potsherds closely comparable to Ljubljana-Adriatic style (Harej 1974: Plate 6: 8; 1978: Plate 1: 10; 1982: Plate 15: 4, Plate 16: 2, Plate 20: 5, 6; 1987: 148). The site was dated approximately around the middle of the third

millennium BC by a combination of dendrochronological information and radiocarbon determinations (Velušček and Čufar 2002: 64; 2014: Table 2; Čufar *et al.* 2013: Figure 1).

37. Parte – Iščica (Ljubljansko barje) – settlement. The site is located several dozen meters to the east of the Parte settlement (Velušček *et al.* 2000: 83; Velušček and Čufar 2002: 64). Pottery fragments were recovered from the bottom of a drainage canal. Among them are only a few sherds reminiscent of Ljubljana-Adriatic style (Velušček *et al.* 2000: Plate 3: 11, Plate 6: 3). The approximate time-span of occupation from year 2850 until 2600 BC was established by combining dendrochronological information with radiocarbon dates (Čufar *et al.* 2012: 2036; 2013: 36; Velušček and Čufar 2014: Table 2).

38. Založnica (Kamnik pod Krimom, Ljubljansko barje) – settlement. Among pottery finds attributed to 'Vinkovci-Somogyvár culture' are several fragments more or less resembling Ljubljana-Adriatic style (Velušček and Čufar 2003: Plate 3: 2, Plate 4: 8, Plate 10: 6, Plate 12: 1, Plate 14: 4, Plate 15: 9; Velušček *et al.* 2011: Plate 2: 6),as well as a double beaker of a peculiar shape, decorated in a manner reminiscent of Cetina style (Velušček and Čufar 2003: Plate 12: 6). The approximate time-span of occupation from year 2500 until 2400 BC was established by combining dendrochronological information with radiocarbon dates (Velušček and Čufar 2003: 127-128).

4.6 Istria

39. Cingarela (Momjan) – cave. A decorated potsherd reminiscent of Ljubljana-Adriatic style, and another potsherd decorated by coarse incision, were recovered from disturbed deposits (Baćić 1956: Plate 6: 2, 3).

40. Dančeva pećina (Baderna) – cave. Fragment of an open bowl with wide rim, decorated by incision, lacking data about context, may be attributed to the third millennium BC (Petrić 1978: Figure 1; 1979: Figure 6).

41. Laganiši (Oprtalj) – cave. Four potsherds 'bearing typical Ljubljana culture decoration' are mentioned but not illustrated in a preliminary report (Komšo 2006: 229).

42. Marlera (Ližnjan) – settlement (?). A potsherd closely comparable to Cetina style was recovered during an extensive program of test excavation at 'site MX1' (Komšo *et al.* 2010: 270).

43. Monkodonja (Rovinj) – hillfort. Isolated and mostly plain potsherds have been compared to Cetina style pottery (Hänsel *et al.* 1997: Figure 39: 7, 12, Figure 43: 7; 2010: Figure 14), but that similarity is very general, at best.

44. Nesactium (Valtura) – settlement, also known as Vizače. Relying on personal communication with Kristina Mihovilić, among the finds from this site was a fragment of a 'cup on a high funnel-shaped pedestal with typical Ljubljana decoration' (Govedarica 1989b: 28, footnote 2).

45. Pećina kod Srbana (Srbani, Nova Vas) – cave. A couple of characteristic Ljubljana-Adriatic potsherds (Govedarica 1989b: Plate 14: 4; Čuka 2010: Plate 3: 13, 14).

46. Pećinovac (Kanfanar) – cave. Several characteristic Ljubljana-Adriatic potsherds, including one decorated by *furchenstich* incision (Buršić-Matijašić 2003: Plate 1: 9, Plate 2: 13-16).

47. Pupićina peć (Vranja) – cave. A couple of decorated potsherds closely comparable to Ljubljana-Adriatic style (Forenbaher and Kaiser 2006: Plate 5.9: 2; Hulina *et al.* 2012: Plate 4: 5), one fragment decorated by coarse incision (Hulina *et al.* 2012: Plate 4: 6), and several decorated sherds, generally attributable to the third millennium BC (Hulina *et al.* 2012: Plate 4: 10-12) were recovered mostly from contexts belonging to Phase 3, attributed to Late Copper Age and Early Bronze Age.

A charcoal sample from the context that contained Ljubljana-Adriatic and coarse incised potsherds yielded the radiocarbon date OxA-18180, 3963±27 bp, calibrated 1SD range: 2561-2464 BC (Hulina *et al.* 2012: 141).

48. Uvala Marić (Barbariga, Vodnjan) – mound, also known as 'Komunal'. It contained an empty central burial chamber constructed in drystone technique. A small number of potsherds were scattered in the soil beneath the mound. Among them were a few sherds shaped or decorated in a manner closely comparable to Cetina style pottery (Codacci Terlević 2006: Plate 1: 1, 12, Plate 2: 14, 23).

4.7 Croatian Littoral and the Kvarner Islands

49. Jami na sredi (Punta Križa, Cres) – cave. Excavation by Mirosavljević yielded two sherds, one of them closely comparable to Ljubljana-Adriatic pottery (Korošec, P. 1956: Plate 4: 2), the other to Cetina pottery (Korošec, P. 1956: Plate 4: 3).

50. Lukovo (Senj) – isolated find of a shaft-hole ax made of metal that probably belongs to the third millennium BC (Brunšmid 1902: Figure 1: 3; Durman 1983: Plate 13: 3).

51. Vlaška peć (Senj) – cave. Ljubljana-Adriatic style pottery is mentioned but not illustrated (Govedarica 1989b: 29).

4.8 Upper reaches of Cetina River

52. Bajagić (Bajagić) – mound. Originally published as Mound 8 together with the mounds on Veliki Rumin Plateau, even though it is located some two kilometers away and on the opposite side of the Rumin gully (Marović 1991: 183). Partially burned human bones were noted in several places within the mantle. Several modestly decorated Cetina style potsherds (Marović 1991: Figure 87: 1, 4, 5, Figure 87: 8, 9), a wide beaker with two opposing handles, decorated in a characteristic Cetina manner (Marović 1984: Figure 7: 1; 1991: Figure 88; Govedarica 1989b: Plate 29: 1) and a stone shaft-hole hammer-ax (Marović 1984: Figure 7: 2; 1991: Figure 87: 2) were recovered from various parts of the mantle.

53. Balajića gomila (Balajići, Bajagić) – mound. An open bowl and three characteristically shaped small beakers, all of them decorated by simple incised Cetina style designs, were collected during an informal excavation of the mound (Marović 1975: Plate 65: 1; Čović 1980b: Figure 4, bottom left; Govedarica 1989b: Plate 27: 4; Milošević 1998: 172).

54. Bašćina (Zelenovići, Čitluk, Cetina) – mound. It contained an eccentrically located cist burial. Two decorated potsherds closely comparable to Cetina style (Marović 1991: Figure 60: 1, 2) and a few chert flakes (Marović 1991: Plate 3: 28-31) were recovered from the mantle.

55. Bitelić (Bitelić, Cetina) – isolated find. A ground stone wristguard (Govedarica 1989b: Plate 30: 6; Milošević 1998: Figure 216). According to Marović, it was found in Kekezova gomila mound (Marović 1984: Figure 15: 6; 1994: Figure 5: 2).

56. Efendići (Obrovac) – isolated finds. Several characteristically decorated Cetina style potsherds were collected from a ploughed field (Milošević 1998: 177-178).

57. Gomile više lada (Čitluk, Cetina) – mounds, also known as 'Lad'. Of the fourteen excavated mounds, two small mounds (#11 and #12) contained almost no finds. Six other relatively small mounds (#6, #7, #9, #10, #13 and #14) contained modest quantities of cremated human remains and occasional nondiagnostic potsherds. The medium-size Mound 5 contained cremated remains and a much larger number of plain potsherds, generally attributable to the third millennium BC. Characteristic potsherds decorated by incision and impression were recovered from five larger mounds (#1 to #4 and #8). Except for Mound 1, those mounds also contained cremated human remains.

Mound 1 contained a couple of decorated potsherds closely comparable to Ljubljana-Adriatic style (Marović 1991: Figure 69: 1, 3) and several other fragments attributable by shape or decoration generally to the third millennium BC (Marović 1991: Figure 69: 2, 4, 7, 11-21). Human remains have not been reported.

Mound 2 contained characteristic Ljubljana-Adriatic potsherds (Marović 1976: Plate 9, bottom left; 1991: Figure 71: 9-11, 14, 15, 19, 20) and other fragments closely comparable to that style (Marović 1991: 2, 3, 12, 13, 16), several characteristic Cetina style sherds, including fragments of pedestalled beakers (Marović 1991: Figure 71: 1, 17), as well as a considerable number of sherds attributable generally to the third millennium BC. Among them are fragments decorated by coarse incision (*e.g.,* Marović 1991: Figure 71: 18). Potsherds were scattered throughout the mantle and the underlying soil.

Mound 3 contained characteristic Cetina style pottery, including a decorated pedestalled beaker with perforated shoulder (Marović 1976: Plate 12; 1984: Figure 10: 1, 2; 1991: Figure 73: 1, Figure 74; Marović and Čović 1983: Plate 31: 3, 6, 11; Govedarica 1989b: Plate 27: 1, 5) and several fragments decorated by *furchenstich* incision (Marović 1976: Plate 12; 1984: Figure 8; 1991: Figure 74: 5-7; Marović and Čović 1983: Plate 31: 11; Govedarica 1989b: Plate 28: 6), a round-bellied jar with cylindrical neck decorated by coarse incision, (Marović 1980b: Figure 31; 1984: Figure 8; 1991: Figure 73: 2; Marović and Čović 1983: Plate 31: 8), a small and flat dagger blade made of metal (Marović and Čović 1983: Plate 31: 7; Marović 1984: Figure 10: 5; 1991: Figure 75: 17; Govedarica 1989b: Plate 28: 3), a damaged ground stone wristguard (Marović and Čović 1983: Plate 31: 4; Marović 1984: 10: 3; 1991: Figure 75: 16; Govedarica 1989b: Plate 28: 4) and a perforated bead made of fired clay (Marović 1991: Figure 75: 15). Those finds were scattered across the mound mantle.

Mound 4 contained characteristic Cetina style pottery, including a small decorated pedestalled beaker (Marović 1976: Plate 13 top and bottom left; 1984: Figure 13: 1-4; 1991: Figure 76: 1-4) and a small ground stone object (a pendant?) (Marović 1991: Figure 76: 10). These finds were scattered across the mound mantle.

Mound 8 contained only a couple of characteristic Cetina sherds (Marović 1976: Plate 13, top right; 1991: Figure 78: 1, 3) and a single Ljubljana-Adriatic sherd (Marović 1991: Figure 78: 2).

58. Kekezova gomila (Kekeze, Bitelić) – mound, also known as 'Velika gomila'. This pillaged mound yielded

a knife made of metal (Marović and Čović 1983: Plate 33: 7; Marović 1984: Figure 15: 8; 1994: Figure 5: 3; Milošević 1998: 145), as well as a ground stone wristguard or, possibly, two wristguards (Marović 1984: Figure 15: 5, 6; 1994: Figure 5: 1, 2; Govedarica 1989b: Plate 30: 5; Milošević 1998: 145). Ljubljana-Adriatic or Cetina pottery has not been reported.

