Siliceous Raw Materials from the Eastern Part of the Polish Carpathians and Their Use in Stone and Bronze Ages

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Abstract: This paper refers to the exploitation of lithic raw materials in the eastern part of the Polish Carpathians. The surface surveys and LIDAR analysis carried out in 2013–2016 on this area resulted in discovery of new resources of various lithic raw materials used in the prehistory: siliceous sandstones, quartzite, siliceous marl, menilite hornstones, light-brown hornstone, flysch radiolarite, Bircza-like flints, light-brown tabular hornstone. The Dynów marl, Bircza flint and siliceous sandstones were exploited both for local and much wider use. Other kinds of raw materials probably have only local significance. The last discovery in the Eastern Polish Carpathians confirms a large variety of local lithic materials available for a prehistoric man. On the other hand, they show the large gaps in our knowledge about resources, differentiation and utilization of the Carpathian lithic raw materials.

Keywords: Carpathians, lithic raw materials, Neolithic, Bronze Age.

Preface

Important questions of prehistoric studies from the Early Palaeolithic period to at least the Bronze Age refer to the resources of the lithic raw materials. These problems were an important part of Jacek Lech's research on flint mining, processing and distribution of flint artefacts from the Early Neolithic onwards (Lech 1981a, 1981b, 1981c, 1983, 1987, 1988, 1991, 1997, 2001, 2004; Lech and Longworth 2000). He is a initiator or/ and a manager of important archaeological projects. Sometime they have resulted in surprising effects which have opened new area of prehistoric research. A perfect example of such an 'effective accident' was the discovery of chocolate flint extraction site at Wierzbica 'Zele', the first flint mine used in the Late Bronze Age (Lech and Lech 1984, 1995, 1997). Considering the impressive list of Jacek Lech's publications, one has played a special role for me. It was almost 40 years ago in a very beginning of my study of archaeology when I 'met' Jacek Lech for a first time in a book about the Neolithic flint workshops at Sąspów (Dzieduszycka-Machnikowa and Lech 1976). Since then his publications have accompanied me constantly, and now after years I would like to say: Dear Jacek, thank you very much for your activity, and... I am looking forward to more works.

Introduction

In contrary to the Cracow-Częstochowa Upland and northern and east-northern surroundings of the Świętokrzyskie Mountains (Holy Cross Mountains), the research on natural deposits of lithic raw materials from Polish Carpathians has relatively a short history (e.g. Foltyn *et al.* 1998; Valde-Nowak 1991, 1995a, 1995b, 2013). Referring to the Eastern Polish Carpathians, several important steps of research on local lithic raw materials should be noticed. The first elaboration presenting a large collection of lithic artefacts from this area was published in 1976 (Dagnan-Ginter and Parczewski 1976). In this paper, local raw material, so called Dynów marl was distinguished. The first monograph of Neolithic and Early Bronze Age on the area of the Polish Carpathians including a catalogue of stone artefacts appeared in 1988 (Valde-Nowak 1988). An important step in research on the exploitation and processing of the East Carpathians lithic raw materials was fieldwork carried out in 1995–1996 and an elaboration of Late Neolithic material from Mount Cergowa site located to the north of Dukla Pass (Budziszewski and Skowronek 2001). At the very beginning of the twentieth century the so called Bircza flint was recognized (Łoptaś *et al.* 2002). In the results of excavations of the Early Bronze Age site at Trzcinica, Jasło district, the artefacts made of local flysch radiolarian were identified (Valde-Nowak 2009). It should be noted that the Carpathian Late Neolithic stone processing sites were also discovered in Slovakia (Valde-Nowak 2001; Valde-Nowak and Strakošova, 2001). In 2012, the research on prehistoric human activity in the High Bieszczady Mountains began. They resulted in the discovery of numerous finds of lithic artefacts made of various raw materials (Pelisiak and Maj 2013; Pelisiak 2014, 2016a, 2016b; Pelisiak *et al.* 2015). These discoveries have inspired fieldwork which directed to the identification of outcrops of lithic raw materials in the Bieszczady Mountains. and their surroundings (Pelisiak 2016a, 2016b) Primary results of the research are presented below.

