Lithic raw material procurement of the Late Epigravettian hunter-gatherers from Kopačina Cave (island of Brač, Dalmatia, Croatia)

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Abstract

This paper considers lithic raw material procurement of Epigravettian hunter-gatherers from Kopačina Cave on the island of Brač (Dalmatia, Croatia). The most significant group among the determined petrographic categories are different cherts, and a significantly smaller group of radiolarites. Cherts are both locally and regionally available, while radiolarites originate from more distant areas. Use of raw material that could have been procured within 20 km radius (local) and in the range of 20–50 km (regional) is predominant and very similar in all phases. Raw material that could have been procured from distances ranging from 20 to 50 km shows a gradual trend of increase in frequency from the earliest to the latest phase, while the raw material procured from distances greater than 50 km (extra-regional) has an obvious drop in frequency from the eldest to the youngest phase. Temporal trends in lithic raw material use suggest certain continuity during the whole Epigravettian sequence as well as change which shows itself in larger exploitation areas or more intensive long-distance contacts in earlier Epigravettian phases in Kopačina than in the later ones, and possibly a higher degree of hunter-gatherers’ mobility. Presence of radiolarites in Kopačina’s Late Upper Paleolithic layers, as well as their potential outcrops suggest movements of hunter-gatherers deeper in east Adriatic continental hinterland where for now only a few traces of human settlements from Late Glacial have been found. Raw material of several found artifacts indicates possible contacts with the west Adriatic coast.

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1. Introduction

Lithic raw material provenance studies have been used very often for exploring prehistoric hunter-gatherers’ territorial patterns, mobility, exchange and social networks (e.g. Pettitt et al., 2012; Brandl et al., 2014; Aranguren et al., 2015; Fontes et al., 2015; Lengyel, 2015; Kaminská, 2016; Thomas et al., 2016). Contrary to this, the issue of raw material origin used for production of Late Upper Paleolithic and Mesolithic industries has been marginalized for a long time in the analysis of lithic assemblages of east Adriatic coast and its hinterlands. Types of raw materials and their potential outcrops were occasionally mentioned (e.g., Batović, 1985; Malez, 1987) without any deeper analysis that would yield data on raw material procurement and possible radius of movement of Paleolithic and Mesolithic groups. These superficial analyses yielded conflicting information on the origin of raw material for lithic artifacts on certain sites (e.g. for Late Upper Paleolithic site Lopar on the island of Rab, please see Batović, 1985 vs. Malez, 1974, 1987). This type of incidental research of lithic raw material origin was accompanied with quite chaotic use of petrographic terms, as well as with different approaches and research resolution.

First microscopic analyses of lithic raw material from the east Adriatic coast were done on Epigravettian assemblages from Sandalja II Cave (Zupanić, 1975) and from Crvena Stijena rock-shelter (Pamić, 1975) with the objective to determine the type of rocks used and possible sources of raw material. Since then there has been little progress in researching the origin of raw material in the context of the eastern Adriatic Upper Paleolithic and Mesolithic (e.g., Kozlowski et al., 1994; Pawlikowski, 1994; Mihailović, 1998; Pellegatti, 2009). Until recently, there was no data on types of lithic raw material, procurement and potential outcrops that could have been used in Dalmatia. An exception to this is Veli Rat Cape in

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the north—west part of the island of Dugi Otok in north Dalmatia, which has been known in the literature for a long time as an important autochthonous outcrop of lithic raw material for Paleo-lithic and Mesolithic communities (Malez, 1979; Batović, 1988).

Recent years witness to the growing body of evidence about Dalmatian prehistoric lithic raw material economy. Since 2005 one of the authors (Z.P.) has been implementing continuous field research of outcrops of lithic raw material (autochthonous and allochthonous) in Dalmatia, surrounding Croatian regions and regions from neighboring countries, as well as microscopic analysis of lithic assemblages from Dalmatian Paleolithic, Mesolithic and Neolithic sites with the objective to reconstruct raw material procurement in the Dalmatian Stone Age (Perhoc, 2009a, 2009b; Perhoc and Altherr, 2011; Forenbaher and Perhoc, 2015; Vukosavljević et al., 2014, 2015). Besides approximately 50 smaller and larger recorded autochthonous and allochthonous outcrops of mainly chert in the region of Dalmatia, we can definitely expect to find new outcrops which are not yet recorded or published (Perhoc, 2009a, p. 39; Perhoc, unpublished research). For detailed list of outcrops with exact location, type of rock, type and size of outcrop, and degree of usability please see Perhoc (2009a, 2009b). Chert outcrops in Dalmatia were recorded less in Triassic and Jurassic, and more in Cretaceous, Palaeogene and Quaternary geological layers. In the layers ranging from Triassic to Palaeogene age, cherts appear in limestone and not as often in dolomites, while in Quaternary deposits they appear in loose sediments (Perhoc, 2009a, 2009b). Because of non-homogenous structure of sedimentary rocks, such as chert, which during creation only partially associate a raw material of an artifact with a specific outcrop (Perhoc, 2009a, p. 27), lithic assemblages of Dalmatian Late Upper Paleolithic and Mesolithic sites, including Kopacina, also have some petrographic types of rocks that do not exist in Dalmatia, therefore, in order to correlate artifacts and sources of raw material it was necessary to do field research in certain regions of neighboring countries. The results of these research studies also bring some new findings regarding contacts and communication of Paleolithic and Mesolithic populations in Dalmatia (Vukosavljević et al., 2014, 2015). Besides the diagenetic cherts in lithic assemblages from Late Upper Paleolithic (e.g., Kopacina Cave, Vela Spila Cave on the island of Korcula) there are also radiolarians. However, there are no autochthonous radiolarite outcrops on Dalmatian coast and islands. Since some artifacts from Kopacina have a preserved pebble rind, suggesting fluvial and/or fluvio-glacial origin of the outcrop, Perhoc (2009a, 2009b) suggests possible collection of pebbles from gravel of Neretva River or Montenegro coast where has been recorded a noticeable share of radiolarians, and particularly in the gravels of rivers Una, Vrbas and Bosna where radiolarites come from an ophiolitic melange (Perhoc and Altherr, 2011).