59. Lukovača (Milaševa draga, Glavaš) – mounds. Ten out of about thirty mounds have been excavated. Five smaller mounds (#71 to #75) contained almost no finds. Characteristic potsherds decorated by incision and impression were recovered from five larger mounds (#67 to #70 and #76). Aside from Mound 68, those mounds also contained cremated human remains.

Mound 67 contained numerous characteristic Ljubljana-Adriatic potsherds (Marović 1991: Figure 38: 1-3, Figure 39: 12, Figure 40: 6, Figure 41: 11) and Cetina potsherds (Marović 1991: Figure 38: 12, Figure 39: 1-4, 10, Figure 40: 7, Figure 41: 7, 8, Figure 42: 5, 7), at least one Cetina style pedestalled beaker (Marović 1976: Plate 5, top; 1991: Figure 42: 6), a coarse incised potsherd (Marović 1991: Figure 41: 12) and a chert blade (Marović 1991: Figure 39: 23). Most of those finds were found near the base of the mound and in the underlying soil.

Mound 68 contained fragments of several characteristically shaped and decorated Cetina style vessels (Marović 1976: Plate 5, bottom; 1984: Figure 11: 1-3; 1991: Figure 43: 1-3, Figure 44: 1-3, 8), a coarse incised potsherd (Marović 1991: Figure 44: 5) and a chert artifact (Marović 1991: 107). There were no human remains, aside from a dislocated recent inhumation near the mound's top.

Mound 69 contained fragments of many characteristically shaped and decorated Cetina style vessels, including several small beakers and at least one pedestalled beaker (Marović 1976: Plate 6; 1984: Figure 12: 1-7; 1991: Figure 46: 1-4, Figure 47: 1-4, 7, 8; Marović and Čović 1983: Plate 32: 8-12; Govedarica 1989b: Plate 27: 2, Plate 28: 2, Plate 29: 4, Plate 30: 3, 4). These finds were recovered from the mound mantle.

Mound 70 contained several Ljubljana-Adriatic fragments (Marović 1991: Figure 48: 6, 7, 10), as well as fragments closely comparable to Cetina style (Marović 1991: Figure 48: 1-4, 12).

Mound 76 contained characteristic fragments of Cetina style beakers (Marović 1991: Figure 49: 1, 3). They were found near the center of the mound, in close proximity of some cremated human bones.

60. Okruglo (Radošić, Sinj) – hillfort. The fortifications and all of the pottery from test excavation were attributed to 'Protocetina facies of Cetina culture', but the finds remain unpublished (Govedarica 1989b: 116).

61. Otišić-Vlake (Sinj) – settlement, also known as 'Vrtača I u Rosića ogradi'. It extends across a carstified plateau dotted by several dozen small dolines that yielded surface pottery finds (Milošević and Govedarica 1986: 53; Milošević 1998: 125-126). Many characteristic Ljubljana-Adriatic potsherds (Milošević and Govedarica 1986: Plate 1: 5, Plate 2: 5, 8, 9, 11, 12, Plate 3: 2-6, 8, Plate 4: 1, 2, 6, 7, Plate 5: 1-3, 6, 7, Plate 6: 1-6, Plate 7: 1-3, 5, Plate 8: 1-6, Plate 9: 2-4, 6, Plate 10: 1-4, Plate 11: 1, 13, Plate 12: 1, 2; Govedarica 1989b: Plate 17: 5, Plate 18: 2, 4, Plate 19: 2, 7, Plate 21: 1) and coarse incised potsherds (Milošević and Govedarica 1986: Plate 1: 1, 3, Plate 2: 1-4, 7, 9, 10, 13, Plate 3: 1, 7; Govedarica 1989b: Plate 17: 1-4, 8) were recovered by excavation from one of those dolines. Also recovered was a ground stone sickle-shaped pendant (Milošević and Govedarica 1986: Plate 5: 4), several flaked stone artifacts (Milošević and Govedarica 1986: Plate 4: 3-5), and a miniature ground stone ax (Milošević and Govedarica 1986: Plate 5: 5).

62. Penića njivice (Penići, Bajagić) – mounds. A group of mounds, three of which have been pillaged. According to Marović, a flat metal dagger blade with four rivets would be from Jukića mound, while the fragment of a dagger blade with rhombic section is reported only as coming from Penića njivice (Marović and Čović 1983: Plate 33: 6, 8; Marović 1984: Figure 15: 1, 2). According to Milošević, both finds were recovered from a cist burial under Jukića mound (Milošević 1998: 195). Ljubljana-Adriatic or Cetina pottery has not been reported.

63. Preočanska Kosa (Preočani, Cetina) – mounds. Of the nine excavated mounds, four small mounds (#89 to #91 and #94A) contained almost no finds. The large Mound 87 contained plain Bronze Age pottery. Three other mounds (#88, #93 and #94) contained just a few Cetina potsherds each, while only Mound 92 yielded a substantial amount of Cetina style pottery.

Mound 87 did not contain prehistoric burials. A few sherds from this mound are reminiscent of Cetina style pottery (Marović 1991: Figure 51: 1, 10).

Mound 88 yielded only a couple of small but characteristic Cetina potsherds (Marović 1991: Figure 52: 1, 2). In a shallow pit near the center of the mound contained a disturbed inhumation, accompanied by a beaker attributable to developed Bronze Age (Marović 1976: 63; 1984: Figure 18: 1; 1991: Figure 52: 4).

Mound 92 was the only one that yielded numerous characteristic fragments of Cetina style beakers (Marović 1976: Plate 7; 1991: Figure 53: 1-10), but it did not contain any trace of a burial.

Mound 93 yielded a couple of fragments closely comparable to Cetina style (Marović 1991: Figure 54: 1, 2). The cist burial, which was used at least three times for inhumation, did not contain any burial goods (Marović 1976: 63; 1991: 124).

Mound 94 yielded only a couple of characteristic Cetina style fragments (Marović 1991: Figure 55: 1, 2).

64. Rarina gomila (Šipići, Vedrine, Trilj) – mound. The battle-ax made of metal probably was collected from the central cist burial. The plain bowl, generally attributable to the Bronze Age, probably was collected outside the burial (Milošević 1984: 15-16, Figure 2: 1, 2).

65. Rudine (Cetina) – mounds. Of about one hundred mounds, 62 have been excavated. Originally, four of them (#10A and #11-13) were published together with Šparevine mounds, but were later grouped together with those at Rudine (Marović 1963; 1991).

Nine small mounds (#29, #32, #37, #41, #42, #56, #79, #80 and #81) did not contain any prehistoric finds. Twenty-seven other small mounds (#11, #28, #30, #33-36, #38, #40, #44, #45, #47, #51, #54, #58, #59, #61-65, #77, #78, #82-84 and #86) yielded only occasional plain prehistoric potsherds. Six medium-size or large mounds (#12, #21, #22, #24, #25 and #39) contained cist burials without any burial goods and a few nondiagnostic potsherds in the mantle. Two small mounds contained cremated human remains and just a few potsherds: a cord-impressed fragment in Mound 55 (Marović 1991: Figure 35: 1), and nondiagnostic sherds in Mound 60.

Characteristic Cetina or Ljubljana-Adriatic style potsherds were recovered from mantles of the remaining eighteen mounds, or from the underlying soil. Among them were nine small mounds (#20, #31, #43, #46, #49, #50, #57, #66 and #85) that did not yield human remains, six medium-size or large mounds (#10A, #13, #19, #23, #48 and #53) contained cist burials without any burial goods, while three medium-size or large mounds (#26, #27 and #52) contained cremated human remains.

A substantial number of Cetina or Ljubljana-Adriatic style pottery was recovered from the following seven mounds:

Mound 26 contained cremated human remains and a considerable number of characteristic Cetina style potsherds that were scattered across the mantle (Marović 1976: Plate 3; 1991: Figure 19: 1-8, 14-18; Marović and Čović 1983: Plate 32: 13).

Mound 27 also contained cremated human remains and a considerable number of characteristic Cetina style potsherds that were scattered across the mantle (Marović 1976: Plate 3; 1991: Figure 22: 1, 2, 4-11, Figure 23: 1-5, 13).

Mound 31 contained characteristic Cetina style potsherds and a flaked stone artifact (Marović 1991: Figure 24: 3-8, 15), but o burial.

Mound 48 contained a central cist burial without any burial goods. Characteristic Cetina style potsherds were recovered from the mantle (Marović 1991: Figure 28: 1-7).

Mound 49 contained characteristic Cetina style potsherds (Marović 1991: Figure 29: 1-6, 13), but o burial.

Mound 52 contained cremated human remains and numerous characteristic Cetina style potsherds (Marović 1976: Plate 4; 1984: Figure 16: 1, 3; 1991: Figure 30: 1-4, 6, Figure 31: 3-5).

Mound 53 contained a central cist burial. A considerable number of decorated potsherds were found near the burial, while others were scattered across the mantle. Among them are characteristic Ljubljana-Adriatic style sherds (Marović 1976: Plate 2; 1984: Figure 9: 3; 1991: Figure 32: 4, 5, 13, Figure 33: 1, 2, 4; Marović and Čović 1983: Plate 30: 13, 14; Govedarica 1989b: Plate 26: 7), coarse incised sherds (Marović 1976: Plate 2; 1991: Figure 32: 3, Figure 33: 5; Marović and Čović 1983: Plate 30: 15; Govedarica 1989b: Plate 24: 7), characteristic Cetina style sherds, including a plain beaker (Marović 1976: Plate 2; 1984: Figure 9: 1, 2, 5; 1991: Figure 32: 2, 6-8, 10), as well as other sherds generally attributable to the third millennium BC (Marović 1991: Figure 32: 11, 12, 14-16, Figure 33: 3, 6).

The following four mounds with cist burials contained occasional characteristic Cetina or Ljubljana-Adriatic potsherds in their mantle:

Mound 10A was pillaged before archaeological investigation. Several characteristic Cetina style potsherds (Marović 1963: Figure 5: 3, 5-7, 9; 1991: Figure 9: 2-5) and a square-sectioned awl made of metal (Marović 1963: Figure 5: 4; 1991: Figure 9: 7) were recovered from the mantle and from the disturbed central cist burial.

Mound 13 contained a central cist burial with no burial goods. Several characteristic Cetina style potsherds were recovered from the mantle (Marović 1963: Figure 9: 1, 2, 4; 1991: Figure 11: 1-4).

Mound 19 contained three cist burials without burial goods. One of them seems to have been used twice for inhumation. Several fragments closely comparable to Cetina pottery were recovered from the mantle (Marović 1976: Plate 1: 4; 1991: Figure 13: 11, 12, 14, 17).

Mound 23 was pillaged before archaeological investigation. It contained a central cist burial that probably was used twice for inhumation. A single Cetina style potsherd was recovered from the mantle (Marović 1991: Figure 18: 9).

The following seven mounds yielded only occasional Cetina or Ljubljana-Adriatic potsherds, and no human remains: Mound 20, several decorated sherds generally attributable to the third millennium BC (Marović 1991: Figure 14: 1-3); Mound 43, a couple of sherds decorated by coarse incision and impression (Marović 1991: Figure 26: 1, 2); Mound 46, a single small decorated sherd closely comparable to Ljubljana-Adriatic pottery (Marović 1991: Figure 26: 7); Mound 50, several sherds reminiscent of Cetina style (Marović 1991: Figure 29: 25-27); Mound 57, a single sherd reminiscent of Cetina style (Marović 1991: Figure 35: 2); Mound 66, a single sherd generally attributable to the third millennium BC (Marović 1991: Figure 35: 6); Mound 85, a single decorated sherd closely comparable to Ljubljana-Adriatic pottery (Marović 1991: Figure 35: 9).

