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Mapping Natural Exposures of Siliceous Marls and Cherts as Potential Zones of Raw Material Acquisition. The Case of the Eastern Polish Carpathian Foothills and the Rzeszów Settlement Region (SE Poland) in the Neolithic and Bronze Age. Preliminary Results

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The Neolithic and Bronze Age communities that settled the eastern Carpathian Forelands and Carpathian Foothills used a variety of local and non-local siliceous raw materials. Raw materials identified in the archaeological record differ in quality and usefulness for making tools. Obsidian, Jurassic flint from the Cracow-Częstochowa Upland, chocolate flint, or Świeciechów and Volhynian flints represent the best quality. On the other hand, some local raw materials were also in use, most popular among them being siliceous marls and cherts. Sources of siliceous marls and cherts are known from many locations in the Dynów, Strzyżów and Przemyśl foothills. Moreover, systematic field surveys in this area have provided new information on the availability of cherts and siliceous marls at many new locations in the region. They appear in the primary autochthonous, secondary autochthonous, and more rarely in sub-autochthonous or residual, sources. Exposures on steep hill slopes and dissected river valleys provide easy access to the best quality raw materials in the primary autochthonous sources. Raw materials from secondary autochthonous sources in the riverbeds were also available, but they were of lesser quality than those from the exposures. The aim of this paper is to present natural exposures of siliceous marls and cherts and discuss them as a potential source of raw materials for the Neolithic and Bronze Age communities inhabiting loess areas of the eastern Carpathian foreland (Rzeszów Settlement Region).

KEY-WORDS: Carpathians, lithics, cherts, siliceous marls, natural sources, Neolithic, Bronze Age

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INTRODUCTION

South-eastern Poland covers a number of regions and landscape zones from the semi-lowland areas in the north to the mountains in the south. The most favourable for early agricultural communities was its central part – the loess belt of the eastern Polish Carpathian Foreland, covered by the most fertile soils in the region. This zone was densely settled from *c*. 5500 BCE, which is the beginning of the Neolithic in this area. From about 3800 BCE, the lower parts of the Eastern Carpathian Foothills were incorporated into the oecumene of agrarian communities as well (Pelisiak 2018a).

The Neolithic and Early Bronze Age communities that inhabited the eastern Carpathian Forelands and Carpathian Foothills used several kinds of siliceous raw materials of varying provenience, which differed in terms of their quality and usefulness for knapping and tool-making. The group of highest quality non-local raw materials comprises obsidian, Jurassic flint from the Kraków-Częstochowa Upland, chocolate flint, together with Świeciechów and Volhynian flints (Kozłowski 1970; Kaczanowska and Lech 1977; Kaczanowska 1985; Czopek and Kadrow 1988; Kadrow 1990; 1997; Zakościelna 1996; Kukułka 1997; 1998; 2001; Valde-Nowak 1999; 2000; Valde-Nowak and Gancarski 1999; Mitura 2004; 2006; 2007; Dębiec 2005; Szeliga 2009; Pelisiak and Rybicka 2013; Dębiec *et al.*, 2014; Dobrzyński *et al.,* 2014; Pelisiak 2017a; 2017b). Another group of stone raw material used in SE Poland consists of local lithics, including those originating from Carpathian sources (Valde-Nowak 1995; 2013; Pelisiak 2016a; 2016b; 2018c). The so-called Dynów marl was probably first recognized in Neolithic materials found near Wesoła village, Brzozów district, in the Dynów Foothills (Dagnan-Ginter and Parczewski 1976), and the sources of this raw material were suggested to be in the Baryczka River valley close to Nozdrzec, Hłudno, Wesoła and Barycz villages (Brzozów district; Parczewski 1986).

Numerous items made of the so-called Dynów or siliceous marls are known from sites of all Neolithic and Early Bronze Age cultures in SE Poland, including the Linear Pottery culture sites in Zwięczyca 3 (actually part of the city of Rzeszów; Dębiec *et al.*, 2014), Cieszacin 41, Jarosław district (Dębiec *et al.*, 2015), Rzeszów 16 (Kadrow 1990) and Rzeszów 117 (Czopek *et al.*, 2014); the Malice culture sites (e.g., Rzeszów 31); the Funnel Beaker culture site in Przybówka 1, Krosno district (Gancarski *et al.*, 2008); the Corded Ware culture sites in Szczytna 6, Jarosław district (Pelisiak 2017a) and Średnia 3, Przemyśl district (Jarosz 2002); the Mierzanowice culture sites in Boratyn 17, Jarosław district (Nowak 2016), Kańczuga 5, Przeworsk district (Koperski and Kostek 1997) and Jarosław 158 (Pelisiak and Rybicka 2013); and the Otomani-Füzesabony culture sites in Trzcinica 1, Jasło district and Jasło 29 (Valde-Nowak and Gancarski 1999). Moreover, numerous blades, flakes, rectangular