Raw materials

There are several regions within the eastern part of the Polish Carpathians where the exploitation of local

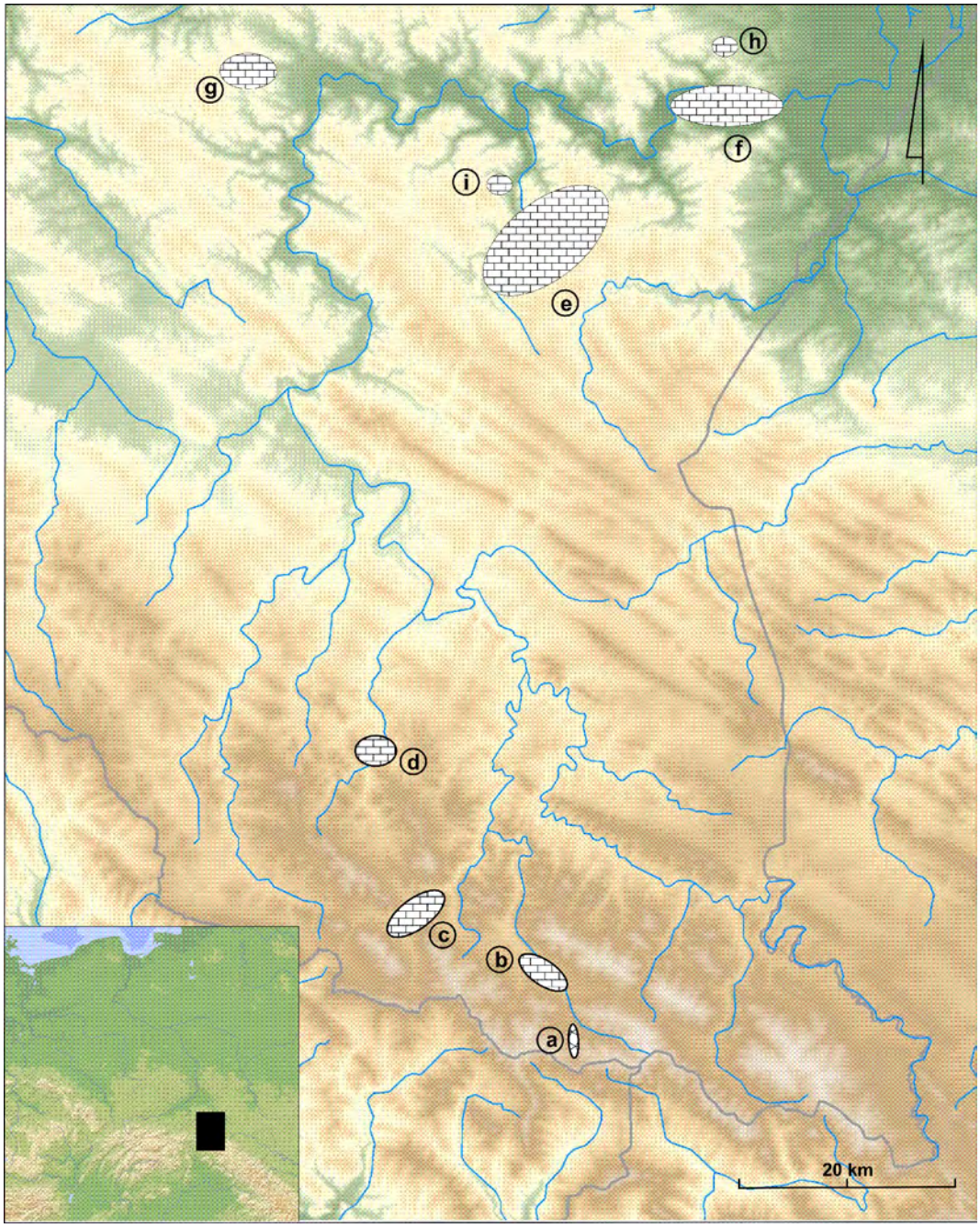

Fig. 1. Natural deposits of lithic raw material. a – Solinka River and Beskidnik Stream valleys, Lesko district (siliceous sandstones); b – Wetlina/Wetlinka River valley, Lesko district (quartzite, siliceous marl, menilite hornstones, light-brown hornstone, flysche radiolarite, Bircza-like flint); c – Cisna and Dołżyca, Lesko district (menilite hornstones); d – Baligród/Rabe, Bieszczady district (Bircza-like flint); e – Bircza region, Przemyśl district (Bircza flint, black, dark-brown and banded menilite hornstone, light-brown hornstone, siliceous marl,); f – Przemyśl/Krasiczyn region, Przemyśl district (flysch radiolarite, menilite hornstones); g –Ulanica near Dynów (Dynów marl, menilite hornstones); h – Maćkowice, Przemyśl district (Bircza flint); i - Jasienica Syfczyńska Przemyśl district (Bircza flint).

lithic raw materials in the Neolithic and Bronze Age is archaeologically confirmed (Fig. 1).