Trench excavation between the mounds at location 'Okruglo' exposed a 20-centimeter thick anthropogenic layer below the layer of humic soil. It contained numerous broken animal bones and small fragments of prehistoric pottery. Most of the potsherds were plain, but a few were decorated in a characteristic Cetina manner (Marović 1991: 79, Figure 36: 11) or by cord impression (Marović 1991: Figure 36: 9, 10).

66. Rumin – Lasića ograde (Bitelić) – isolated find. Two fragments of a vessel decorated by cord impression (Marović 1984: Figure 3).

67. Šparevine (Milaši, Cetina) – mounds. Of more than a hundred mounds, 24 have been excavated. Originally, four additional mounds were published within this site (#10A and #11-13), but later they were included among the mounds at Rudine (Marović 1963; 1991).

Twelve mounds, most of them small (#1, #15-18, #95, #96, #98-100, #102 and #103) did not contain any prehistoric finds. Eight other finds, most of them also small (#4-10 and #97), yielded only occasional nondiagnostic prehistoric potsherds from mantle or the underlying soil.

Characteristic Cetina or Ljubljana-Adriatic style potsherds were recovered from mantles of the remaining four mounds. Two of them, the small Mound 3 and the medium-size Mound 101, contained only a few characteristically decorated potsherds. The other two, the medium-size Mound 2 and the large Mound 14, contained cist burials without any burial goods and a substantial quantity of characteristically decorated pottery.

Mound 2 contained a central cist burial without any burial goods, as well as much later cremation burials attributed to the Iron Age or the Roman Period. Characteristically decorated Ljubljana-Adriatic potsherds (Marović 1963: Figure 2: 5, 7, Figure 3: 3, 6; 1991: Figure 2: 6, 7, Figure 3: 4, 6), Cetina style potsherds (Marović 1963: Figure 2: 1-4, Figure 3: 1, 2, 5; 1991: Figure 2: 1-4, 8, 9, 11, Figure 3: 2), a few coarse incised potsherds (Marović 1963: Figure 2: 6; 1991: Figure 3: 5), or potsherds generally attributable to the third millennium BC (Marović 1963: Figure 3: 7, 8; 1991: Figure 2: 12, Figure 3: 1), as well as a broken ground stone shaft-hole hammer-ax (Marović 1963: Figure 4: 3; 1991: Figure 2: 10) were recovered from its mantle and the underlying soil.

Mound 3 was damaged and did not yield a burial. Two decorated potsherds closely comparable to Cetina style (Marović 1963: Figure 4: 4, 5; 1991: Figure 4: 1, 2), were recovered from its mantle together with much later Iron Age and Roman pottery.

Mound 14, also known as 'Milaševa gomila' (Marović 1976: 56; 1991: 27; Milošević 1998: 74-75), contained an eccentrically located cist burial without any burial goods, as well as 47 cremation burials attributed to the Iron Age or the Roman Period. Fragments of several characteristically shaped and decorated Cetina beakers were recovered from its mantle and the underlying soil (Marović 1963: Figure 41: 1-4; 1991: Figure 6: 1-5).

Mound 101 contained only a few potsherds. Among them are several fragments decorated by coarse incision and impression (Marović 1991: Figure 7: 1, 3-5). A single flaked stone artifact also was recovered (Marović 1991: 31).

68. Trilj (Trilj) – isolated finds. Among many metal finds recovered from the Cetina river bed were two flat axes and one of two shaft-hole axes that may belong to the third millennium BC (Milošević 1998: 38, 291-292, Figure 59, Figure 476).

69. Velike gomile (Zelenovići, Čitluk, Cetina) – mounds. Three large and two small mounds have been excavated. The large mounds contained occasional nondiagnostic potsherds in their mantles, but characteristic Ljubljana-Adriatic or Cetina sherds were absent. Mound 1 and Mound 3 contained inhumations in stone cists. Burial 1 in Mound 1 yielded a shaft-hole ax made of metal and a length of gold wire (Marović and Čović 1983: Plate 34: 9; Marović 1984: Figure 19: 6; 1991: Figure 58: 6). The burial in Mound 3 contained a metal ring-shaped ornament (Marović 1976: Plate 9; 1984: Figure 19: 8; 1991: Figure 58: 7; Marović and Čović 1983: Plate 34: 8). These finds might belong to the third millennium BC. The small mounds did not contain any archaeological finds (Marović 1991: 134).

70. Veliki Rumin (Bitelić) – mounds. Seven fairly large to very large mounds have been excavated. All but one of them (Mound 4) contained occasional nondiagnostic potsherds in their mantles. Five mounds (#1-5) contained inhumations in stone cists, but no burial goods. Only Burial 17 in Mound 1 (the younger of two central burials in that mound) yielded a small flat dagger blade made of metal (Marović and Čović 1983: Plate 33: 4; Marović 1984: Figure 15: 4; 1991: Figure 82; Milošević 1998: Figure 276). Mound 5 yielded the only decorated potsherd generally attributable to the third millennium BC (Marović 1991: Figure 85: 1).

71. Zelenovića ogradice (Zelenovića kuće, Čitluk, Cetina) – mounds, also known as 'Ogradice', 'Gomile iznad ogradica' or 'Gomile više Zelenovića ogradica'. Seven mounds of various sizes have been excavated. The two smallest ones (#6 and #7) contained only occasional nondiagnostic potsherd in their mantles. The remaining five mounds yielded various amounts of characteristic Cetina style pottery from their mantles. Mound 4 contained two cist burials, while the other four mounds (#1-3 and 5) contained modest quantities of cremated human remains.

Mound 1 contained cremated remains and potsherds scattered across the mantle; some of the potsherds are attributable to Cetina style (Marović 1991: Figure 62: 1-5, 10).

Mound 2 also contained cremated remains and characteristically decorated Cetina style potsherds scattered across the mantle (Marović 1991: Figures 1-9).

Mound 3 contained cremated remains, deposited near the center and relatively high within the mantle. These remains were surrounded by fragments of several characteristic Cetina style beakers, including a small pedestalled beaker with perforated shoulder (Marović 1976: Plate 10; 1984: Figure 17: 1, 3; 1991: Figure 64: 1-7; Marović and Čović 1983: Plate 31: 5, Plate 32: 3, 5, 6; Govedarica 1989b: Plate 31: 4).

Mound 4 contained two cist burials without any burial goods. Several characteristic Cetina style potsherds were recovered from the mantle (Marović 1976: Plate 11, top left; 1991: Figure 66: 1-3).

Mound 5 contained cremated remains at its base. Characteristically decorated fragments of small Cetina style beakers were recovered from their vicinity (Marović 1976: Plate 11, top right and middle left; 1991: Figure 67: 1-7).

72. Živalji (Obrovac) – mounds, also known as 'Obrovac-Živalji', 'Han' or 'Buljani'. Only one of the five mounds has been excavated, while the rest were obliterated. All of them contained cist burials (Marović 1994: 65; Milošević 1998: 207).

The excavated mound contained near its center two stone cists with inhumations. One of the cists has been used twice. That cist yielded several metal implements: a short sword with a massive metal grip decorated by engraving, a small flat dagger blade and a length of gold wire (Marović and Čović 1983: Plate 33: 1, Plate 34: 1; Marović 1984: Figure 14: 1, 3; 1994: Figure 3: 1, 2). The same burial yielded a ground stone wristguard (Marović and Čović 1983: Plate 34: 7; Marović 1984: Figure 14: 4; 1994: Figure 3: 3; Govedarica 1989b: Plate 34: 5) and several cord-impressed potsherds (Marović and Čović 1983: Plate 34: 4-6; Marović 1984: Figure 14: 2, 5; 1994: Figure 3: 4).

Two isolated finds were collected from obliterated mounds: another dagger with massive grip and a gold coil from the Archaeological Collection of the Franciscan Monastery (Marović and Čović 1983: Plate 33: 5; Marović 1984: Figure 15: 7; 1994: 65, footnote 5). Ljubljana-Adriatic and Cetina style pottery is absent.

73. Župna kuća (Bajagić) – mound. A pillaged mound contained a central cist burial, without any burial goods. An elongated dagger blade with rhombic section, made of metal and decorated by engraving, is an isolated find from this mound (Marović and Čović 1983: Plate 33: 3; Marović 1984: Figure 15: 3).

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74. Begovići (Kozica, Vrgorac) – mound. Fragments of partially burned human bones were found near its center. A small, flat dagger blade with two rivets made of metal (Beg 2009: Figure 8; Beg Jerončić 2011: Plate 1: 4), a ground stone wristguard (Beg 2009: Figure 7; 2011: 531; Beg Jerončić 2011: Plate 1: 1), a chert blade segment (Beg Jerončić 2011: Plate 1: 2), and three characteristic Cetina potsherds were found nearby. Several other Cetina sherds were scattered across the mantle (Beg 2009: Figures 3-6; 2011: 531; Beg Jerončić 2011: Plate 2: 9-13, Plate 3: 14, 15).

The age of human remains was determined by direct radiocarbon dating of a human tooth sample: Beta-248564, 3670±40 bp, calibrated 1SD range: 2134-1979 BC (Beg Jerončić 2011: 98; Jerončić, pers. com.).

75. Biskupija (Knin) – settlement (?), also known as 'Bukorovića bašće'. Several fragments of characteristically decorated Cetina style beakers and open bowls with wide rim were recovered from a layer of clayey soil that was encountered at a depth of almost three meters during excavation of a medieval cemetery (Marović 1952: Figure 1: 1-5; Batović 1973b: Plate 23: 6, 7, 9, 10).

76. Eraci (Plina) – mound. It was used for burial purposes over an extended period and was extended several times. It contains three cist burials, one of which was used twice. About a dozen decorated Ljubljana-Adriatic style potsherds, as well as a fragment of a round-bellied jar with cylindrical neck decorated by coarse incision, were recovered from the layer of soil underlying the mound. Three or four Ljubljana-Adriatic sherds were found next to the burials, while a single one was found in the mantle above them (Bilić *et al.* 2011: Plate 2: 15, 18-23, Plate 3: 24-28, Plate 4: 32). Two bifacial points were recovered from the layer of soil underlying the mound (Bilić *et al.* 2011: Plate 2: 16, 17).

77. Ervenik (Knin) – mounds. The only excavated mound contained a central cremation burial, three cist burials, and a burial in a simple shallow pit. The primary cremation was badly disturbed by a later cist burial. Characteristic Cetina style potsherds were scattered across the original soil surface and the bottom part of the mantle. (Buttler 1932: Figure 3).

78. Gradina (Gornje Raščane, Zagvozd) – hillfort. Several potsherds (catalog #29-32) may be attributed generally to the third millennium BC (Katavić *et al.* 2011: 57-58, Plate 5: 29-32).

79. Jukića gomile (Zagvozd) – two mounds. In Mound 1, the central Burial 3 contained a modest quantity of cremated human remains and at least two inhumations. At least three vessels, shaped and decorated in a characteristic Cetina manner, were recovered from that burial (Olujić 2011: 661; 2012: Figures 11-13a, Plates 8-10). The peripherally located cist of Burial 4 did not contain any burial goods. Both mounds also contained later burials.

The age of 'soot remains' from Burial 3 was determined by radiocarbon: Beta-241024: 3590±40 bp, calibrated 1SD range: 2014-1892 BC. The age of 'soot remains' from the mantle, possibly related to Burial 4, was determined by radiocarbon: Beta-241020, 3850±60 bp, calibrated 1SD range: 2454-2209 BC (Olujić 2011: 661; 2012: 64, 68).