In our earlier paper (Vukosavljević et al., 2011) we undertook a preliminary analysis of lithic raw material used in Kopacina assemblage and techno-typological analysis of lithic assemblage. The main goal of this paper is to reconstruct lithic raw material procurement strategies and importance of certain outcrops in lithic production of Late Epigravettian hunter-gatherers from Kopacina Cave and their possible relation to Late Glacial environmental change in the Adriatic region. Proposed raw material procurement strategies are based on petrographic analysis and correlation of geological and archeological samples.

2. Regional setting

2.1. Geography and paleoenvironment

Kopacina is located at the north—west part of the island of Brac, the biggest island in the group of middle Dalmatian islands, with a surface of 395 m² (Fig. 1). Island is 36 km in length and 12 km in width. Brac represents a mountain of the outer Dinaride mountain chain whose lower parts are under sea so the basic relief line is the longitudinal mountain reef. The highest peak of the island is Vidova gora (778 masl), which is also the highest peak of Adriatic islands (Derado, 1984). Northern side of the island has mild slopes towards the sea, while the southern slopes are much steeper (Derado, 1984; Vukadin, 1984; Cubraković, 1984). Brac has so called Hvar-orientation, west-east, that is different than the generally prevailing orientation of the Adriatic coast (Derado, 1984).

The Adriatic area was quite different in the Late Glacial and partly Post-Glacial than it is today, due to the lower sea level. Sea level rise has resulted in gradual flooding of the Adriatic Plain, as well as other coastal Mediterranean plains (Shackleton et al., 1984; van Andel, 1989; Lambeck, 1996; Suric and Juracić, 2010). Great Adriatic plain has undergone most significant changes (Shackleton et al., 1984), due to relatively shallow northern part of the Adriatic basin with a low gradient (0.02) down to –100 m (Suric and Juracić, 2010). The North Adriatic was a paleoplain approximately 300 X 150 km in size, which connected the Apennine and Balkan Peninsula (Mussi, 2002). According to P.T. Miracle (1995, 117–118) the Adriatic Plain was the biggest during Dryas 1 and has not significantly shrunk during the sea level rise from −100 do –93 m (around 12,500 bp) when it has occupied approximately 92% of its previous size. Between 12,500 bp and 11,800 bp the sea level has risen to approximately −75 m, and the Adriatic Plain at this sea level has occupied approximately 64% of its previous size. Before approximately 10,500 bp the Adriatic Plain covered 53% of its previous space, while around 9000 bp only 17% and was reduced only to a narrow zone in the Gulf of Trieste.

Rossignol-Strick et al. (1992) on the basis of analysis of pollen cores from Adriatic seabed approximately 90 km south of Dubrovnik give us an idea of paleovegetation of the South Adriatic area. Part of the core that can be approximately situated between 16,700 and 13,800 bp is characterised by significant presence of pollen of Artemisia, Gramineae and Chenopodiaceae, with presence of deciduous trees (oak, hazel, elm, beech) therefore suggesting presence of dry but not cold grassland. Since approximately 13,800 bp there is an increase in the quantity of pollen from pine, birch and alder. After 13,200 bp there is an increase in the share of thermophil deciduous species including hornbeam. Between 10,900 and 10,000 bp there is a drop in share of trees of all types, but an increase in share of Arte misia and Chenopodiaceae. After 9400 bp there is an increase in the frequency of pollen from trees with addition of Mediterranean species (pistachio, olive and hornbeam) (Rossignol-Strick et al., 1992, 416–417).

In fauna assemblage from Kopacina not one large mammal species is an indicator of certain paleoecological conditions, but rather suggest the existence of different environments. Species adapted to cold were not found in the assemblage (Miracle, 1995, 146–148).

Boschian and Fusco (2007) describe Late Glacial environment of the Adriatic Plain as a monotonous, flat and dry environment of shrubby-herbaceous communities. Uniformity of this environment is occasionally interrupted by swamp areas and small surfaces covered with trees of different pine species and some deciduous species which are most probably appearing near the river flows which are subject to seasonal flooding.

2.2. Geology and characteristics of lithic outcrops

The following simplified geological overview of part of Dalmatia includes chert outcrops (Fig. 2) which according to our research on lithic production were used by populations of Kopacina Cave. Central Dalmatia is made mainly of Cretaceous limestones and
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