1.The Solinka River and the Beskidnik Stream valleys near Moczarne (the part of Wetlina village, Lesko district). The sources of siliceous sandstones are located here (Fig. 2:a). In some parts of the valleys, siliceous sandstone layers up to 20cm thick appear in almost vertical or oblique positions depending of tectonic influence. This raw material is gray or dark gray in

Fig. 2. Samples of raw material. a – Solinka River valley, Wetlina, site 17, Lesko district (core made of siliceous sandstone); b – Wetlina, site 12, Lesko district (fragment of blade made of quartzite); c–f – Wetlina/Wetlina river valley, Lesko district (c – siliceous marl, d – flysch radiolarite, e – menilite hornstone, f – Bircza-like flint). Photo and elaboration: Z. Maj and A. Pelisiak.

colour. Wet blocks of siliceous sandstone extracted from the river-beds were easy for processing using chipping techniques. When dried they became hard for flaking. The best access to the outcrops is only locally from slight slopes of some parts of the valleys. The artefacts made of siliceous sandstone were discovered in these parts of the valleys. On the basis of chronology of artefacts discovered here, it can be assumed that these sources of siliceous sandstone were exploited in the Late Neolithic and Bronze Age (Pelisiak 2014, 2016b). This raw material was exploited for both local and nonlocal use.

2. Sources of several groups of lithic raw material were recognized at Wetlina, Lesko district (within the Wetlinka River Valley). Veins of almost white and light

light pink quartzite were recognized in a exposures of the dissected, steep Wetlinka River valley slopes as well as in a belt of the this river in the NW part of Wetlina village (Fig. 2:b). The use of quartzite is confirmed by the fragment of quartzite blade dated to the Neolithic period, found near the outcrops (Pelisiak and Maj 2013; Fig. 2:a). Outcrops of the siliceous marl occur in the Wetlina River valley slopes only on the small area (about 150 m long, along the river) in the SE part of the Wetlina village (Fig. 2:c). Siliceous marl from this location is light gray and almost white in colour. Its utilization is confirmed by chipped chunks discovered near the outcrops. Because of relatively low quality, it is possible that siliceous marl from Wetlina was exploited only for local use. Outcrops of several kinds of tabular menilite hornstones were discovered along the Wetlinka River in the dissections within the river valley, as well as in the riverbed (Fig. 2:e). They are black, dark brown, and brown-greenish in colour. Moreover, dark-brown, and banded menilite horstone also occurs here. Besides the colour, it differ in presence of inclusions and fractures, and in the texture. All forms of menilite horstone from this area are of relatively low quality. Numerous artefacts made of menilite hornstone discovered in the Bieszczady Mountains (Pelisiak and Maj 2013; Pelisiak 2014, 2016b; Pelisiak *et al*. 2015) confirm the exploitation of this raw material in the Late Neolithic period as well as in the Early Bronze Age. Besides of menilite hornstones, there are the boulders of relatively high quality light-brown hornstone. This raw material is much more hard and compact and more suitable for making tools then the menilite hornstone. The grey-greenish lithic material similar to flysch radiolarite was also discovered in the Wetlinka riverbed. Some artefacts found at the sites on the Połonina Wetlińska Massif dated to the Early Bronze Age were made of these kinds of raw material (Pelisiak and Maj 2016). In the Wetlinka riverbed also nodules of Bircza-like, grey in colour lithic and opaque raw material was recognized (Fig. 2:f). The nodules are irregular in shape up to 35cm in diameter. The cortex is granular well delineated from the flint mass. One blade made of this raw material was found in the High Bieszczady Mountains. (Pelisiak and Maj 2013; Fig. 2:d).

3. Outcrops of black menilite hornstone were discovered in the Solinka River Valley at Cisna and Dołżyca, Lesko district (Fig. 3:b). This raw material was available from the riverbed, from the dissections in the river valley and from the steep slopes of the valley. The exploitation of these sources of raw material is confirmed by the presence of the Late Neolithic and (?) Early Bronze Age processing sites located in the close vicinity to the outcrops.

4. The sources of flint similar to Bircza flint were discovered near Baligród (within Bystre Scale, Bieszczady district; Fig. 3:a). The irregular nodules up to 40cm in diameter occur in the Rabe riverbed to about 3km south-west of Baligród, Lesko district. The flint mass is matt, grey or dark grey in colour and completely opaque. Its cortex is up to 1,5cm thick and well delineated of flint mass. This kind of raw material has not been identified in chipped assemblages yet. However, it is possible that some artefacts described as made of Bircza flint, in fact were made of flint from Baligród region.