80. Kovačina (Popirača, Vučevica) – settlement. A single potsherd closely comparable to Ljubljana-Adriatic style (Šuta 2013a: Figure 6, Phase 2, top right), another one comparable to Cetina style (Šuta 2013a: Figure 6, Phase 2, bottom), a coarse incised sherd (Šuta 2013a: Figure 6, Phase 2, top left), and a cord-impressed sherd (Šuta 2013a: Figure 6, Phase 3, bottom right) were recovered from a couple of small dolines during rescue excavations.

81. Kruške (Otrić-Seoci, Prolog) – mounds. Of about thirty mounds, six have been excavated. Four of those mounds yielded pottery attributable to the third millennium BC.

Mound AN 161B was obliterated before archaeological investigation. Many plain potsherds, several characteristically decorated Ljubljana-Adriatic style sherds, and at least one coarse incised sherd were recovered from its remains (Arheo Plan *et al.* 2014: Figure 14).

Mound AN 162A contained a central cist burial, dated by radiocarbon to later Bronze Age. A single decorated potsherd, closely comparable to Ljubljana-Adriatic style, was recovered from the underlying soil (Arheo Plan *et al.* 2014: Figure 23).

Mound AN 162B contained an eccentrically located cist burial, dated by radiocarbon to later Bronze Age. Numerous potsherds were recovered, most of them from the underlying soil. Among them was a single characteristic Ljubljana-Adriatic style potsherd (Arheo Plan *et al.* 2014: Figure 33, Plate 2: PN4), as well as three characteristic Cetina style potsherds (Arheo Plan *et al.* 2014: Figure 34, Figure 35, Plate 2: PN5, PN6, PN11).

Mound AN 162C contained a peripherally located cist burial, dated by radiocarbon to later Bronze Age. Numerous potsherds were recovered from the mantle and the underlying soil. Among them is a single coarse incised fragment (Arheo Plan *et al.* 2014: Figure 54, Plate 2, bottom).

82. Mali Mosor (Ercegovci, Dicmo) – mounds. Of the five mounds, two have been excavated.

Mound 1 contained cremated human remains near its center. Two ornaments made of sheet gold, potsherds attributed to 'Cetina culture', an obsidian flake, and two small bifacial points made of chert were recovered from the vicinity of the cremation, but only the golden ornaments were illustrated. Aside from the cremation, the mound contained five other, later burials, three of them in stone cists (Periša 2006: 367-368).

Mound 2 contained cremated human remains that were scattered near its center. Several decorated Cetina style potsherds, recovered from the mantle, have been reported but not illustrated (Periša 2006: 368).

83. Matijin Dolac - gomile (Dugobabe, Vučevica) – two mounds. Neither one of them contained burials. Fragments of a plain Cetina style beaker, recovered from the mantle of Mound 1, have been reported but not illustrated (Šuta 2013a: 15). Mound 2 yielded several characteristic Cetina style potsherds (Šuta 2006: 420; 2013a: Figure 8).

84. Matijin Dolac - vrtače (Dugobabe, Vučevica) – isolated finds from small dolines. Two potsherds decorated by coarse incision (Šuta 2006: 419; 2013a: Figure 7).

85. Nevest (Unešić) – isolated find of a group of metal implements: a decorated shaft-hole hammer-ax, a small flat ax, and two square-sectioned bars with pointed ends. Some of these objects may belong to the third millennium BC (Mirosavljević 1953: Figure 1: 3).

86. Ograđe (Vid, Metković) – mounds. Characteristic Ljubljana-Adriatic and Cetina style potsherds were recovered from two or three mounds out of the eight mounds that had been excavated.

Mound 1 contained near its center two cist burials, without any burial goods. Characteristic Ljubljana-Adriatic potsherds (Marović 1980b: Figure 25: 24, Figure 28: 1; Marović and Čović 1983: Plate 30: 5, 7; Govedarica 1987: Plate 6: 2, 3; 1989b: Plate 24: 5, 6, Plate 46: 6) and a fragment decorated by coarse incision and impression (Marović 1980b: Figure 28: 2; Marović and Čović 1983: Plate 30: 4; Govedarica 1987: Plate 6: 4; 1989b: Plate 24: 3). were recovered from its mantle.

Mound 8 was very badly damaged. Fragments of several undecorated Cetina style beakers were recovered from the remains of its mantle (Marović 1980b: Figure 45: 1-5; Marović and Čović 1983: Plate 30: 8-11; Govedarica 1989b: Plate 25: 2, 3).

Cetina style finds also are mentioned in Mound 4 (Marović and Čović 1983: 196), but they are not illustrated.

87. Podi (Dugopolje) – mounds. Fragments of several characteristic Cetina style vessels have been recovered from one of the three excavated mounds (Gogala 2015).

88. Poljanice (Bisko) – mounds. Only six of the 35 mounds contained cremation burials and cist burials. A ground stone wristguard was recovered from Mound 34 (Milošević 1998: 275).

89. Radović (Radovići, Vrgorac) – mound. It contained an inhumation burial in a cist, as well as cremated human remains that were scattered across the mantle. Numerous potsherds decorated by incision and impression have been reported, but not illustrated (Šućur and Mucić 2011: 575).

90. Ravča (Pranići, Ravča, Vrgorac) – two mounds. Both of them were pillaged, and the finds were not collected systematically. One of the mounds yielded a wristguard made of metal, its shape closely resembling ground stone wristguards (Marović 1994: Figure 4: 1, Plate 2: 2), as well as several other metal implements attributable to later Bronze Age. Allegedly, all of these finds were recovered from a burial cist.

91. Samogorska špilja (Župa, Zagvozd) – cave. Several decorated potsherds closely comparable to Cetina style (Tomasović 2007: 412, top; 2011b: Figures 3 and 4, Plate 2: 1, 2).

92. Sridnja gora (Dujmovići, Grabovac, Zagvozd) – mound. It contained remains of a stone-paved pyre site and, next to it, a modest quantity of cremated human bones surrounded by stones. Most of the small pottery fragments were recovered from the mantle or the underlying soil. Among them are several characteristically decorated Ljubljana-Adriatic style potsherds (Milošević 2011: Figure 9: 3, 4, Figure 10: 3, 4) and a potsherd reminiscent of Cetina style (Milošević 2011: Figure 9: 2, Figure 10: 2). A metal implement, recovered from a cleft near the mound's edge, which originally was attributed to the mid-second millennium BC (Milošević 2011: 32, 36, Figure 9: 1, Figure 10: 1), is an ear syringe from Roman Period (Latinović *et al.* 2017: 170, Figure 90).

93. Sveti Spas (Knin) – hillfort. Of some twenty potsherds that have been published from Marun's excavation, most are decorated by coarse incision, or incision and impression, in a manner attributable generally to the third millennium BC (Buttler 1933: Plate 32.1; Korošec 1962: Plate 7).

94. Topolje (Kovačić, Knin) – isolated find of a group of metal implements: four copper shaft-hole axes and a small dagger blade with rhombic section. These objects probably belong to the third millennium BC (Mirosavljević 1953: Figure 1: a, b, Figure 2; Durman 1983: 42, 49, Plate 10: 5, Plate 16: 2).

95. Unešić (Unešić) – isolated find. Fragment of a characteristic Cetina style constricted handle, without further provenience information (Brusić 1973: 52, Plate 50: 5).

96. Vlake (Brčići, Vučevica) – two mounds. Mound 2 contained a central cremation burial. Among many potsherds scattered across the mantle were fragments of a characteristic Cetina style pedestalled beaker (Šuta 2013a: Figure 10).

97. Vrba (Bračević, Muć) – mound. Cetina style pottery has been reported, but not illustrated; it had been collected from an obliterated mound (Marović 1976: 66).

98. Vukosavi (Dusina, Vrgorac) – mound. An eccentrically located cist burial contained a modest quantity of human skeletal remains, some of which were burned, but no burial goods. Among the mostly plain potsherds recovered from the mantle was a single characteristic Ljubljana-Adriatic style sherd (Beg Jerončić and Jerončić 2011: Plate 3: 14; 2012: 692, bottom left figure), as well as a few other sherds attributable generally to the third millennium BC (Beg

Jerončić and Jerončić 2011: Plate 3: 15, 16). Several small metal implements belonging to the Roman Period also were recovered from the mantle. A human tooth from the burial cist yielded a direct radiocarbon date around year 1000 BC (Beg Jerončić and Jerončić 2011: 233-234), which corresponds to the Late Bronze Age.

99. Zagomilje 2 (Kokorići, Vrgorac) – settlement. Among the pottery recovered by excavation, there are decorated sherds closely comparable to Cetina style (Mucić and Kovačević Bokarica 2011: Plate 3: 14), cord-impressed sherds (Mucić and Kovačević Bokarica 2011: 189, catalog #25 and 26), and other sherds that are attributable generally to the third millennium BC (Mucić and Kovačević Bokarica 2011: Plate 3: 17, Plate 4: 23, 27). Several blade segments and a small bifacial artifact made of chert, as well as a flat ground stone pendant also were recovered (Mucić and Kovačević Bokarica 2011: Plate 3: 11-13, 16). The site was initially reported as a burial site (Kovačević and Mucić 2012), due to a later inhumation within the area of the settlement. Those human remains were dated directly by radiocarbon: Beta-260022, 3400±40 bp, calibrated 1SD range: 1744-1643 BC (Mucić and Kovačević Bokarica 2011: 139).

100. Zemunica (Bisko, Trilj) – cave. Ljubljana-Adriatic potsherds have been reported, but not illustrated (Šošić and Karavanić 2006: 377). The same layer yielded a small bifacial point (Šošić and Karavanić 2006: Figure on p. 378).

4.10 Northern Dalmatia

101. Gaj (Brnjica, Pakovo Selo) – mounds. The only excavated mound contained modest quantities of cremated human remains, deposited within several small oval-shaped stone-lined features. Hundreds of potsherds were recovered from the mantle and the burials, including a small number of characteristic Cetina style sherds (Menđušić 1987: Figure 2; Podrug 2008: Figure 23).

102. Ivankovača (Danilo) – mound. It contained a cist burial near its center. A ground stone shaft-hole hammer-ax, a hammer-ax with massive shaft made of metal, and an elongated dagger blade of rhombic section and four rivet holes were collected from the mound, which was obliterated during road construction (Govedarica 1989b: Plate 35: 1-3; Della Casa 1996: 130-131; Menđušić 1997: 55; Podrug 2008: 45, Figure 24; Brajković *et al.* 2013: 26, 61). Another shaft-hole ax, mentioned by Govedarica (1989b: Plate 35: 5), is not mentioned in later publications.

103. Kosa kod mula (Vrsi, Nin) – mounds. Most of the potsherds were collected from the mantles of the five excavated mounds. Some of those sherds were decorated by incision and impression. According to textual description, they are attributable probably to the third millennium BC (Batović 1973a: 28-30; Govedarica 1989b: 130).