axes, and waste from their preparation or repair have been discovered as single finds, as have bifacial axes (Dagnan-Ginter and Parczewski 1976; Valde-Nowak 1988; Pelisiak 2013; 2017b). An exceptional site was discovered on Cergowa Mountain (Mała Cergowa) near Dukla, Krosno district. Exposures of lithic raw materials and remains of workshop sites show exploitation of these silicities at least in the Late Neolithic (Budziszewski and Skowronek 2001).

Among the lithic artefacts described as made of siliceous marl or Dynów marl, some differentiation of physical features of the raw materials used can be observed (differences in colour, weight, and compactness). These differences may stem from the state of preservation of some artefacts (weathering may have changed the mineral composition of raw material used – see Budziszewski and Skowronek 2001: 157) or from them possibly being made from a rock other than siliceous marl. This second possibility is suggested by the results of tests in which the raw material of some of the analysed artefacts did not positively react with a 5% solution of HCl. The results show that more than 50% of the analysed artefacts, which were previously described as made of Dynów/siliceous marl, were in fact made of another raw material, probably yellowish or grey-yellowish hornstone chert (e.g., Pelisiak 2018b; 2018c). As a consequence, the group of artefacts made of so-called Dynów or siliceous marl and cherts may comprise items made of several different raw material varieties. Moreover, both the siliceous marls and the cherts may have come from different sources, with each source having its own different chemical composition and physical properties.

The results of the tests conducted so far provide inspiration for (1) testing more raw material samples and more artefacts previously described as made of siliceous marls, and for possible corrections of raw material qualification of lithic artefacts (2) mapping the natural exposures of siliceous marls and cherts as potential zones of raw materials acquisition; (3) identifying places of acquisition of raw material in prehistory and locations of siliceous marl and chert workshops. This paper refers to the results of systematic field prospection for raw material sources performed in 2016–2019 in six sampled areas of the Dynów Foothills (Fig. 1).

METHODS

The mapping of natural exposures of knappable lithic raw materials suitable for making tools (siliceous marl and chert) in the Dynów Foothills, an area close to a fertile loess zone inhabited from the Early Neolithic onwards, began in 2016. Settlement sites in the region often yield axes, flake tools, and waste of these raw materials during excavations, and such finds are also common on the surface. Cherts and siliceous