5. The surface surveys carried out in 2015 resulted in discovery of variety of lithic material in the Bircza region, Przemyśl district. Outcrops of several kinds of Bircza flint (Fig. 3:d) were recognized within the 'Krępak' Nature Protection Area (ca 5km NE of Bircza) and near Leszczawa village, Przemyśl district (5–10km S of Bircza). They also occur in the riverbed. Moreover, there were probably Neolithic exploitation places located in the Krępak area, Przemyśl district. Several semi-circular depressions, flint chunks, and debris were frequently recorded on the surface around the depressions. The Bircza flint is opaque and in some cases granular pattern. Cortex is granular and rough, not well delineated of the flint mass. Several variants differ in colours (from dark brown, almost black to dark and light grey) and they can be found in nodules up to 40cm in diameter or in tabular form of up to 20cm thick. Beside of Bircza flint, there are black, dark-brown and banded (Fig. 3:c) tabular menilite horstones, as well as light-brown tabular hornstones. These layers have been exposed by the cutting of the riverbed into the hill side. As confirmed by the Middle and Late Palaeolithic assemblage from Przemyśl, the site 'Cegielnia Teicha' (Tomaszewski and Libera 2007),[1] different kinds of the Bircza flint as well as menilite hornstone were used from Middle Palaeolithic onwards (see also Łoptaś *et al.* 2002). Moreover, there are also tabular siliceous marl (Fig. 3:e) in Bircza Krępak and Leszczawa outcrops (Fig. 4). This raw material is light-grey in colour and completely opaque. It is similar to so called Dynów marl.

6. Outcrops of flysch radiolarite and menilite hornstone were noted near Przemyśl and Krasiczyn, Przemyśl district. Grey or greenish-grey flysch radiolarite occurs in the San riverbed as well rounded pebbles up to 15cm in diameter. This raw material is similar to the those recognized in the Early Bronze Age chipped assemblage from the Trzcinica site near Jasło, Jasło distict (Valde-Nowak 2009). Moreover, as for this area, tabular menilite hornstone appears in several variants: black, dark-brown and laminated.

[1] I would like to offer my special thanks to Andrzej Jacek Tomaszewski from State Archaeological Museum in Warsaw for showing me the material from this site.