104. Mala glavica (Mataci, Podvršje, Ljubač, Ražanac) – mound, also known as 'Matakov brig'. It contained four cremation burials, only one of which has been lined by stones. Many potsherds were scattered across the mantle, including a few that were closely comparable to Cetina style pottery (Batović and Kukoč 1986; 1987: Figure 1; 1988a; 1988b: Plate 29: 1, 3, 5, 7, 8, Plate 30: 3, 12, 14, Plate 31, Plate 37: 3, 9, Plate 38: 3, Plate 50: 13-15). Also recovered were a ground stone wristguard, a pendant made of bovine horn, and about thirty flaked stone artifacts, including several blade segments and a small bifacial point (Batović and Kukoč 1987: Figure 2; 1988b: Plate 24, Plate 25: 12, 13, Plate 26: 1, Plate 43: 8, 10, Plate 44: 1).

105. Mrdakovica (Zaton) – hillfort (?). Fragment of an open bowl, decorated in a manner that is closely comparable to Cetina style (Brusić 1973: Plate 29: 2).

106. Pazjanice (Starigrad Paklenica) – cave. A small decorated potsherd closely comparable to Ljubljana-Adriatic style (Forenbaher and Vranjican 1982: Figure 5: 2, Figure 6: 2).

107. Poljakuše (Crno Brdo, Danilo Biranj) – mounds. The seven excavated mounds contained cremation burials and Cetina style pottery, but the finds remain unpublished (Podrug 2008: 44-45; Podrug and Krnčević 2011: 562; Brajković *et al.* 2013: 31, 59-60).

108. Privlaka (Nin) – mound (?). Isolated find of a group of gold objects, probably collected from a burial, although it has been published as a hoard (Vinski 1959: 209, footnote 28). It consists of twenty carinated beads, two buttons, two rings made of square-sectioned bars, and nine ornaments made of corrugated gold sheet (Vinski 1959: Plate 1, Plate 2: 6-14; Govedarica 1989b: Plate 26: 1-3, 5, 8-11; Heyd 2007: 95).

109. Renje (Vrpolje, Šibenik) – hillfort, also known as 'Gradina kod Vrpolja' or 'Gradina u Vrpoljcu'. A surface-collected decorated potsherd may be attributed generally to the third millennium BC (Korošec 1962: Plate 5: 5; Brusić 1973: Plate 7: 4).

110. Stanine (Nadin) – mounds. Only one of the five mounds enclosed by a drystone wall contained burials, while remains of buildings were found beneath the other four mounds. Three small stone-lined pits containing cremated human remains were found at base of Mound 1, close to the mound's center. Many potsherds were recovered from the mantle. All pottery finds, including those that were recovered from the

test trenches excavated within the drystone enclosure, have been attributed to 'late Cetina culture', but no illustrations have been published (Batović and Čondić 2005: 85-87; Kukoč 2009: 55).

111. Stubica (Dubrava kod Šibenika) – cave. Among the informally collected finds are about a dozen characteristically decorated Cetina style potsherds (Brusić 1973: Plate 32, Plate 33: 1).

112. Šarina draga (Zaton kod Šibenika) – cave, also known as 'Pećina u Šarinoj Drazi'. Fragment of an open bowl, decorated in a manner that is closely comparable to Ljubljana-Adriatic style, was recovered during test excavation (Brusić 1973: Plate 40: 1).

113. Škarin samograd (Mirilović Zagora, Unešić) – cave. Some of the finds have been recovered during Marović's archaeological excavation (Marović and Čović 1983: 191), while other finds were collected by informal digging, and during various visits to the site (Brusić 1973: 54-55). The pottery assemblage contains only a few characteristically decorated Ljubljana-Adriatic sherds (Marović and Čović 1983: Plate 28: 9, 10; Govedarica 1989b: Plate 25: 5, 6), a greater number of characteristic Cetina style sherds (Brusić 1973: Plate 17: 1, 2, Plate 20: 6, Plate 21: 3, 4, Plate 23: 1; Marović and Čović 1983: Plate 28: 5, 7, 8, 11, Plate 29: 2-5, 7, 8, 12; Govedarica 1989b: Plate 23: 1, 2, Plate 24: 8, Plate 25: 4, Plate 28: 7, 8, Plate 29: 3, Plate 31: 3, 9), several coarse incised sherds (Marović and Čović 1983: Plate 29: 6, 10; Govedarica 1989b: Plate 28: 5, Plate 31: 6), as well as a number of sherds generally attributable to the third millennium BC (Brusić 1973: Plate 18: 1, Plate 20: 6, Plate 23: 2, Plate 24: 3). According to the very limited and insecure information about stratigraphic contexts of those finds (Brusić 1973: 54-55; Marović 1976: 68; Marović and Čović 1983: 196-198; Govedarica 1989b: 113, 115, 154; Marijanović 2007: 26-28), Cetina style pottery appears throughout a layer that is over 1,5 meters thick (from depth 2,7 to 1,1 m), while the rare Ljubljana-Adriatic style potsherds appear only in the lower part of that layer (from depth 2,7 to 2 m).

114. Tradanj (Zaton kod Šibenika) – cave. A large part of the site was torn up by digging in late 19th century. A test excavation, carried out in year 1971, indicated that the remaining parts of the site also were disturbed. At that occasion, several characteristic Ljubljana-Adriatic style potsherds (Brusić 1973: Plate 7: 2, 3), Cetina style potsherds (Brusić 1973: Plate 45: 1, Plate 47: 1), coarse incised potsherds (Brusić 1973: Plate 49: 1, Plate 50: 3), as well as a few sherds generally attributable to the third millennium BC (Brusić 1973: Plate 48: 1, Plate 50: 2) have been recovered.

115. Ulnovac (Stričani, Danilo) – two mounds. Broken animal bones and many small potsherds were scattered through the mantles of both mounds, but burials were not encountered (Menđušić 1997; 2000). The pottery collection contains some characteristically decorated Ljubljana-Adriatic sherds (Podrug 2008: Figure 21), as well as some sherds decorated by coarse incision and impression (Menđušić 1993: Figure on p. 27; Podrug 2008: Figure 21, bottom left; Brajković *et al.* 2013: Figure on p. 58). A ground stone pendant also was recovered (Menđušić 2000: Figure on p. 37; Podrug 2008: Figure on p. 188, #87; Brajković *et al.* 2013: Figure on p. 58).

116. Vaganačka pećina (Starigrad Paklenica) – cave. Among the finds attributed to Phase 6, there are several characteristic Ljubljana-Adriatic style potsherds (Forenbaher and Vranjican 1985: Plate 5; Govedarica 1989b: Plate 3: 5, Plate 6: 6), and a single coarse incised sherd (Forenbaher and Vranjican 1985: Plate 3: 11; Govedarica 1989b: Plate 5: 5).

117. Vreline (Islam Grčki) – settlement, also known as 'Ciciline bujaduše'. Many potsherds and flaked stone artifacts were recovered from the site's surface. Among them are several characteristically decorated Cetina style potsherds (Brusić 1973: 77a; Batović 1987: Plate 22: 9, 11, 12, Plate 25: 1, Plate 26: 1), and several small bifacial points (Batović 1987: Plate 19: 1, Plate 21: 1, 2, Plate 26: 10-15).

118. Zaton (Nin) – mounds. Finds belonging to 'Cetina culture' are mentioned, but not illustrated (Govedarica 1989b: 130).

4.11 Middle Dalmatia

119. Biranj (Kozjak, Kaštela) – hillfort. A couple of Ljubljana-Adriatic style potsherds and about a dozen small bifacial points (Šuta 2013b: 99-100, Figures 5 and 6).

120. Bubnjavača (Veliko Brdo, Makarska) – cave. The layers attributed to the Early Bronze Age and Copper Age yielded a couple of decorated potsherds closely comparable to Ljubljana-Adriatic style (Tomasović 2011a: Figure on p. 570), three characteristic Cetina style sherds, (Tomasović 2012: Figure on p. 605, top; 2016: Figure on p. 654, bottom right), and several coarse incised fragments (Tomasović 2012: Figure on p. 605, bottom; 2016: Figure on p. 654, top right). Their stratigraphic relationships are unclear due to disturbed deposits.

121. Grapčeva spilja (Humac, Hvar) – cave. A relatively large number of potsherds shaped and decorated in a characteristic Ljubljana-Adriatic manner was recovered in the course of Novak's excavations (Novak 1955: Plate 231-233; Korošec, P. 1956: Figures 1 and 2, Plate 2: 4, Plate 3: 2-4, Plate 4: 4, Plate 5: 3-6; 1962: Plate 1: 1-3, Plate 2: 1; Batović 1973b: Plate 24: 1, Plate 25: 1-3; Govedarica 1989b: Plate 18: 1, Plate 19: 8, Plate 20: 1, Plate 22: 2),

as well as at least one coarse incised potsherd (Korošec 1962: Plate 6: 9; Petrić 1981: Plate 2: 4). Novak also illustrates a couple of narrow and elongated pendants made of ground stone that may be attributed to the third millennium BC (Novak 1955: Plate 143).

The later small-scale test excavation yielded only a few small decorated potsherds that may be attributed to the third millennium BC. Among them are sherds closely comparable to Cetina style pottery that were recovered from the lower stratigraphic contexts of the Late Copper Age Phase 4 (Forenbaher and Kaiser 2008: Plate 20: 12-15), Ljubljana-Adriatic sherds and coarse incised sherds that were recovered from the upper stratigraphic contexts of the same phase (Forenbaher and Kaiser 2008: Plate 20: 17-19), and a potsherd closely comparable to Cetina style from the lowermost stratigraphic context of Phase 5 that was attributed to the Early and middle Bronze Age (Forenbaher and Kaiser 2008: Plate 21: 2).

Two radiocarbon determinations are available for dating of Phase 4. A charcoal sample recovered from a context near the middle of Phase 4 (Stratigraphic Unit 1220) yielded the date Beta-103478, 4190±50 bp, calibrated 1SD range: 2882-2678 BC. Another charcoal sample recovered from a context near the top of Phase 4 (Stratigraphic Unit 1200) yielded the date Beta-103477, 3880±120 bp, calibrated 1SD range: 2551-2144 BC (Forenbaher and Kaiser 2008: Table 1).

122. Kopačina (Donji Humac, Brač) – cave. Fragment of an open bowl decorated in a manner closely comparable to Cetina style was recovered from the backdirt that was redeposited from the cave during earlier excavations (Kliškić 2007: 444, top right).

123. Marina (Trogir) – submarine find. A round-bellied jar with cylindrical neck, shaped and decorated in a manner that is closely comparable to Ljubljana-Adriatic style was recovered by chance from a depth of some thirty meters (Radić Rossi 2011: 117-118, Plate 1).

124. Markova spilja (Hvar) – cave. A couple of characteristic Cetina style potsherds (Novak 1959: Plate 11: 1, Plate 17: 4).

125. Spilja Svetog Filipa i Jakova (Marina, Trogir) – cave. Potsherds decorated by incision, impression, and incrustation have been attributed to 'all three phases of Cetina culture', but they have not been illustrated (Piteša 2005: 245).

126. Split-Gripe (Split) – isolated find. A group of gold, copper and pottery objects was found in a cleft during house construction. The pottery has disappeared, the gold objects (some fifty perforated beads of various shapes, two bracelets and two or three ringlets made of wire, a button and a long band of sheet gold) have been destroyed, while the copper implements (a hammer-ax, two shaft-hole axes, two flat axes and three fragments of a rectangular-sectioned) are kept by the Archeological Museum in Split bar (Marović 1953: 125-128, Plate 3, Figures 1-4; Vinski 1959: 211, Plate 2: 15, 16).

4.12 Southern Dalmatia

127. Grad (Nakovana, Orebić) – hillfort. Fragments of a characteristically decorated Ljubljana-Adriatic beaker were recovered by test excavation from buried prehistoric soil and an immediately overlying anthropogenic context (Forenbaher 2011: 691).