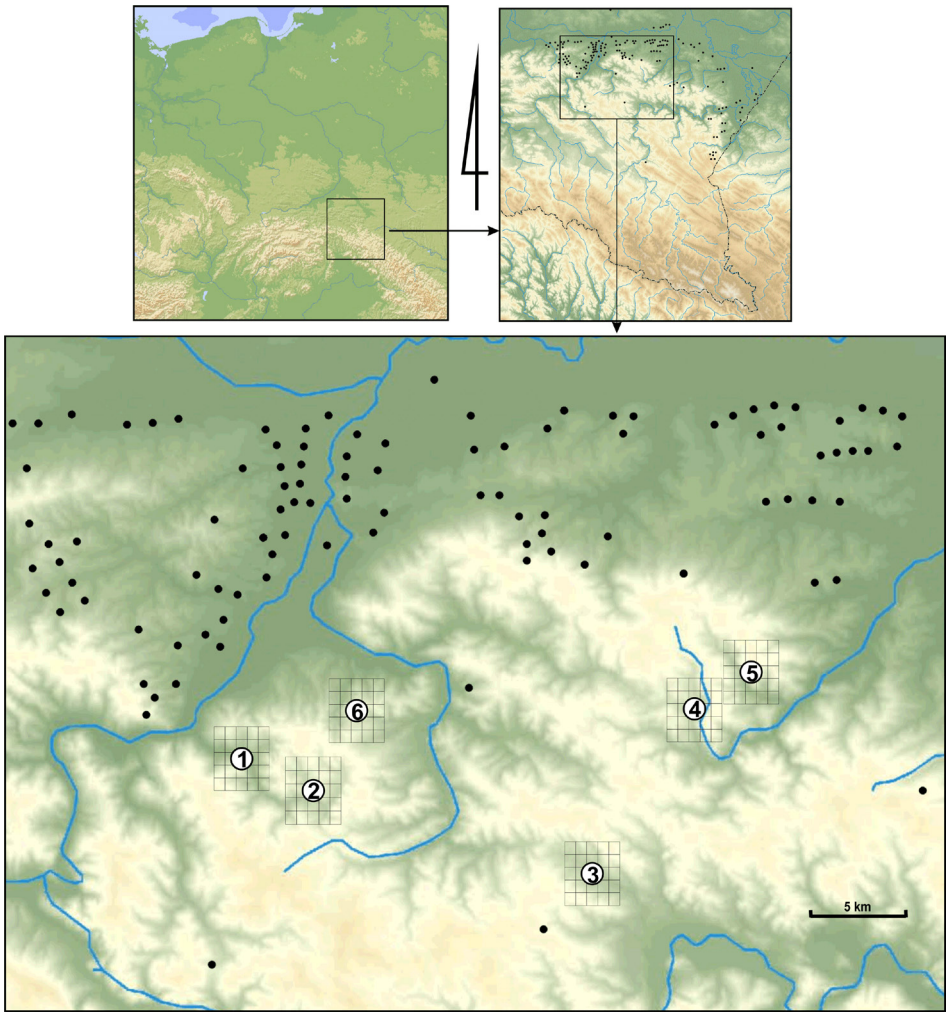

Fig. 1. Example of the Neolithic inhabitation of the loess sub-Carpathians zone (dispersion of the LBK sites in the Rzeszów LBK settlement region – black pot symbols mark LBK sites) and the part of the Dynów Foothills examined for lithic sources. 1. Central and lower part of the Lubenka stream basin, its tributaries beds and valleys, and their close surrounding. 2. Upper part of the Lubenka stream valley and in surrounding near Straszydle quarry. 3. Surrounding of Ulanica village close to the Ostrówek stream. 4. The Tarnawka stream valley and its close surrounding. 5. The Husówka stream valley and its close surrounding. 6. The Hermanówka stream valley and its close surrounding. Graphic elaboration: A. Pelisiak.

marls were commonly used, but their physical characteristics generally precluded their application in the production of blade cores, blades, and blade tools.

The research on sources of lithic raw material presented here followed this procedure:

1. Analysis of geological maps and information on the siliceous raw materials and their natural exposures described in the geological publications. Both siliceous marls and yellowish and grey-yellowish cherts are present in many locations in the Dynów, Strzyżów and Przemyśl foothills as well as in other parts of the eastern Polish Carpathians (e.g., Wdowiarz 1949; Gucik 1961; Kotlarczyk *et al.*, 1977; Leszczyński *et al.*, 1995; Rajchel and Myszkowska 1998; Leszczyński 2003; 2004; Garecka 2008; Górniak 2011). The sources and uses of these raw materials have also already been discussed in the context of prehistory (e.g., Dagnan-Ginter and Parczewski 1976; Parczewski 1986; Valde-Nowak 1995; 2013; Budziszewski and Skowronek 2001; Pelisiak 2016a; 2016b; 2018c). Moreover, systematic field surveys for lithic raw material resources in the eastern Polish Carpathians have provided new information on the availability of cherts and siliceous marls at many localities in the region (Fig. 2; Pelisiak 2016a; 2018b; 2018c).
2. Analysis of the topography and relief of the Dynów Foothills, geomorphology, and watercourse valleys in this area, and analysis of LiDAR pictures for identification of natural exposures, availability of the natural sources of raw material, potential places of raw material acquisition in prehistory and possibilities of transporting the raw material and/or stone items from acquisition places to the settlements located in the loess zone.
3. Systematic field surveys oriented towards (a) the verification and complementation of the results of the above analysis, and (b) the mapping of all potential raw material sources available for prehistoric peoples.
4. Collecting samples of raw material for lithotheca, macro- and microscopic analysis, and for petrographic, physical, chemical, and ichnological analysis.

OUTCROPS AND NATURAL OPENINGS

The field surveys for lithic raw material sources carried out in 2016–2019 were concentrated in the nearby vicinity of the loess zone of the southern Carpathian Foreland, densely inhabited from the beginning of the Neolithic. Several parts of the Dynów Foothills, up to 25 kilometres from settlement sites known from the loess areas between Rzeszów and Łańcut, were subjected to systematic research. The hilly landscape of the foothills is characterized by folded and napped flysch covers of the Outer Carpathians (Kotlarczyk 1988; Kuśnierek and Ney

Fig. 2. Lubenia village (surrounding of the Lubenka stream valley). Example of primary autochthonous sources of cherts. Photo: A. Pelisiak.

1988; Bąk 2007) and the Skole Nappe, dissected by numerous ravines and watercourse valleys.