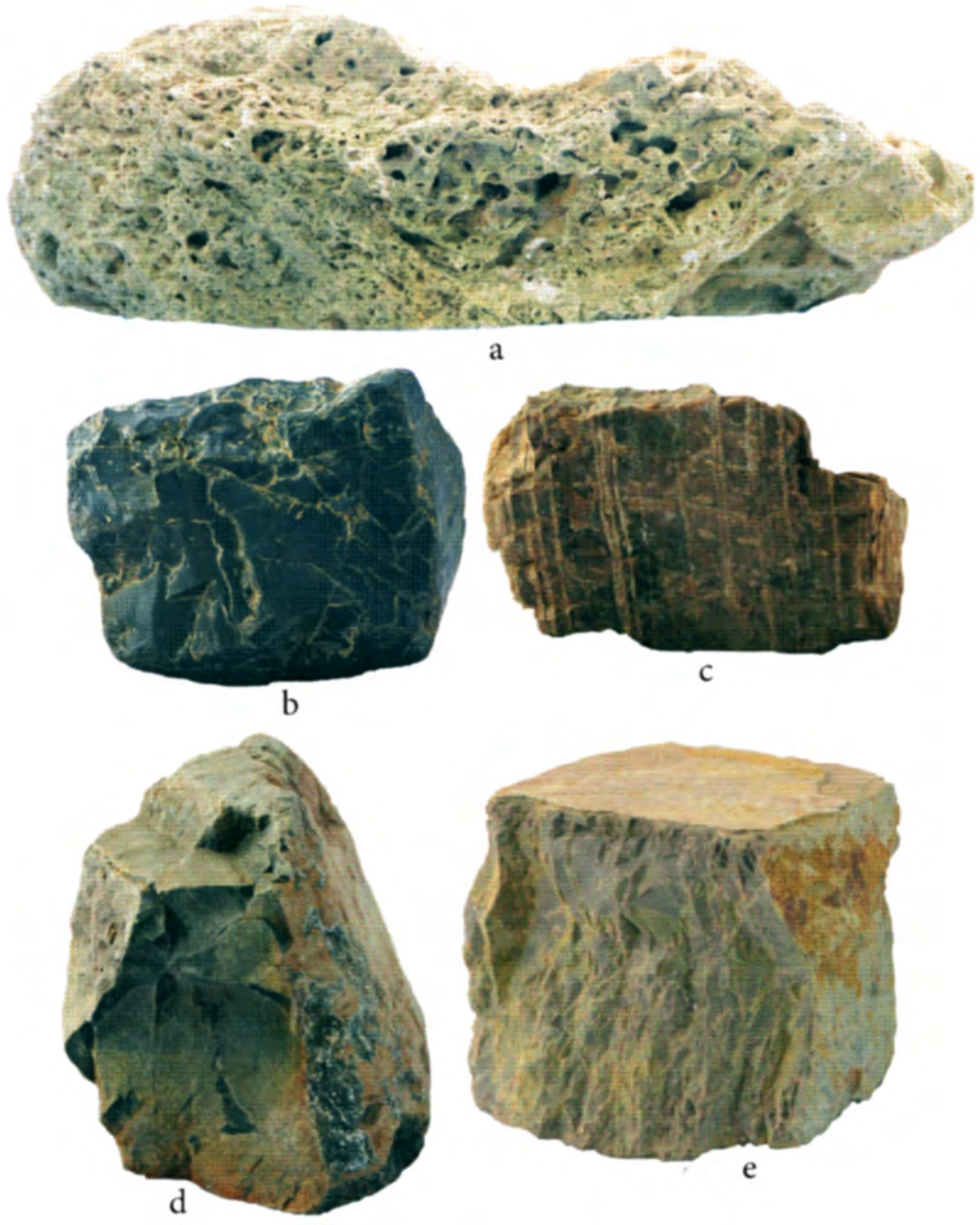

Fig. 3. Samples of raw material. a – Baligród/Rabe (Bircza-like flint), Bieszczady district; b – Cisna, Lesko district (menilite hornstone); c–e – Bircza region, Przemyśl district (c – banded menilite hornstone, d – Bircza flint, e – siliceous marl). Photo and elaboration: Z. Maj and A. Pelisiak.

7. Frequent use of so called Dynów marl was confirmed for the first time in the course of elaboration of two collections of artefacts from the Dynów Foodhill, Rzeszów district (Dagnan-Ginter and Parczewski 1976). The outcrops of this raw material were discovered at Ulanica village, near Dynów town, Rzeszów district. Dynów marl (siliceous marl) in a fresh condition is predominantly milky-grey or grey in colour. Due to the susceptibility of the raw material to the chemical and physical alterations, prehistoric artefacts often have changed in their appearance. In some cases they look more coarse-grained, more porous and lighter compared to the original material. The menilite hornstones are also present in Ulanica outcrops.

8. The workshop of flint axes of the raw material similar to Bircza flint was discovered at Maćkowce, Przemyśl district, about 7km north of Przemyśl (Łoptaś *et al.* 2002). It can suggest unknown outcrops of raw material located near this site. Less possible is transport of raw

Fig. 4. Outcrop at Leszczawa near Bircza, Przemyśl district. Photo: A. Pelisiak.

material from across the San River from sources near Bircza located at least 25km in straight line to the south-west.

9. More than 20 Neolithic and Early Bronze Age sites with artefacts made of Bircza flint including axes workshops, were found in the Przemyśl Foothills near Jasienica Sufczyńska and Kotów, Przemyśl district, about 10 km to the north-west of Bircza.[2] Large quantity of these finds may suggest presence of very local and still unknown outcrops of this raw material. However, it is also possible that raw material came from sources located near Bircza itself.

Discussion

There is a relatively large group of siliceous raw materials available in the eastern part of the Polish Carpathians. They were used locally, regionally or in large area of SE Poland and probably Slovakia. Numerous outcrops of menilite hornstones were probably used locally from the Middle Palaeolithic onwards. Siliceous marl (Dynów marl) was used in the Neolithic period and Early Bronze Age. Axes and other artefacts were discovered in the Linear Pottery culture context, and in a large number at the Funnel Beaker, Corded Ware and Mierzanowice cultures sites (Dagnan-Ginter and Parczewski 1976; Valde-Nowak 1988; Pelisiak and Rybicka 2013: 17; Dębiec *et al.* 2014, 2015: 99; Czopek *et al.* 2015: 18). Siliceous sandstones from Moczarne (Wetlina region) were use in the Bronze Age but we cannot exclude their use in the Late Neolithic period (Jarosz *et al.* 2008: 286; Machnik *et al.* 2008: 173). Bircza flint was used from the Middle Palaeolithic onwards (Łoptaś *et al.* 2002) on the relatively large area of south-eastern Poland. The processing sites, first of all axe workshops, suggest large-scale utilization of this raw material which took place in the Late Neolithic and Early Bronze Age.