128. Gudnja (Ponikve, Ston) – cave. Excavations that were carried out by Spomenka Petrak from year 1963 until 1968 yielded a substantial number of potsherds decorated by coarse incision and impression (Petrić 1981: Plate 2: 2; Marijanović 2005: Figures 23-26, Plates 42-47), characteristic Ljubljana-Adriatic style fragments (Marijanović 2005: Plates 48-51) and Cetina style fragments (Marijanović 2005: Plate 58: 5-8, Plate 59: 1, 2), about a dozen potsherds decorated by excision (Marijanović 2005: Plates 49 and 51), a bowl decorated by cord impression (Marijanović 2005: Figure 30), as well as other potsherds decorated in a peculiar manner that most likely belong to the third millennium BC (*e.g.,* Marijanović 2005: Plate 55: 1-4). Ljubljana-Adriatic and coarse incised pottery, fragments decorated by excision, and those decorated by cord impression, have been attributed to Gudnja's Phase 5, while Cetina style pottery has been attributed to Gudnja's Phase 6. The site's stratigraphy generally supports such division, although the detailed information about context of specific finds is not available. Aside from the Cetina finds, Phase 6 also contains later Bronze Age pottery. Its subdivision into two subphases is not based on stratigraphy, but exclusively on formal typological traits of the finds (Marijanović 2005: 73-92).

129. Spila (Nakovana, Orebić) – cave. A number of Ljubljana-Adriatic and Cetina style potsherds were recovered during excavation in Sector 1 and Sector 3 (Forenbaher and Perhoč 2015: 10, 42). Publication of those finds is pending.

Sector 1 yielded only a few characteristic Ljubljana-Adriatic and Cetina style potsherds. Most of them were recovered from a mixed context that contained Early Copper Age and late Copper Age pottery, and was attributed to Spila's Phase 5 (Forenbaher and Perhoč 2015: 10). Several coarse incised sherds were recovered from the same context.

Sector 3 yielded about a dozen characteristic Ljubljana-Adriatic and Cetina style potsherds, as well as five sherds decorated by coarse incision and impression. All

three classes of potsherds were scattered throughout the 0,4 meters thick layer attributed to Spila's Phase 5 (Copper Age). The plain Early Copper Age (Nakovana style) pottery predominates in the lower part of that layer (Phase 5a), while the plain Late Copper Age pottery predominates in its upper part (Phase 5b) (Forenbaher and Perhoč 2015: 42).

Three radiocarbon determinations are available for dating Phase 5 in Sector 3 (Forenbaher and Perhoč 2015: Table 2). One charcoal sample was recovered from the lowermost context of Phase 5a (Stratigraphic Unit 1013): z-3478, 4185±95 bp, calibrated 1SD range: 2892-2633 BC. Another charcoal sample was recovered from the topmost context of Phase 5a (Stratigraphic Unit 1010):[1] z-3480, 4160±75 bp, calibrated 1SD range: 2877-2647 BC. A third charcoal sample was recovered from a Phase 5b context (Stratigraphic Unit 1002): z-3481, 3485±90 bp, calibrated 1SD range: 1917-1691 BC.

130. Uvala Duga (Sušac) – isolated find, recovered from a Neolithic site recorded as 'SU-002' (Bass 1998: 169; Della Casa and Bass 2001). About a dozen fragments of an open bowl decorated by incision and excision, in a manner closely comparable to Ljubljana-Adriatic style, were recovered during archaeological excavation (Figure 102). The find is kept at Vela Luka Cultural Centre and was previously unpublished.

131. Vela spila (Vela Luka, Korčula) – cave. Many characteristically decorated fragments of Ljubljana-Adriatic style pottery (Čečuk and Radić 2005: Drawings 29 and 30, Figures 40 and 41, Figure on p. 263, Plate 87, Plate 88, Plate 89: 2, 3, Plate 91: 6, 8, 9, Plate 94: 9, 11-13), fragments decorated by coarse incision and impression (Čečuk and Radić 2005: Figure 42, Plates 85 and 86, Plate 91: 1-5, 7, Plate 92: 6, Plate 94: 7, 10, 14), occasional fragments decorated by *furchenstich* incision (Čečuk and Radić 2005: Plate 92: 3, Plate 93: 7) or excision (Čečuk and Radić 2005: Plate 87: 1, Plate 92: 5), rare fragments closely comparable to Cetina style (Čečuk and Radić 2005: Plate 92: 3, Plate 93: 1), as well as other potsherds generally attributable to the third millennium BC were recovered from the 0,7 meters thick Layer 2. An inhumation in a large plain pottery vessel has been attributed to the same period. In its vicinity were found seven complete chert blades and a copper shaft-hole hammer-ax (Čečuk and Radić 2005: 251-252, Figure 38). An attempt was made to split the finds from Layer 2 into two subphases, but all of the aforementioned pottery classes are present throughout that layer (Čečuk and Radić 2005: 245, 250).

[1] Based on preliminary analysis of the pottery assemblage, Stratigraphic Unit 1010 originally was attributed to Phase 5b (Forenbaher and Perhoč 2015: Table 2); after a detailed analysis, it was reattributed to Phase 5a.

New excavations initiated in year 2010 yielded about forty characteristically decorated fragments of Ljubljana-Adriatic pottery, about twenty potsherds decorated by coarse incision and impression, and several other fragments attributable generally to the third millennium BC, all of them from the Late Copper Age layers of the site. Publication of those finds is pending.

132. Vilina pećina (Ombla, Dubrovnik) – cave. Isolated find of a single potsherd decorated by coarse incision and impression (Petrić 1981: Plate 2: 1; Govedarica 1989b: Plate 22: 1).

4.13 Western Herzegovina

133. Grabovica (Buško blato, Tomislavgrad) – mound, also known as 'Glavica u Naklu'. The disturbed central cist burial did not contain any burial goods. Numerous small potsherds were recovered from the lower part of the mantle and the underlying soil. Only a few of those sherds are closely comparable to Cetina style pottery (Marović 1980a: Figure 6: 3, Figure 7: 1, 2, 9; Govedarica 1989b: Plate 23: 3), a couple are decorated by coarse incision and impression (Marović 1980a: Figure 6: 1, 6; Govedarica 1989b: Plate 23: 5), while a few others may be attributed generally to the third millennium BC (Marović 1980a: Figure 6: 7, 12, 13).

134. Krstina (Posušje) – hillfort. Several surface-collected potsherds decorated by incision and impression, closely comparable to Cetina style pottery (Oreč 1978: Plate 14: 8-15).

135. Nečajno (Posušje) – hillfort. Many of the potsherds decorated by incision and impression may be attributed to the third millennium BC (Oreč 1978: Plate 13: 3, Plate 14: 1-4; Čović 1983: Plate 18: 2-8; 1989: Plate 2: 2, Plate 7: 1, 2, 5, Plate 6: 1-11, Plate 7: 3, 6, 7, Plate 8: 3; Govedarica 1989b: Plate 33: 3, Plate 34: 2, Plate 37: 7). They were collected from layers that also contained characteristic later Bronze Age pottery. A single cord-impressed potsherd was found close to the modern ground surface (Čović 1989: 70, Plate 8: 5).

136. Orlov Kuk (Vučipolje, Posušje) – hillfort. Some of the surface-collected potsherds are decorated in a manner reminiscent of Cetina style (Oreč 1978: Plate 10: 12, 15).

137. Ravlića pećina (Tihaljina) – cave. Characteristic Ljubljana-Adriatic style potsherds (Marijanović 1981: Plate 35: 2, 3, Plate 36: 2, 5, 6; 2012: Plate 68: 3-5, 8, 9, Plate 69: 1-3, 5, Plate 73: 7), sherds decorated by coarse incision and impression (Marijanović 1981: Plate 36: 1, 3; 2012: Plate 67: 1-8, Plate 70: 1,2), and a couple of sherds decorated by excision (Marijanović 1981: Plate 36: 6; 2012: Plate 68: 5, Plate 73: 7) have been attributed

to a stratigraphically earlier Phase 3a. Several decorated sherds closely comparable to Cetina style pottery were attributed to the same phase (Marijanović 2012: Plate 68: 6, 7, Plate 70: 4), but most of the characteristic Cetina style pottery was attributed to the stratigraphically later Phase 3b (Marijanović 1981: Plate 38: 2-4, Plate 39: 5, 7-9, Plate 40: 5; 2012: Plate 76: 1-3, Plate 77: 5). Division between Phase 3a and 3b was based upon stratigraphic distribution of characteristic pottery finds, but also on separation of specific sherds based on their formal typological traits (Marijanović 1981: 8; Marijanović 2012: 20). About a dozen cord-impressed sherds were attributed to a later Phase 4, designated as 'the younger phase of the Early Bronze Age' (Marijanović 2012: Plate 85, Plate 86).

Aside from the pottery, several blade segments made of chert and a ground stone wristguard have been attributed to Phase 3a (Marijanović 1981: Plate 5: 4; 2012: Plate 59: 6). Another similar ground stone object (a pendant or an unfinished wristguard) has been attributed to an earlier Phase 2c (Marijanović 1981: Plate 5: 5; 2012: Plate 17: 3).

138. Trostruka gradina (Sovići, Grude) – hillfort. A single Cetina style potsherd was collected during the surface survey of the site (Oreč 1978: Plate 17: 15). Several other Cetina style sherds (Čović 1980a: Figure 3: 4, 5; 1980b: Plate 3: 3, Plate 5: 6; 1983: Plate 16: 6, Plate 18: 11; 1989: Plate 12: 3, 4, Plate 13: 3, Plate 14: 1) and numerous cord-impressed potsherds (Oreč 1978: Plate 17: 13, 14; Čović 1980a: Figure 2: 4-7; 1980b: Plate 5: 1-5; 1983: Plate 18: 9, 10, 12; 1989: Plate 10: 1-7, Plate 11: 1-8) were recovered by archaeological excavation from an anthropogenic layer that also contained numerous later Bronze Age finds.

139. Varvara (Rama) – hillfort, also known as 'Velika gradina' or 'Gradina na vrelu Rame'. Almost all of the potsherds closely comparable to Ljubljana-Adriatic style (Čović 1978: Plate 5: 2, Plate 8: 8, Plate 10: 3, Plate 11: 1-6) and coarse incised potsherds (Čović 1978: Plate 5: 4, 5) were recovered from contexts attributed to the earliest Phase A-1. A small bifacial point was recovered from a context attributed to Phase A2 (Čović 1978: Plate 18: 6). Fragment of a vessel whose shape and decoration are reminiscent of Cetina style pottery was recovered from a context attributed to Phase A-3 (Čović 1983: Plate 25: 11; Govedarica 1989b: Plate 32: 9).

4.14 Eastern Herzegovina

140. Badanj (Stolac) – rock shelter. A couple of characteristic Ljubljana-Adriatic potsherds (Marijanović 1978: Plate 1: 1; 1982: Figure 4) and a single coarse incised sherd (Marijanović 1982: Figure 5) were collected from the surface or the disturbed topmost layer.

141. Džakulina glavica (Rivine, Stolac) – hillfort, also known as 'Đakulina glavica'. An informally collected circular object made of fired clay and richly decorated in a characteristic Ljubljana-Adriatic manner (Marijanović 1982: Figure 6; Govedarica 1989b: Plate 22: 7). Marijanović mentions another characteristic Ljubljana-Adriatic potsherd, but does not provide its illustration (Marijanović 2003: 64-65).