Field work was focused on natural openings, quarries, and watercourse valleys, primarily on their fragments characterized by the steep slopes, steep cliffs, steep slopes undercuts, on the river and stream beds, and on the ravines which dissect the hills. Six areas were initially selected for field examination: (1) the central and lower part of the Lubenka stream basin, its tributaries' beds and valleys, and their immediate surroundings (the nearest Linear Pottery culture sites [LBK] are located at a distance of 4 km; Fig. 2); (2) the upper part of the valley of the Lubenka stream and the surroundings of the Straszydle quarry (the nearest LBK sites are located at a distance of 7 km; Fig. 3); (3) the surroundings of Ulanica village close to the Ostrówek stream (the nearest LBK single find was discovered at a distance of 4 km; the nearest LBK settlements are located at a distance of 25 km; Fig. 4); (4) the valley of the Tarnawka stream and its immediate surroundings (the nearest LBK sites are located at a distance

Fig. 3. Upper part of Lubenka stream valley in Straszydle village. Example of primary autochthonous sources of cherts. Photo: A. Pelisiak.

of 6 km; Fig. 5); (5) the valley of the Husówka stream and its immediate surroundings (the nearest LBK sites are located at a distance of 4 km); and (6) the valley of the Hermanówka stream and its immediate surroundings (the nearest LBK sites are located at a distance of 4 km).

A variety of chert and siliceous marl types occur in the examined areas. It should also be underlined that some varieties of chert and siliceous marl show almost the same macroscopic characteristics, which makes them highly similar one to another. In fresh condition, the colour of the chert and siliceous marls can be light-yellow, almost white, from grey-yellow to grey, or from light brown to dark brown. They are compact, predominantly dull, non-transparent, and sometimes with a mild waxy shine. The fracture is platy-flaky or conchoidal, granular-looking or coarse grained. The cortex is non-existent or is very thin.

Siliceous marls and cherts in all examined areas occur in various topographic and geomorphological positions. According to Zsolt Mester's classification (Mester 2013: 12),

Fig. 4. Ulanica village close to the Ostrówek stream. Example of primary autochthonous sources of cherts. Photo: A. Pelisiak.

they appear in primary autochthonous, secondary autochthonous and more rarely in sub-autochthonous or residual sources. They are displayed in a vertical or nearly vertical position due to tectonic influence, as continuous and discontinuous layers, in the form of lenses or irregular, more or less flat, pancake-shaped blocks. The layers are typically 25–30 cm thick, but some are significantly thinner – from 1 to 3 cm. Some layers of siliceous marl and cherts (excluding layers of black menilite hornstone) are not well--delineated from the adjacent layers. Such a position makes it easy to access and extract blocks of raw material.

FINAL REMARKS

There are various potentially significant sources of siliceous marls and cherts suitable for manufacturing chipped and polished tools in each of the examined areas. Exposures

Fig. 5. Taranawa village (Tarnawka stream valley). Example of primary autochthonous sources of siliceous marls. Photo: A. Pelisiak.

of cherts and siliceous marls on steep slopes of the hills and dissecting river valleys offer easy access to the best quality raw material in the primary autochthonous sources. This positioning made the raw material relatively easy to reach and extract. Raw materials from secondary autochthonous sources in the riverbeds were also obtainable, but they were of worse quality than those from the exposures.

Cherts and siliceous marls were available in many locations in the region and each settlement could exploit a number of sources. The distance from the Neolithic and Early Bronze Age settlements located in the sub-Carpathian loess zone to the nearest sources of these raw materials was about 4 km in a straight line. Moreover, chert and siliceous marls were available in many locations in the region, and it is possible that every settlement exploited several different sources.

Pieces of raw material of suitable quality could be removed from the source area and taken to other sites for further processing. However, it should be noted that so far no prehistoric places of extraction and manufacturing of siliceous marl and chert

artefacts have been discovered in the examined areas. On the other hand, hypothetical mines such as small and shallow open-air galleries or pits could have been cut into steep slopes of river valleys and hills. It is worth emphasising the low archaeological visibility of traces left by such extractions, and their vulnerability to destruction by a variety of natural and anthropogenic processes (e.g., landslides, erosion).

The field prospection for lithic raw material sources will continue. Chemical and physical analyses of raw material samples from the sources and of artefacts from the archaeological contexts have also been undertaken. The problem of key importance and the main goal of this research is to characterise and define the raw material from particular sources (to collect comparative raw materials) and to identify the sources of raw materials used for production of artefacts found on the Neolithic and Early Bronze Age sites in the region. The initial results are promising.

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