Another question refers to the methods used in the course of exploitation of different kinds of raw materials in eastern part of the Polish Carpathians. Excavations of copper and lithic mining sites located at the mountain areas of Europe show variety of possible methods used for exploitation of raw material (e.g. Weisgerber 1986; Basili *et al.* 1995; Barkai *et al.* 2007; Parish 2011; Tarantini *et al.,* 2011; Tarriño *et al.* 2014; Crandell and Popa 2015; O'Brien 2015). There is no doubt that they were determined by the geological conditions. There are two main groups of natural sources of raw materials in the eastern Polish Carpathians. The primary sources contain not redeposited raw material located in a horizontal position within the steep slopes of river valleys and hills. The secondary sources contain pieces of raw materials from weathered deposits and raw material naturally redeposited to the riverbeds, low river terraces, and to the foot of the slopes. In both cases these positions made them relatively easy to recognize, reach and exploit these raw materials.

Horizontal or almost horizontal position of the hornstones in all discussed regions, as well as the Bircza flint beds allowed for an easy access to the raw materials. Then, the open-air gallery and the shallow pits may have been cut into raw material-bearing layers in the walls of the valleys and hill slopes. This method of obtaining of raw material suggests results of LIDAR analysis and surface prospection carried out in 2015 near Bircza town. In the 'Krępak' Nature Protection Area, several semi-circular depressions up to 10 m wide with the broken cobbles, pieces of flint and hornstones as well as flint and hornstone chunks were noted. There were not recognized such structures on the other parts of The Eastern Polish Carpathians under discussion but the low archaeological visibility should be emphasized.[3]

Another possible method of obtaining of raw material refers to the siliceous sandstone. Well visible in the Solinka River and Beskidnik Stream, and easy to reach almost vertical plates of siliceous sandstone made it possible to exploit them from the riverbeds. Such method of exploitation could not leave archaeological remains and the traces left due to the exploitation of raw material can be difficult to observe nowadays. In respect to the High Bieszczady Mountains, it is confirmed by relatively numerous artefacts found near the exposures of this raw material.

Third possible method of obtaining of raw material refers to the various secondary deposits of hornstones,

[2] These sites were discovered during the surface surveys by Michał Parczewski. I am grateful to Michał Parczewski for information about these sites and showing me unpublished archaeological material from the Przemyśl Foothills area.

[3] It is possible that the similar Late Neolithic exploitation structures were used at the Mountain. Cergowa site, Krosno district (Budziszewski *et al.* 2016).

siliceous marls or flysch radiolarite. It was based on collecting pieces of raw materials from the surface of the ground and from riverbeds. This method is also archaeologically difficult to observe.

Final remarks

The surface surveys and LIDAR analysis carried out in 2013–2016 in eastern part of the Polish Carpathians resulted in discovery of new resources of various lithic raw materials used in the prehistory. Siliceous sandstones were exploited in the High Bieszczady Mountains. Exploitation of quartzite siliceous marl, menilite hornstone, light-brown hornstone, flysch radiolarite and Bircza-like flint is confirmed in Wetlina. Resources of raw materials similar to Bircza-flint were recognized near Baligród. Outcrops of menilite horstone and the processing site were found at Cisna. Field works on the area near Bircza town revealed new information about Bircza-flint, as well as resulted in discovery of outcrops of black, dark-brown and banden meniliute hornstones, light-brown tabular hornstone and siliceous marl. Natural resources of flysch radiolarite and menilite hornstone were recognized in the San River valley near Przemyśl and Krasiczyn. In Ulkanica near Dynów the outcrops of Dynów marl and menilite hornstone were discovered. Dynów marl, Bircza flint and siliceous sandstones were exploited both for local and much wider use. Other kinds of raw material have probably only local significance. The last discoveries in the eastern Polish Carpathians confirm a large variety of local lithic material available for a prehistoric human being. On the other hand, they also reveal large deficiencies in our knowledge about the resources, differentiation and utilization of the Carpathian lithic raw material. The research planned in following years should gradually cover these gaps.

English by the author

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