142. Gornje Banje (Stolac) – mounds. A coarse incised fragment was recovered from a burial in Mound 1 (Marijanović 2003: Figure 11).

143. Greben pećina (Zavala) – cave, also known as 'Pećina u grebenu Nož'. Fragment of an open bowl, decorated in a manner that is closely similar to Ljubljana-Adriatic style, was collected during a surface survey. (Kujundžić *et al.* 1986: Figure 4; Marijanović 2003: Plate 30: 1).

144. Guvnine (Domanovići) – hillfort. One of the eight excavated trenches yielded potsherds decorated by coarse incision and impression (Marijanović 2000: Plate 1), a couple of decorated Ljubljana-Adriatic style fragments (Marijanović 2000: Plate 2: 1, 6; 2003: Plate 21: 1, 6), and another fragment that may be attributed generally to the third millennium BC (Marijanović 2000: Figure 3).

145. Hateljska pećina (Berkovići) – cave. The layer corresponding to Phase 3 yielded characteristic Ljubljana-Adriatic style potsherds (Marijanović 1992b: 73; 2000: Figures 18-27, Plate 31: 1, Plate 32: 1, Plate 33; 2003: Figures 1 and 2, Plate 17: 1, Plate 18: 1, Plate 19), several characteristic Cetina style potsherds (Marijanović 2000: Figure 28, Figure 30, Plate 32: 2; 2003: Plate 18: 2), as well as several fragments decorated by coarse incision and impression (Marijanović 2000: Figure 16, Plate 31: 2-4, Plate 34; 2003: Plate 17: 2-4, Plate 20). These three classes of finds cannot be separated stratigraphically (Marijanović 1991a: 241-242).

146. Lazaruša (Dabrica) – cave. The layer corresponding to Phase 2 yielded numerous potsherds decorated by coarse incision and impression (Marijanović 2000: Plate 5, Plate 6, Plate 7: 1, 3, 5, Plate 8: 6; 2003: Plate 24, Plate 25: 1, 3, 5, Plate 26: 6), characteristic Ljubljana-Adriatic potsherds (Marijanović 2000: Figures 5, 8 and 10, Plate 8: 2, 3, Plate 9: 2; 2003: Plate 26: 2, 3), a single sherd closely comparable to Cetina style pottery (Marijanović 2000: Plate 7: 2; 2003: Plate 25: 2), a couple of sherds decorated by *furchenstich* incision (Marijanović 2000: Plate 7: 4, Plate 8: 1; 2003: Plate 25: 4, Plate 26: 1), several cord-impressed fragments (Marijanović 2000: Figures 6, 7 and 8, Plate 7: 4, Plate 8: 1, 4), and a few other sherds that may be attributed generally to the third millennium BC (Marijanović 2000: Figure 9, Plate 9: 1; 2003: Plate

26: 1). The aforementioned classes of finds cannot be separated stratigraphically (Marijanović 1991: 232).

147. Ljubomir (Trebinje) – mounds, also known as 'Ljeskova glavica'. Several characteristic Cetina style potsherds were recovered from the surface and the mantle of Mound 11 (Čović 1980a: 36; 1980b: Plate 1: 5; 1983: Plate 20: 6, 7; Govedarica 1989b: Plate 31: 5, 7), while cord impressed fragments were recovered from the underlying soil (Čović 1980a: Figure 1: 1, 2, Figure 2: 1; Marijanović 2003: Figures 4 and 5). Mound 8 yielded a ground stone shaft-hole hammer-ax (Čović 1983: Figure 12: 4; 1989: Plate14: 4) and a broken ground stone wristguard (Čović 1983: Plate 20: 2; 1989: Plate 14: 6; Govedarica 1989b: Plate 31: 8).

148. Orah (Bileća) – mounds. Mound 1 yielded fragments of a beaker, shaped and decorated in a manner closely comparable to Cetina style (Govedarica 1989b: Plate 24: 2). Unpublished finds from Mound 2 and Mound 4 also have been attributed to 'Cetina culture' (Marović and Čović 1983: 197, 198).

149. Zelena pećina (Blagaj) – cave. A few potsherds decorated by coarse incision and impression (Brusić 1973: Plate 5: 7; Marijanović 2003: Figures 7 and 8), by cord impression (Čović 1980a: Figure 1: 3; Marijanović 2003: Figure 6), in a manner closely comparable to Ljubljana-Adriatic style (Marijanović 2003: Figure 10), and Cetina style (Brusić 1973: Plate 5: 8; Marijanović 2003: Figure 9), were recovered from the topmost layer of the site.

4.15 Central Bosnia

150. Alihodže (Travnik) – hillfort. Several fragments closely comparable to Ljubljana-Adriatic style (Benac 1950: Plate 4: 8, Plate 5: 9-11), a fragment decorated by large comb impression (Čović 1983: Plate 26: 9), as well as several sherds reminiscent of Cetina style pottery (Benac 1950: Plate 4: 13, Plate 5: 6-8).

151. Gradac (Ilinjača, Kotorac, Sarajevo) – hillfort. Fragments of one or two characteristic Cetina style pedestalled beakers, from an unknown context (Korošec 1941: Figure 1; Govedarica 2006a: Plate 1: 3, 6; 2006b: Plate 1: 2, 6).

152. Pod (Čipuljić, Bugojno) – hillfort. The earliest Phase A yielded potsherds reminiscent of Ljubljana-Adriatic style (Čović 1983: Plate 24: 13, Plate 25: 8, 9, Plate 26: 1, 2, 4, 6, 8; 1991b: Plate 14: 7, Plate 16: 2, Plate 20: 7, Plate 22: 1-4, 7, Plate 23: 4, Plate 24: 1-4, Plate 26: 1-3), two fragments of a vessel reminiscent of Cetina style (Čović 1983: Plate 24: 11; 1991b: Plate 12: 1, Plate 24: 8), cord-impressed potsherds (Čović 1983: Plate 24: 12; 1991b: Plate 14: 3, 8, Plate 19: 8, Plate 20: 6, Plate 25: 1-4), as well as other sherds that may be attributed generally to the third millennium BC. The same site yielded a broken ground stone hammer-ax and several blade segments made of chert (Čović 1983: Plate 25: 1, 5 and 6).

4.16 Eastern Bosnia

153. Borci (Vrlazje, Rogatica, Glasinac) – mounds. Mound 2 contained several inhumations from diverse periods. Several characteristic Cetina style potsherds were recovered from the mantle and the underlying soil (Čović 1970: Plate 2: 3a, 3b; 1983: 187; Batović 1973b: Plate 23: 5; Govedarica 2006a: Plate 1: 4-6; 2006b: Plate 1: 4, 5 and 7).

154. Ferizovići (Rogatica, Glasinac) – mounds, also known as 'Opaljene gomile'. Many of them were obliterated during road construction. The finds come from a mound that contained cremated remains. They had been scattered across the mantle and were not collected systematically. Among them are several characteristic Cetina style potsherds (Cerović 1990: Plate 2: 2-4, Plate 3: 1, 2, 4; Govedarica 2006a: Plate 2: 2, 3, 8), a ground stone pendant, several flaked stone artifacts, two boar tusks and a heart-shaped bronze pendant attributable to the Middle Bronze Age on typological grounds (Cerović 1990: Plate 3: 5, 7, 8; Della Casa 1996: 130; Govedarica 2006a: Plate 2: 6, 9, 11; 2006b: Plate 2).

155. Rusanovići (Rogatica, Glasinac) – mound. It contained several inhumations from later prehistoric periods. Characteristic Cetina style potsherds were recovered from the mantle and the underlying soil (Čović 1970: Plate 1: 2; 1983: Plate 27: 2; Batović 1973b: Plate 24: 2; Govedarica 2006a: Plate 1: 2; 2006b: Plate 1: 3).

156. Vrtanjak (Maravići, Rogatica, Glasinac) – mound. A small beaker closely comparable to Cetina style vessels, without any information about context (Čović 1970: Plate 1: 1; 1980b: Figure 4; 1983: Plate 27: 5; Batović 1973b: Plate 24: 4; Govedarica 2006a: Plate 1: 1; 2006b: Plate 1: 1).

157. Živaljevići (Rogatica, Glasinac) – mound. Mention of pottery that may be attributed generally to the third millennium BC (Govedarica 2006a: 32, footnote 14; 2006b: 99).

4.17 Western Serbia

158. Anište (Ražana, Kosjerić, Užice) – mounds. A couple of vessels were recovered from a pyre site near the center of Mound 1. They were decorated in a manner reminiscent of Cetina style, but their shapes are foreign to Cetina pottery repertoire (Čović 1970: Plate 3: 5, 6; Maran 1987: Figure 2: 2; Govedarica 2006a: Plate 3: 1, 2; 2006b: Plate 3: 1, 2).

4.18 Montenegro

159. Boljevića gruda (Tološi, Podgorica) – mound. The central burial in a pit contained an inhumation and a single flaked stone artifact (Guštin and Preložnik 2015: Figure 7). Two groups of finds were found in the mantle above the burial. One contained a ground stone shaft-hole hammer-ax with a cap made of sheet gold that covered the top end of the shaft, a rhombic-section dagger blade made of metal, two lozenge-sectioned golden hair rings and a flat ground stone pendant (Saveljić-Bulatović and Lutovac 2003; Baković and Govedarica 2009: Figures 6 and 7; Baković 2011: Figures 1-4; Guštin and Preložnik 2015: Figure 4: 4-8, Figure 18: 1-4). The other contained fragments of three vessels (a shallow pedestalled bowl, a beaker and a funnel) decorated in a characteristic Ljubljana-Adriatic manner (Saveljić-Bulatović and Lutovac 2003; Baković and Govedarica 2009: Figures 9-11; Baković 2011: Figures 5-7; Guštin and Preložnik 2015: Figure 4: 1-3, Figures 19-21).

A human bone sample, recovered from the central burial, yielded the radiocarbon date KIA-19424, 4440±35 bp, calibrated 1SD range: 3321-3018 BC (Guštin and Preložnik 2015: 31-32).

160. Mala gruda (Tivat) – mound. The central cist burial contained an inhumation, as well as characteristic Ljubljana-Adriatic style bowl and beaker (Parović-Pešikan and Trbuhović 1974: Plate 3: 7, 8, Plate 4: 9; Parović-Pešikan 1976: Plate 3; Govedarica 1989b: Plate 42: 1, 2; Primas 1996: Figure 5), five golden square-sectioned hair rings, an elongated dagger with a midrib made of an alloy of gold and silver, and a silver shaft-hole battle ax with a gold sheet cap that covered the handle top (Parović-Pešikan and Trbuhović 1974: Plate 4: 10, Plate 5: 11-13; 1976: Plate 4; Govedarica 1989b: Plate 43: 4, 5, 7, 8; Primas 1996: Figures 6.13, 6.14, 7.10 and 7.11). A number of chert flakes and blade segments were recovered from the mantle (Parović-Pešikan and Trbuhović 1974: Plate 6, Figure 16: 1-14).

161. Mogila na Rake (Sutomore, Bar) – mound. Aside from inhumed remains of three individuals, the central cist burial contained a shallow bowl and a peculiar beaker resembling an *askos.* Both vessels were decorated in a characteristic Ljubljana-Adriatic manner. A considerable number of flaked stone artifacts, and a few nondiagnostic potsherds, were recovered from the mantle (Zagarčanin 2016).

162. Odmut (Plužine, Piva River) – cave. The majority of characteristic Ljubljana-Adriatic potsherds were recovered from the upper part of Stratum VI, which corresponds to Layer 3 (Marković 1977: Plate 4: 1, 2, 7, 9, Figures 5-6; 1985: Plate 29: 2-4, 6; Govedarica 1989b: Plate 43: 3, 6, Plate 44: 3, 5). Potsherds decorated by coarse incision and impression (Marković 1977: Plate 4: 3-6; 1985: Plate 27: 2, 5, Plate 28: 4, 6-8, Plate 29: 8; Govedarica 1989b: Plate 44: 2, 4, 6) and cord-impressed potsherds (Marković 1985: Plate 28: 9) were recovered from the same layer.

A charcoal sample, recovered from near the top of Stratum VI (or Layer 3), yielded the radiocarbon date Z-409, 4280±120 bp, calibrated 1SD range: 3089-2674 BC (Marković 1977: 11; 1985: 44; Srdoč *et al.* 1977: 473; Breunig 1987: 104).

163. Rubež (Nikšić) – mound. Fragments of a shallow bowl, shaped and decorated in a characteristic Ljubljana-Adriatic manner, were recovered from a pillaged mound (Benac 1955: Plate 1: 6; Korošec 1962: Plate 5: 1, 2; Govedarica 1987: Figure 8; 1989b: Plate 44: 1; Della Casa 1995: Figure 6; 1996: Figure 152).

164. Spila (Glogovac, Perast) – cave. The youngest deposits of this site (Stratum IIc = Layer 2) contained pottery attributable to Early Neolithic and Late Neolithic, as well as a few sherds that may be attributed to the third millennium BC (Marković 1985: Plate 18: 5, 7, Plate 19: 2, 4). One of them is reminiscent of Ljubljana-Adriatic style (Marković 1985: Plate 18: 6), while another is decorated in a manner closely resembling coarse incision (Marković 1985: Plate 19: 1).

165. Velika gruda (Tivat) – mound. Aside from an inhumation, the central cist burial contained a characteristic Ljubljana-Adriatic style shallow bowl, eight golden square-sectioned hair rings, a flat ax made of arsenic copper, two double-edged knives (at least one of them made of tin bronze), two boar tusks and a hammer or whetstone made of ground stone (Primas 1996: Figures 5.1-5.4, 6.5, 7.2, 7.5, 8.1 and 8.3). Numerous later Bronze Age burials were dug into the upper part of the mantle (its secondary enlargement). That part of the mantle contained many small and weathered potsherds, including a few decorated sherds that are closely comparable to Cetina style (Primas 1996: 67, Figure 5.13B; Della Casa 1995: 567, Figure 5; 1996: 66, 126, Figure 92: 110-118), and two simple flaked stone tools (Della Casa 1996: Figure 92: 120, 121).

Three radiocarbon determinations are available for dating the central burial. A sample of fir wood was recovered from the burial cist: UZ-2692/ETH-7631, 4335±80 bp, calibrated 1SD range: 3090-2886 BC. A charred sample of a pulse plant was recovered from the topmost part of the primary mound: UZ-2696/ETH-7685, 4355±65 bp, calibrated 1SD range: 3086-2900 BC. A composite charcoal sample was recovered from the pit that had been dug above the burial: UZ-2693/ETH-7579, 4155±65 bp, calibrated 1SD range: 2874-2639 BC (Primas 1996: 48-52).

166. Vranjaj (Herceg-Novi) – cave. Ljubljana-Adriatic and Cetina style finds are mentioned, but not illustrated (Govedarica 1989b: 183).

4.19 Albania

167. Bardhoc (Kukës) – two mounds. Both contained many burials from diverse periods. Some of the metal implements (the simple flat dagger blades, a pin with a cone-shaped sheet decorated by repoussé dots) probably belong to the third millennium BC. About a dozen potsherds from Mound 1 were decorated in a manner reminiscent of Ljubljana-Adriatic style (Hoti 1982: Plate 10: 1-3, 5, 6, Plate 13: 1, 2, 6-10).

168. Gajtan (Shkodër) – settlement. Potsherds closely similar to Ljubljana-Adriatic style were recovered from Layer I that also contained Neolithic and/or Early Copper Age pottery, while potsherds closely similar to Cetina style were recovered from Layer II that also contained Late Bronze Age and Iron Age pottery (Jubani 1972: Figures 2 and 8, Plate 2: 7, Plate 4: 2, 4; Korkuti 1985: Plate 4: 20-23; Bodinaku 1985: Plate 1: 2, 7).

169. Këneta (Kukës) – mounds. Four of the total of nine mounds had been excavated. Mound 4 yielded a beaker of a peculiar shape, decorated by incision and impression in a manner that is common in the Adriatic during the third millennium BC (Govedarica 1989b: Plate 44: 7).

170. Pazhok (Elbasan) – mound. A beaker with a strap handle is decorated in a manner reminiscent of Ljubljana-Adriatic style (Govedarica 1989b: Plate 43: 1).

171. Shkrel (Dedaj, Shkodër) – mounds. Eight out of a total of 40 mounds have been excavated. Some of them contained cist burials. Fragment of a Cetina style open bowl was recovered from one of the mounds (Bodinaku 1985: Plate 1: 11; Govedarica 1989b: Plate 46: 1; Maran 2007: Plate 2: 3).

172. Shtoj (Skadar) – mounds. Most of the finds have been attributed to later Prehistoric periods. A few potsherds closely comparable to Cetina style were recovered from mantles of two mounds that contained cist burials without any burial goods (Primas 1996: 133). A characteristically shaped and decorated beaker, closely comparable to Cetina style pottery, was recovered from the central cist burial of Mound 6 (Koka 1985: Plate 1: 1; Govedarica 1989b: Plate 46: 2; Oikonomidis *et al.* 2011: Figure 1: i).

4.20 Western Greece

173. Andravida-Lechaina (Patras, Peloponnesus) – settlement. Finds were collected from a dumpsite after the archaeological site had been obliterated by construction. Among them are several sherds more or less resembling Cetina style pottery (Rambach 2007: Plate 15: d, Plate 16: c, i, Plate 17: e, Plate 18: a, c-f).

174. Korakou (Corinth, Peloponnesus) – settlement. Several fragments of vessels of peculiar shapes, decorated in a manner reminiscent of Cetina style, were recovered in the course of Blegen's excavations (Rutter 1982: Plate 100: 39, 41, 42).

175. Lerna (Lerna, Peloponnesus) – settlement. Fragments of pottery comparable to Cetina style were recovered from three subphases (IVa, IVb, and IVc) attributed to EH III Period (Rutter 1982: 461, Figures 2-3, Plates 98-100; Maran 1987: 79). Among them are more or less characteristic Cetina potsherds (Rutter 1982: #12-15, #18, #20-28, #35-38; Maran 1987: Figure 3: 6-8; Nicolis 1998: Figure 6: 5) and fragments of vessels of peculiar shapes, decorated in a manner reminiscent of Cetina style (Rutter 1982: #16, #17, #33).

176. Olympia (Peloponnesus) – settlement. Two groups of complete vessels were found in the course of Dörpfeld's excavations on the floor of an elongated house with a rounded end. Among them were two cups and five beakers whose shape and decoration more or less resemble Cetina style pottery (Dörpfeld 1935: Plate 22: 1-5, 7, 8; Maran 1987: Figure 2: 1, Figure 3: 1). The same layer yielded several flaked stone artifacts, some of them made of obsidian (Dörpfeld 1935: 101, Plate 22: 17-27). An open bowl with wide rim, decorated in a characteristic Cetina manner, was published subsequently, without information about its context (Maran 1987: Figure 3: 9). All of those finds were attributed to EH III Period (Rutter 1982: 481; Maran 1987: 79). Other potsherds of 'Balkan appearance' have been recovered by later excavations. According to their textual description, at least some of them are comparable to Cetina style pottery (Maran 2007: 14; Rambach 2007: 82-83), but they have not been illustrated. Notably, the decorative designs on about sixty fragments of gray Minian ware, which most likely are of a local provenience, resemble Cetina style designs (Rambach 2007: 85).

177. Steno (Leukas) – mounds. Thirty out of about fifty relatively small and densely packed mounds have been excavated, each one girded by a circular drystone wall. They contained more than sixty burials known as 'Royal Graves' or 'R-graves'. The mounds were erected above pyre sites, strewn by occasional small fragments of cremated human bones. They contained pithos burials, cist burials, stone-lined burials, and burials in simple pits, many of them marking later episodes of mound reuse (Dörpfeld 1927: 217-250). Most authors agree that the primary R-graves are attributable roughly to the EH II Period (Maran 2007: 9; Oikonomidis *et al.* 2011: 196-197; Merkouri and Kouli 2011: 207; Müller Celka 2011: 418).

Burial R15b, located above a pyre site, contained an inhumation in pithos, about eighty pierced gold beads, three (or six?) square-sectioned golden hair rings, two silver bracelets, four pendants made of deer teeth, and two obsidian blades (Dörpfeld 1927: Supplement No. 60: 3, 4, 7, 8, Supplement No. 63c: 3, 5; Primas 1996: Figure 6: 13A, 1-3; Maran 2007: 9, footnote 42). Burials R1 and R4 also yielded obsidian blades (Dörpfeld 1927: Supplement No. 63c: 2, 6).

Pottery finds that might be comparable to Ljubljana-Adriatic style are extremely rare. Among them are a few decorated sherds from the 'layer of the R-graves' without detailed information about context (Dörpfeld 1927: Supplement No. 61b: 12, Supplement No. 68b), and a vessel of a peculiar shape, decorated in a manner reminiscent of Ljubljana-Adriatic or Cetina style (Dörpfeld 1927: Supplement No. 66a: 1; Primas 1996: Figure 5: 12).

178. Zygouries (Corinth, Peloponnesus) – settlement. A pedestalled vessel of a peculiar shape, decorated by incision and impression in a manner reminiscent of Cetina style, was recovered during Blegen's excavations (Rutter 1982: 470, Plate 100: 40).

4.21 Center of the Adriatic

179. Salamandrija (Palagruža) – special purpose open air site. Several hundred potsherds decorated by incision and impression in a characteristic third millennium BC manner have were recovered in the course of a multi-annual exploration program (surface survey, test trenching and area excavations). Among them are characteristic Ljubljana-Adriatic potsherds (Forenbaher and Kaiser 1997: Figure 3: 5; Kaiser and Forenbaher 1999: Figure 3d; Forenbaher 2009a: Figure 3, middle and bottom; 2009b: Figure 4, a few of the fragments; 2013: Figure 8.5, a few of the fragments) and Cetina style potsherds (Forenbaher and Kaiser 1997: Figure 3: 2; Kaiser and Forenbaher 1999: Figure 3g; Forenbaher 2009a: Figure 3, top; 2009b: Figure 4, most of the fragments; 2013: Figure 8.5, most of the fragments). The same site yielded at least six ground stone wristguards, as well as many flaked stone artifacts, including several hundred blade segments, about seventy small bifacial points, and about fifty microlithic crescents (Forenbaher and Kaiser 1997: Figures 4 and 5; Kaiser and Forenbaher 1999: Figures 4, 6 and 7; Forenbaher 2009a: Figure 3; 2009b: Figure 5; 2013: Figures 8.6 and 8.7). As a consequence of later construction and other intensive activities that took place on the constricted plateau of the site (Kirigin 2012), all prehistoric finds were recovered from secondary contexts, where they were found together with historic finds.

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